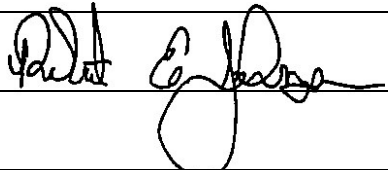




New England Association of Schools and Colleges
COMMISSION ON INSTITUTIONS OF HIGHER EDUCATION

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COVER PAGE FOR SUBSTANTIVE CHANGE REQUESTS

Name of Institution	University of Massachusetts Dartmouth
Type of proposed change (See http://cihe.neasc.org/downloads/POLICIES/Pp72_Substantive_Change.pdf)	Dual degree PhD program with a non-regionally accredited institution, Universidade de São Paulo, Brazil
Effective date of implementation	12/7/2011
Date of institutional governing board approval	2/7/2001 (date of approval of Intercampus Marine Science graduate program)
Is state approval required?	☒ No ☐ Yes, approved (date) _____ (Attach verification.)
Contact Person:	Name: Tesfay Meressi Title: Associate Provost for Graduate Studies Phone: 508-999-8542 Fax: 508-999-8052 e-mail: tmeressi@umassd.edu
Please summarize the proposed change	Approval by NECHE is requested for a dual PhD program between the Universidade de São Paulo Instituto Oceanográfico (USP-IO), Brazil, and the University of Massachusetts Dartmouth (UMass Dartmouth) in marine science. The program involves co-supervision and research residencies of Ph.D. students leading to a dual degree/diploma in Oceanography (USP-IO)/Marine Sciences (UMass Dartmouth). The School for Marine Science and Technology administers the program. We seek formal approval of the USP-IO/UMass Dartmouth dual Ph.D. program by NECHE.
Signature of CEO:	
Date:	

The Universidade de São Paulo Instituto Oceanográfico - University of Massachusetts Dartmouth Dual Ph.D. Program: Substantive Change Proposal

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Introduction

The Universidade de São Paulo Instituto Oceanográfico (USP-IO), Brazil, and the University of Massachusetts Dartmouth (UMass Dartmouth), USA have a long-standing and mutually-beneficial cooperation in instruction and research in marine sciences and oceanography. In an effort to further the academic cooperation and cross-cultural exchanges between our organizations, we have sought to develop a program for co-supervision of Ph.D. students and offering of a dual degree/diploma in Oceanography (USP-IO)/Marine Sciences (UMass Dartmouth). The dual degree (DD) program was initiated in 2011 as part of a large UMass system-wide initiative to foster academic collaborations with USP through a Memorandum of Understanding (see Appendix I and further description later in this document). Since the program began, there have been two students from USP-IO that have successfully completed the program. The School for Marine Science and Technology administers the program, but was only recently made aware that the program constituted a substantive change. As soon as that was discovered, the New England Commission of Higher Education (NECHE) was contacted for guidance as to how to proceed. Based on that feedback, this substantive change proposal was prepared. **The purpose of this proposal is to seek formal approval of the USP-IO/UMass Dartmouth dual Ph.D. program by NECHE.**

Background

UMass Dartmouth is one of five campuses of the University of Massachusetts system and is located in North Dartmouth, Massachusetts. The campus has a total enrollment of ~8500 students including roughly 1600 graduate students. The University is ranked as a Tier 1 National Research University by US News and World Report and is designated as a Carnegie National Doctoral – Higher Research Activity (R2) – University. UMass Dartmouth underwent its last accreditation review in 2010 and submitted an interim report in 2015.

The origins of the University stem back to the late 1800s from what were then textiles schools in the Southeastern Massachusetts region. In 1960, the state legislature created Southeastern Massachusetts Technological Institute (SMTI) by merging the New Bedford Institute of Technology and the Bradford Durfee College of Technology. The 710 acre campus in North Dartmouth, part way between New Bedford and Fall River, was established in 1964. The dramatic campus design was the work of architect Paul Rudolph, then dean of Yale's school of Art and Architecture. There was a clear public demand for a comprehensive university, and in 1969 SMTI became Southeastern Massachusetts University (SMU). The university continued to grow through the 1970s, when its first residence halls were finished and through the '80s, as research and studio facilities came into being.

In 1991, a new University of Massachusetts structure combined the Amherst, Boston, and Worcester campuses with Southeastern Massachusetts University and the University of Lowell (now UMass Lowell). Thus Southeastern Massachusetts University became the University of Massachusetts Dartmouth.

With the intent to establish a robust marine science curriculum and associated research program, in 1997 UMass Dartmouth completed construction of a 32,000 square foot School for Marine Science and Technology (SMAST), located on 2.6 acres in New Bedford near Buzzards Bay. The facility was expanded

in 2017 to add an additional 64,000 square foot building and a full program of research and development is now supported in these combined facilities.

USP is a public university in São Paulo, Brazil. It is the largest Brazilian public university and the country's most prestigious educational institution, the best university in Ibero-America and holds a high reputation among world universities, is a top ranked University in Latin America (among top 300 in the world) based on the Times Higher Education World University Rankings (<https://www.timeshighereducation.com/student/best-universities/best-universities-latin-america>) and ranked second best in Latin America (118 in the world) by the QS World Universities Rank (<https://www.topuniversities.com/university-rankings/latin-american-university-rankings/2019>). Over the years, QS World University Rankings consistently ranked USP among the top 5 universities in the Latin world. USP is involved in teaching, research and university extension in all areas of knowledge, offering a broad range of courses. Pertaining to research, USP is Brazil's largest research institution, producing more than 25% of the scientific papers published by Brazilian researchers in high quality conferences and journals.

The university was founded in 1934, and has become one of the largest institutions of higher education in Latin America, with more than 80,000 enrolled students. Currently, it has eleven campuses, four of them in the city of São Paulo. The remaining campuses are in the cities of Bauru, Lorena, Piracicaba, Pirassununga, Ribeirão Preto, and two in São Carlos.

The Graduate Program in Oceanography of the University of São Paulo is accredited at the national level (see Appendix II) and is ranked as the best program in Marine Sciences of Brazil. All accredited academic graduate programs in Brazil are evaluated every four years by a federal research funding agency “Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior”- CAPES. The grades vary from one to seven. Since the 2017 evaluation, the graduate program from the Instituto Oceanográfico (IOUSP) obtained grade CAPES-7, a mark never reached before by a Marine Sciences program in Brazil.

The Intercampus Marine Science Graduate Program

The USP-IO – UMass Dartmouth dual Ph.D. program is offered in conjunction with the Intercampus Marine Science (IMS) graduate degree program. Recognizing the importance of having a strong marine science academic and research program within the University of Massachusetts, the UMass Board of Trustees approved the intercampus M.S. and Ph.D. degree programs in Marine Science and Technology in 2001 (T01-006). Other participating UMass campuses include Amherst, Boston, and Lowell. In 2012, the Board of Trustees designated the UMass Dartmouth campus as the lead campus for the IMS program. The degree program is fundamentally grounded in a broad, integrated, interdisciplinary approach to the study of marine sciences and technology and science management. The program prepares students for employment opportunities in the private and governmental sectors and academia. Emphasis is placed on the education of researchers and scholars who will contribute not only to research, but also to the application of that research in environmental stewardship, resource management, marine technology, and economic development.

IMS offers three graduate degree programs: M.S., Ph.D., and Professional Science Masters (PSM). Students located at the four participating campuses are required to complete “core” courses selected from the natural and social sciences to equip them for interdisciplinary studies and research followed by

additional courses in an area of concentration. These courses will ensure that all students master key concepts and skills central to an interdisciplinary marine sciences graduate program.

To build on the core courses, each student selects an area of concentration and chooses electives appropriate to this concentration, as approved by their faculty advisor and/or thesis committee. Option areas, which are intended as guidelines, are listed below:

- MASMA - Marine and Atmospheric System Modeling and Analysis
- CSS - Coastal Systems Science
- ICM - Integrated Coastal Management
- LMRS - Living Marine Resources Science and Management
- MBEC - Marine Biogeochemical Cycles and Environmental Change
- MOT - Marine Observation Technologies
- OHH - Ocean and Human Health

The course load for full-time graduate students is nine (9) or more credits per semester; part-time graduate student status is defined as eight (8) or fewer credits in a semester. For doctoral candidates, students must spend the equivalent of at least one continuous academic year of full-time graduate work (nine credits per semester) in residence at the University.

Students located at the four participating campuses are required to complete "core" courses selected from the natural and social sciences to equip them for interdisciplinary studies and research before focusing upon an area of concentration. Each IMS student must complete four core courses (12 credits), one in each of four core areas: biological oceanography, chemical oceanography, physical oceanography, and Marine Policy and/or Management areas (including law and economics). The core courses are intended to provide a common grounding in the biological, chemical, and physical oceanographic areas of marine sciences and technology, and in related marine policy and management disciplines. At least two core courses are offered each semester using the University's substantial distance learning facilities and technology. Students normally complete the core courses in the first two semesters.

The core curriculum for the IMS graduate program is consistent with other well-recognized graduate programs. See, for example, peer programs at the University of Maine (<https://umaine.edu/marine/graduate-programs/oceanography/>), University of Delaware (<https://www.ceoe.udel.edu/schools-departments/school-of-marine-science-and-policy/oceanography-program>), and University of Maryland (<http://mees.umd.edu/ocean/>).

Curriculum quality is maintained through regular updates of course content and evaluation of teaching based on student feedback as well as review by faculty peers.

The Dual Ph.D. Program

The dual Ph.D. program was established to foster academic cooperation between USP-IO and UMass Dartmouth by means of the co-supervision of Ph.D. students of both institutions, aiming at the preparation of the Ph.D. thesis leading to a double diploma, under joint responsibility of both institutions. A Memorandum of Understanding (Appendix I) lays out the following terms:

- 1) Regularly enrolled students from the Ph.D. programs at USP-IO or at UMass Dartmouth pursuing a double diploma are required to have co-supervision to prepare a Ph.D. thesis and must satisfy

all degree requirements of both institutions. At UMass Dartmouth, the USP student will be accepted to the UMass Intercampus Marine Science Ph.D. degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student. At USP-IO, the UMass Dartmouth student will be accepted to the USP-IO Ph.D. degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student. The student shall be enrolled concurrently at both institutions in order to meet this requirement (the institutions will establish a record of this matriculation in an academic transcript).

- 2) A student shall be nominated by the institution in which he/she is originally enrolled through a Letter of Commitment, which shall contain the name of the student, title of the project to be developed, work plan, provisional title for the thesis, name of co-directors from both institutions and name of Ph.D. program and corresponding area of specialization, if available. The Letter of Commitment shall be assessed by the appropriate graduate bodies within each institution. The student's admission to degree status will be approved by customary institutional procedures for this degree program, considering the student's qualifications, prior academic work, availability of faculty to serve as thesis co-director, and access to research facilities.
- 3) Each student shall follow a joint program agreed upon by both institutions as well as by their corresponding co-directors, who agree to fulfill their responsibilities as Ph.D. co-directors of the student. At both institutions, the student will earn the minimum required number of academic credits for the Ph.D. degree. The terms of this agreement permit reciprocity of earned credits - appropriate academic credit earned at USP-IO to be accepted also as UMass Dartmouth credit; and credit earned at UMass Dartmouth to be accepted also as USP-IO credit, towards the degree, as determined by the curriculum review and approval processes of the university. Details on curricular equivalency are given in Addenda I and II of the MOU.
- 4) The period of preparation of the thesis shall be shared between the two institutions involved in the co-supervision, in alternate periods in each country. UMass Dartmouth will require a minimum of two semesters in physical residency in the United States or aboard a research vessel sponsored by UMass Dartmouth. USP-IO will require a minimum of two semesters in physical residency in Brazil or aboard a research vessel sponsored by USP-IO.
- 5) The procedures for co-supervision of Ph.D. students aiming at double diploma shall abide by terms and conditions in the graduate rules and regulations in both institutions. However, students at both institutions under this special agreement will be afforded appropriate flexibility in meeting requirements.
- 6) The student accepted by the host institution shall be considered an exchange student who is seeking a degree, and shall have all rights equal to a regular student. Minimum U.S. requirements must be met, including sufficient fluency in English to engage in the academic program. Minimum Brazil requirements must be met also, however, the disciplines at USP-IO will be taught in English.
- 7) The institutions will seek to have a balanced number of participants.
- 8) The thesis shall be written in English with an abstract in Portuguese.
- 9) The thesis shall be presented only once, in the institution in which the student is originally enrolled, abiding by the graduate rules and regulations of that institution. The second school's dissertation advisor and committee member(s) will participate in the defense (advisor plus one or two additional faculty from the second school), either physically or by synchronous electronic technology. To receive both degrees, the student must meet the approval of both dissertation co-directors that the thesis is appropriate for the award of the degree.

- 10) Both qualifying and thesis defense committees shall consist of at least five members: the UMassD and USP advisors (2), one faculty member of each university (2) and one external member of the expertise area of the PH.D. work (1).
- 11) The publication, utilization and protection of the subject of the thesis and the corresponding research results are ensured by both Ph.D. programs, according to the specific procedures adopted in each country.
- 12) Health insurance must be arranged by the student in his/her country of origin prior to his/her arrival at the host institution.
- 13) Faculty who are actively involved in this program will be presented by their home institution for election to faculty status or membership in the partnering institution, so as to ensure such privileges as chairing or being members of dissertation committees, participating in research, and approving their course to receive credit—as required by the academic procedures and requirements of each institution.
- 14) This agreement utilizes the "pay at home" model, in which, during the period of residence in the host institution, a student pays for academic charges as if they were incurred at the home institution and receives a waiver of academic charges at the host institution. While this arrangement is designed for a balanced number of students studying in both directions, UMass Dartmouth acknowledges that at least initially more USP-IO students than UMass Dartmouth students will participate. UMass Dartmouth will offer waivers of annual academic charges for up to six USP-IO students each year in excess of UMass Dartmouth students to participate in the program. The remaining expenses (transportation, accommodations and the like) shall be borne by the student, who may seek funding from external agencies or from his/her institution of origin.
- 15) At the completion of the student's stay, the host institution shall forward to the appropriate office of the home institution an official document, specifying the activities carried out by the student and, as the case may be, the evaluation attained.
- 16) Both institutions shall promote the integration of the student in the academic life of the host institution.
- 17) The host institution shall provide adequate research conditions and locations for the work of the student within its reach.
- 18) Both institutions acknowledge the validity of the co-supervision and the thesis defended and approved, granting the Doctorate degree (Ph.D. degree) to the candidate, valid in Brazil and in the USA.
- 19) Two doctoral diplomas will be issued, one from USP-IO and another one from UMass Dartmouth.
- 20) To ensure the technical-administrative coordination, USP-IO and UMass Dartmouth will appoint Coordinators at each institution.
- 21) It is incumbent on the Coordinators to provide solutions and to forward all academic and administrative issues that may occur during the effective term hereof, as well as to ensure supervision of the activities.
- 22) Written implementation agreements will be formulated between the institutions for all necessary academic and administrative matters. These shall be reviewed and updated at least annually.

Standards of Accreditation

Standard 1 – Mission and Purposes

The IMS program mission is to improve the quality of graduate education in marine sciences and related technology within the University as well as foster research and public service in support of the

Commonwealth's efforts in protection, preservation, restoration, and sustainable economic development of its extensive coastal and ocean lands, waters, and resources. The program was designed to prepare students academically in marine sciences and technology, to contribute to the economic development of the Commonwealth through technology transfer, and serve as a catalyst for research and development in marine sciences and technology. All of these functions support the University of Massachusetts's mission: "to provide an affordable and accessible education of high quality and to conduct programs of research and public service that advance knowledge and improve the lives of the people of the Commonwealth, the nation and the world."

Consistent with the stated missions of the University of Massachusetts and the Intercampus Marine Science degree program, the USP – UMass Dartmouth dual Ph.D. program provides access for students to two internationally regarded programs in marine science. Graduate students enrolled in the program are co-advised by a faculty member from each institution, and students participate in a one-year research residency at the host institution. This provides an opportunity for participating students to enrich their education with an international experience, and foster a global perspective, which is fundamental to the inherently global aspect of marine science and oceanography.

Standard 2 – Planning and Evaluation

The USP-IO – UMass Dartmouth dual Ph.D. program was developed through a joint committee of faculty and directors from both institutions. Two delegations from USP-IO—led by its Director and Graduate Program Director—visited the UMass Dartmouth School for Marine Science and Technology SMAST during February and October, 2011. A reciprocal delegation, consisting of the Associate Dean and two faculty members from SMAST, visited USP-IO during June, 2011. These individuals reviewed the existing curricula and program requirements of the USP-IO and IMS programs, and developed a course and credit equivalence metric that met criteria for both institutions. An MOU outlining the overall protocol was completed and signed by the respective administrations of USP and UMass (see description of MOU above).

Regarding evaluation, an Academic Quality Assessment and Development (AQAD) review of all Intercampus Marine Science degree programs is conducted every five years and one was recently completed in FY17-18. This included a comprehensive review by an external review team and feedback and input from students, faculty and alumni involved with the program. This extensive review resulted in an action plan (see Appendix III) to address recommendations of the external committee, and this plan is currently being implemented.

Student progress in the graduate program is assessed based on performance in the coursework, as well as through regular meetings with co-advisors and student, maintaining student progress tracking sheets, meetings with advisory committees, dissertation proposal defense, comprehensive exams, writing of thesis or dissertation, and public and closed defense of thesis or dissertation. Additional metrics of student outcomes include student presentations at professional meetings, student authored or co-authored publications, and student involvement in service activities. Finally, program effectiveness is reflected in our alumni through tracking of career placement following graduation as well as alumni awards or other recognitions.

Standard 3 – Organization and governance

The Intercampus Marine Science (IMS) graduate degree program was approved by the UMass Board of Trustees in 2001 (T01-006). UMass Dartmouth serves as the lead campus of the IMS program. Because the USP-IO – UMass Dartmouth dual Ph.D. program was developed within the existing degree program framework, approval beyond the respective University faculty and administrations was not required.

The governance of the USP-IO – UMass Dartmouth dual Ph.D. program is accomplished according to the terms of the MOU between USP and UMass Dartmouth as described previously. As stated in the MOU, administrative coordination of the program is the responsibility of Coordinators at each institution. It is incumbent on the Coordinators to provide solutions and to forward all academic and administrative issues that may occur during the effective term hereof, as well as to ensure supervision of the activities. Academic governance is achieved through the normal processes of faculty oversight of curriculum, admissions, and advising. These functions are handled at the campus level in accordance with existing academic procedures. This includes proposal of new or modified courses, approval of new faculty, and review and approval of applications for admission. The doctoral dissertation committee provides the critical role of mentoring students and serves as the primary level for recommendation of degree conferral. Faculty who are actively involved in this program are presented by their home institution for election to faculty status or membership (e.g., adjunct status) in the partnering institution, so as to ensure such privileges as chairing or being members of dissertation committees, participating in research, and approving their course to receive credit—as required by the academic procedures and requirements of each institution.

Standard 4 – The Academic Program

Students are required to complete “core” courses selected from the natural and social sciences to equip them for interdisciplinary studies and research followed by additional courses in an area of concentration. A listing of core and elective courses along with representative syllabi are provided in Appendix IV. The core courses are intended to provide a common grounding in the biological, chemical, and physical oceanographic areas of marine sciences and technology, and in related marine policy and management disciplines. At least two core courses are offered each semester. These courses will ensure that all students master key concepts and skills central to an interdisciplinary marine sciences graduate program. Students normally complete the core courses in the first two semesters.

The “mapping of course equivalence” between the two curricula of the partner Ph.D. programs - Intercampus Marine Science (IMS) Ph.D. program at the University of Massachusetts Dartmouth (UMassD) and the Oceanography Ph.D. program at the University of São Paulo (USP), Brazil is described in addenda to the MOU in Appendix I. The following paragraphs summarize this course equivalency:

A typical UMassD Ph.D. student is required to satisfy the following credits during his/her tenure:

The Ph.D. Program requires a minimum of fifty-four (54) credit hours. Each student must complete four core courses; one in each of four core areas: biological oceanography, chemical oceanography, physical oceanography, and marine policy and/or management areas (including law and economics). Work in the concentration area includes a minimum of 24 credit hours of formal courses (in addition to the core courses and which includes elective and seminar courses and does not include dissertation research) and helps the student prepare for the written and oral candidacy examinations.

It is also required that students apply a minimum of 18 credit hours toward dissertation research. Ph.D. students are not normally accepted as part-time students. Courses may be taken at any IMS-affiliated program on the four campuses, in other departments, and may be included in a student's program of studies as determined by the student's major advisor and/or dissertation committee.

The following equivalency mapping was established at the initiation of the UMassD-USP Dual Ph.D. Degree (DD) program:

Core Course (Four Courses in PO, BO, CO and Policy – 12 credits) Equivalency Mapping:

The Core-Course requirement for a USP student enrolled in the DD program is generally satisfied through substitution on the basis of prior coursework for the following reasons:

Most (85%) of the Ph.D. graduate students at the Institute of Oceanography at the University of São Paulo (IOUSP) who are eligible to apply to the DD program from Brazil are students with a B.S. in General Oceanography, which covers the four traditional areas of marine science plus conservation policy and marine affairs. Therefore, the students with such backgrounds receive a waiver of the requirements for the Introduction to Biological Oceanography, Introduction to Chemical Oceanography, and Introductory Physical Oceanography courses. Additionally, because they generally take many courses involving conservation policies and marine affairs topics, these students also receive a waiver of the marine policy course requirement.

The course topics corresponding to the four required UMass IMS core courses are covered in a number of relevant IOUSP advance-level undergraduate courses as detailed in the attached document: IOUSP UMass Core Courses Syllabus Equivalence.

Note that students in the USP undergraduate General Oceanography B.S. program take multiple (if not all) of these courses during their 4 years of course work. Additionally, they take an additional year for their senior thesis research (mandatory) work. The B.S. program in General Oceanography at IOUSP also has a significant field component, which is described at the end of the syllabus description.

IOUSP also has agreements that validate the M.S. programs of Federal University of Rio Grande (FURG), Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro State University (UERJ), and Universidade do Vale do Itajai (UNIVALI). Thus, students completing their undergraduate B.S. from these universities and enrolling in the UMassD-USP DD program at IOUSP have effectively covered the content in the required core courses.

Other graduate courses, including those that may not cover the same material, are identified as substitutions in place of the core courses to satisfy the core credit requirements.

Elective Courses (24 credits) Equivalency Mapping:

The Ph.D. graduate program at IOUSP requires the students to take a large number of graduate courses in their own program before they come to UMass Dartmouth for their research and residency requirement at UMassD. These graduate courses have multiple credits in a trimester system. Note that each IOUSP credit is equivalent to one UMass credit and they often spend more time in a week (15-week for a trimester) for a course than a typical 3-credit course making their courses credit-heavy. Such courses are to be listed in the tracking sheet as “Electives” or as core

course substitutions, and the UMassD IMS Ph.D. requirement of a total of 36 credits for “Core” and “Electives” as well as seminar will have to be satisfied by the student.

Research Credit (18 credits) Equivalency Mapping:

The Ph.D. thesis research requirement at IOUSP is a continuous process during the student’s time in the program and students at IOUSP do not receive credit for dissertation research as is the case for UMassD IMS Ph.D. students. Thus, the totality of the student’s research at IOUSP and the residency at UMass for two semesters along with research credits accumulated while at UMass is considered to satisfy the research credit requirements under the UMassD-USP DD Ph.D. program.

In addition, the students in the DD program are required to attend the seminar (not graded) and give at least one seminar while in residency to local/regional/national or international conferences. Again, they do not receive course credit for this.

Due to the provision of substitution of prior coursework for core courses and non-counting of research credits, an overall GPA count for these DD program students will be reported only for the formal courses taken at UMass Dartmouth. Although IOUSP transcripts do not report a GPA, it can be estimated based on the grade received.

By the end of their fifth semester, doctoral candidates are expected to have taken a general examination to determine their suitability to proceed. During their fourth semester, a general comprehensive examination committee is formed. Both comprehensive exam and dissertation defense committees consist of at least five members: the UMassD and USP advisors (2), one faculty member of each university (2) and one external member of the expertise area of the Ph.D. work (1).

No later than the sixth semester, the student's committee administers the general comprehensive examination, which has a written and oral component. The general comprehensive examinations cover the core areas and the student's area of concentration. Examinations are designed to test the intellectual competence and maturity of the student in the broad area of marine sciences and in the selected area of concentration.

Upon passage of the comprehensive exams (written and oral) and dissertation proposal presentation, dual-degree students are required to spend at least two semesters conducting research at the host institution. Students choose research areas of mutual interest to the two institutions.

Standard 5 – Students

The student's admission to degree status will be approved by customary institutional procedures for the degree program, considering the student's qualifications, prior academic work, availability of faculty to serve as dissertation co-director, and access to research facilities. Program standards for admission to the graduate program generally include the following criteria:

- Undergraduate or graduate degree with a GPA of 3.00 or higher
- Undergraduate major in one of the basic scientific disciplines or engineering
- OR, must have strong multidisciplinary training with completion of at least 6 semesters of coursework in the natural sciences, generally to include biology, chemistry, and/or physics
- Preparation in mathematics at least through integral calculus is strongly encouraged

As per terms of the MOU, a student shall be nominated by the institution in which he/she is originally enrolled through a Letter of Commitment, which shall contain the name of the student, title of the project to be developed, work plan, provisional title for the thesis, name of co-directors from both institutions and name of Ph.D. program and corresponding area of specialization, if available. The Letter of Commitment shall be assessed by the appropriate graduate bodies within each institution. The student's admission to degree status will be approved by customary institutional procedures for this degree program, considering the student's qualifications, prior academic work, availability of faculty to serve as thesis co-director, and access to research facilities.

At UMass Dartmouth, the USP student will be accepted to the Intercampus Marine Science Ph.D. degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student. At USP-IO, the UMass Dartmouth student will be accepted to the USP-IO Ph.D. degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student.

The program is expected to be especially attractive to Portuguese-speaking U.S. students, of which there are a significant number in the Massachusetts SouthCoast region. However, all courses in the IOUSP program are taught in English and the dissertation must be written in English with an abstract in Portuguese. USP also offers an online introductory course in Portuguese for international students (<http://www.usp.br/internationaloffice/en/index.php/portugueseecourse>).

Initially, we anticipate that a relatively small number of students (<5) will participate from either institution. However, as the program gains reputation and faculty and students from the different institutions develop more familiarity with one another, the program may expand up to a maximum of six students from either institution at any given time.

Student financial support is sought through consultation with the institution advisors. In the case of UMass Dartmouth students, there are some institutional funds available for graduate assistantship as well as grant-funded opportunities. Students are also encouraged to seek fellowship opportunities. USP is state-supported and does not require students to pay tuition. USP-IO students may apply for so-called “sandwich program grants” from federal and state funding agencies that can provide support for airfare, monthly living allowance, and health insurance during their time in the U.S. UMass Dartmouth students while in Brazil will have access to subsidized low-cost meal options at the USP campus dining facilities.

Students from either institution will have access to counseling and crisis services at the campus they are attending to deal with personal issues. Such services are offered through the UMass Dartmouth Student Affairs office and through the USP Institute of Psychology. USP also has an Ombudsman’s Office to handle grievances or complaints.

Academic concerns of students can be addressed through consultation with the host advisor and with the support from the student’s dissertation committee. SMAST and USP-IO administrative staff are also available to assist students with routine needs and inquiries.

Standard 6 – Teaching, Learning, and Scholarship

Faculty from both institutions are highly accomplished in their fields having earned advanced degrees and having experience in teaching and advising graduate students at the Ph.D. level. CV’s are listed in Appendix V. There are currently 12 regular faculty in the School for Marine Science and Technology and

five affiliate faculty in other UMass Dartmouth academic units that contribute to the marine science program. At USP-IO, there are 11 participating faculty.

Student advising is accomplished through joint membership on dissertation committees. Routinely committee meetings as well as qualifying exams are carried out by videoconference facilities at both ends. Students are required to have regular meetings with the co-advisors from both institutions. A dissertation committee is formed generally no later than at the end of a student's fourth semester and regular meetings with this committee are required.

Students in the USP-IO – UMass Dartmouth dual Ph.D. program are expected to contribute to scholarship as part of their dissertation research. This includes presentation of their work at professional meetings and authorship or co-authorship on peer-reviewed journal publications.

Standard 7 – Resources

No significant new resources are required for this program beyond that currently available to the existing graduate programs at the respective institutions. Program costs will be covered through existing personnel and programmatic budgets. The program functions using a "pay at home" model, in which, during the period of residence in the host institution, a student pays for academic charges as if they were incurred at the home institution and receives a waiver of academic charges at the host institution. While this arrangement is designed for a balanced number of students studying in both directions, UMass Dartmouth acknowledges that at least initially more USP-IO students than UMass Dartmouth students will participate. UMass Dartmouth will offer waivers of annual academic charges for up to six USP-IO students each year in excess of UMass Dartmouth students to participate in the program. The remaining expenses (transportation, accommodations and the like) shall be borne by the student, who may seek funding from external agencies or from his/her institution of origin. Projected enrollment over the coming four years is given below:

<i>USP-IO UMass Dartmouth Dual PhD Program Enrollment</i>	# of Students Year 1	# of Students Year 2	# of Students Year 3	# of Students Year 4
UMass Dartmouth	1	2	2	2
USP-IO	2	3	4	4

An approximate project multi-year budget breakdown of program costs (from existing resources) includes the following:

	Year 1	Year 2	Year 3	Year 4
Faculty	\$8,000	\$16,000	\$16,000	\$16,000
Administration	\$3,000	\$3,000	\$3,000	\$3,000
Support Staff	\$4,500	\$4,500	\$4,500	\$4,500
Supplies	\$500	\$500	\$500	\$500
Library Costs	\$500	\$500	\$500	\$500
Lab Expenses	\$500	\$500	\$500	\$500
Total Estimated In-Kind Costs	\$17,000	\$25,000	\$25,000	\$25,000

These cost estimates assume a faculty member will dedicate approximately 10% of their time (@ average annual salary level of \$80,000) per student to advisement and mentoring during the period the student is in residence at the faculty member's campus. We have also included estimated costs for administration (2% person year) and staff support (10% of one staff person) as well as supplies, library, and lab expenses. Costs above do not include student assistantships, which are awarded on a competitive basis and derived primarily from grants and fellowships as well as some internal funds.

Standard 8 – Educational Effectiveness

Curriculum quality is maintained through regular updates of course content and evaluation of teaching based on student feedback as well as review by faculty peers. At the end of each course, students are given the opportunity to evaluate the course using a scan-sheet-questionnaire. Course evaluations are an important part of reappointment, tenure and promotion decisions. At UMass Dartmouth, faculty teaching evaluation scores for FY2014-2017 ranged 3.95 to 4.52 out of 5 (median=4.30).

Additional evaluation of teaching effectiveness is based on student survey results and faculty peer assessments of teaching either by direct observation or by assessment of course materials. This latter assessment is performed as part of the faculty annual evaluation process.

Student progress through the graduate program is assessed through performance in the coursework, as well as through regular meetings with advisor and student, maintaining student progress tracking sheets, meetings with advisory committees, dissertation proposal defense, comprehensive exams, writing of dissertation, and public and closed defense of dissertation. Additional metrics of student outcomes include student presentations at professional meetings, student authored or co-authored publications, and student involvement in service activities. Finally, program effectiveness is reflected in our alumni through tracking of career placement following graduation as well as alumni awards or other recognitions.

In addition to the ongoing evaluative monitoring described above, an Academic Quality Assessment and Development (AQAD) process is conducted as part of the university's Performance Measurement

System, as specified by the UMass Board of Trustees (document T98-033). The AQAD reviews focus on academic majors and graduate programs, grouped by the academic department or other unit that offers them. In the case of interdepartmental or intercampus programs, the review is carried out by the program's director or coordinator. For the Intercampus Marine Science graduate program, UMass Dartmouth serves as the lead campus with participation by UMass Amherst, Boston and Lowell. The Dean of the School for Marine Science and Technology (SMAST) serves as the program coordinator.

The AQAD process asks program faculty to assess academic qualities such as currency of curriculum, student successes, and faculty interests and strengths. Each review involves a self-study, a visit by external evaluators, and formation of an action plan. AQAD focuses on program quality and effectiveness. Its results can be used as input to guide strategic and programmatic decisions.

The AQAD process culminates in an approved Action Plan (Appendix III) that is arrived at in a consultative process between the Dean and the faculty of the program being reviewed. The Action Plan indicates how the program will address any issues raised during the review and establishes programmatic priorities for the next review period.

Core criteria to be addressed in the review process include the following:

- 1) Relevance of program goals and objectives to campus mission and priorities;
- 2) Relevance of curriculum to current standards of the discipline and rigor and coherence of curriculum;
- 3) Faculty quality and productivity;
- 4) Assurance that teaching and learning processes facilitate student success;
- 5) Effective use of resources (including budgetary and human resources).

The most recent AQAD review was conducted in FY17-18 and the resulting Action Plan is provided in Appendix III.

Standard 9 – Integrity, Transparency, and Public Disclosure

Both USP-IO and UMass Dartmouth are committed to high standards for academic and research integrity and seek to maintain an environment conducive to diversity and inclusion and accessibility. All faculty are required to comply with local, state, and federal regulations, mandates, and statutes that impact higher education. Students are treated equitably through policies for student conduct and rights. The [UMass Dartmouth Student Conduct Policies and Procedures](#) outlines these procedures and is publicly accessible on the University website.

Students from either institution will have access to counseling and crisis services at the campus they are attending to deal with personal issues. Such services are offered through the UMass Dartmouth Student Affairs office and through the USP Institute of Psychology. USP also has an Ombudsman's Office to handle grievances or complaints.

UMass Dartmouth and USP strive to provide current, accessible and comprehensive information about their programs through web presence, social media, targeted email, recruitment events, and regular publications. Information about the dual degree program is available on the UMass Dartmouth SMAST website (<https://www.umassd.edu/programs/dual-phd-sao-paulo/>). The UMass Dartmouth Office of Institutional Research and Assessment (IR) collects and disseminates statistical summaries of student characteristics, enrollment information, admissions trends, degrees issued, and legal information

pertaining to the University. It provides data that serve to inform and guide policies related to the academic programs for internal and external audiences including the UMass President's office, the Massachusetts Department of Higher Education, and the Federal government.

Projection of Future Developments

The USP-IO – UMass Dartmouth dual Ph.D. program is part of a portfolio of programs at UMass Dartmouth that offer learning opportunities related to the Portuguese-speaking cultures. UMass Dartmouth is located in a region with the largest concentration of Brazilian, Cape Verdean, and Portuguese immigrants in the U.S. It has internationally recognized programs in Portuguese language and studies.

The USP-IO – UMass Dartmouth dual Ph.D. program provides an ideal opportunity for students from Brazil and the U.S. to experience the cultures of each country as well as benefit from the high quality marine science programs at both institutions. In addition to this unique educational experience for students, it is anticipated that this program will foster additional collaborations among faculty from the different institutions, thus enhancing joint research activities and ultimately leading to further growth in the program.

Appendices

Appendix I. USP_UMass Dual PhD MOU



International Academic Protocol Agreement for Co-supervision of PhD thesis and Dual PhD degree in Oceanography (USP-IO)/Marine Sciences (UMass Dartmouth)

AGREEMENT between the UNIVERSIDADE DE SÃO PAULO, in the interest of INSTITUTO OCEANOGRÁFICO (USP-IO), Brazil, and the UNIVERSITY OF MASSACHUSETTS DARTMOUTH (UMass Dartmouth), USA, aimed at academic cooperation for the co-supervision of PhD students and dual degree/diploma in Oceanography (USP-IO)/Marine Sciences (UMass Dartmouth).

In recognition and in furtherance of our institutions' long-standing and mutually-beneficial cooperation in instruction and research in marine sciences and oceanography—the **UNIVERSIDADE DE SÃO PAULO** and the **UNIVERSITY OF MASSACHUSETTS DARTMOUTH** have mutually agreed and covenanted as set forth in the terms and conditions herein below:

CLAUSE 1- PURPOSE

The purpose of this Agreement is to foster academic cooperation between USP-IO and UMass Dartmouth by means of the co-supervision of PhD students of both institutions, aiming at the preparation of the PhD thesis leading to double diploma, which shall occur under joint responsibility of both institutions, according to the terms and conditions hereby established.

CLAUSE 2— GOALS AND FORMS OF COOPERATION

2.1. Regularly enrolled students from the PhD programs at USP-IO or at UMass Dartmouth pursuing a double diploma are required to have co-supervision to prepare a PhD thesis and must satisfy all degree requirements of both institutions. At UMass Dartmouth, the USP student will be accepted to the UMass School of Marine Science PhD degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student. At USP-IO, the UMass Dartmouth student will be accepted to the USP-IO PhD degree program and enrolled as a degree-seeking student, completing at least two consecutive semesters as a full-time student. The student shall be enrolled concurrently at both institutions in order to meet this requirement (the institutions will establish a record of this matriculation in an academic transcript).

2.2. A student shall be nominated by the institution in which he/she is originally enrolled through a Letter of Commitment to the present Agreement, which shall contain the name of the student, title of the project to be developed, work plan, provisional title for the thesis, name of co-directors from both institutions and name

of PhD program and corresponding area of specialization, if available. The Letter of Commitment shall be assessed by the appropriate graduate bodies within each institution involved in the Agreement. The student's admission to degree status will be approved by customary institutional procedures for this degree program, considering the student's qualifications, prior academic work, availability of faculty to serve as thesis co-director, and access to research facilities.

2.3. Each student shall follow a joint program agreed upon by both institutions as well as by their corresponding co-directors, who agree to fulfill their responsibilities as PhD co-directors of the student. At both institutions, the student will earn the minimum required number of academic credits for the PhD degree. The terms of this agreement permit reciprocity of earned credits - appropriate academic credit earned at USP-IO to be accepted also as UMass Dartmouth credit; and credit earned at UMass Dartmouth to be accepted also as USP-IO credit, towards the degree, as determined by the curriculum review and approval processes of the university. Details on curricular equivalency are given in Addenda I and II.

2.4. The period of preparation of the thesis shall be shared between the two institutions involved in the co-supervision, in alternate periods in each country. UMass Dartmouth will require a minimum of two semesters in physical residency in the United States or aboard a research vessel sponsored by UMass Dartmouth. USP-IO will require a minimum of two semesters in physical residency in Brazil or aboard a research vessel sponsored by USP-IO.

2.5. The procedures for co-supervision of PhD students aiming at double diploma shall abide by terms and conditions in the graduate rules and regulations in both institutions. However, students at both institutions under this special agreement will be afforded appropriate flexibility in meeting requirements.

2.6. The student accepted by the host institution shall be considered an exchange student who is seeking a degree, and shall have all rights equal to a regular student. Minimum US requirements must be met, including sufficient fluency in English to engage in the academic program. Minimum Brazil requirements must be met also, however, the disciplines at USP-IO will be taught in English. The institutions will seek to have a balanced number of participants.

2.7. The thesis shall be written in English with an abstract in Portuguese.

2.8. The thesis shall be presented only once, in the institution in which the student is originally enrolled, abiding by the graduate rules and regulations of that institution. The second school's dissertation advisor and committee member(s) will participate in the defense (advisor plus one or two additional faculty from the second school), either physically or by synchronous electronic technology. To receive both degrees, the student must meet the approval of both dissertation co-directors that the thesis is appropriate for the award of the degree.

2.9. Both qualifying and thesis defense committees shall consist of at least five members: the UMassD and USP advisors (2), one faculty member of each university (2) and one external member of the expertise area of the PHD work (1).

2.10. The publication, utilization and protection of the subject of the thesis and the corresponding research results are ensured by both PhD programs, according to the specific procedures adopted in each country.

2.11. Health insurance must be arranged by the student in his/her country of origin prior to his/her arrival at the host institution.

2.12. Faculty who are actively involved in this program will be presented by their home institution for election to faculty status or membership in the partnering institution, so as to ensure such privileges as chairing or being members of dissertation committees, participating in research, and approving their course to receive credit—as required by the academic procedures and requirements of each institution.

CLAUSE 3 - FINANCIAL SUPPORT

This agreement utilizes the "pay at home" model, in which, during the period of residence in the host institution, a student pays for academic charges as if they were incurred at the home institution and receives a waiver of academic charges at the host institution. While this arrangement is designed for a balanced number of students studying in both directions, UMass Dartmouth acknowledges that at least initially more USP-IO students than UMass Dartmouth students will participate. UMass Dartmouth will offer waivers of annual academic charges for up to **six** USP-IO students each year in excess of UMass Dartmouth students to participate in the program. The remaining expenses (transportation, accommodations and the like) shall be borne by the student, who may seek funding from external agencies or from his/her institution of origin.

CLAUSE 4 — OBLIGATIONS OF USP-IO AND OF UMass Dartmouth

4.1. At the completion of the student's stay, the host institution shall forward to the appropriate office of the home institution an official document, specifying the activities carried out by the student and, as the case may be, the evaluation attained.

4.2. Both institutions shall promote the integration of the student in the academic life of the host institution.

4.3. The host institution shall provide adequate research conditions and locations for the work of the student within its reach.

4.4. Both institutions acknowledge the validity of the co-supervision and the thesis defended and approved, granting the Doctorate degree (PhD degree) to the candidate, valid in Brazil and in the USA.

4.5. Two doctoral diplomas will be issued, one from USP-IO and another one from UMass Dartmouth.

CLAUSE 5— COORDINATION OF THE AGREEMENT

5.1. To ensure the technical-administrative coordination of this Agreement, USP-IO hereby appoints Prof. **Ilson Carlos Almeida da Silveira**, and UMass Dartmouth hereby appoints the Dean of the School for Marine Science and Technology at UMass Dartmouth, **Steven E. Lohrenz**.

5.2. It is incumbent on the Coordinators to provide solutions and to forward all academic and administrative issues that may occur during the effective term hereof, as well as to ensure supervision of the activities.

5.3. Written implementation agreements will be formulated between the institutions for all necessary academic and administrative matters. These shall be reviewed and updated at least annually.

CLAUSE 6- INTELLECTUAL PROPERTY

6.1. The rights to any intellectual property resulting from work carried out under this Agreement shall be subject to legal provisions in force in the countries, states, or governing regulations of the participating institutions.

6.2. In the case of creation of inventions, improvements and innovations by means of the activities protected by this Agreement, in accordance with the Brazilian legislation on international covenants of which Brazil is a signatory, it is considered that:

6.2.1. The intellectual property rights over any creation developed under this Agreement will belong to USP-IO and UMass Dartmouth, in equal parts.

6.2.2. The parties agree to reciprocal communications, in the event of reaching results susceptible to privilege or patent acquisition, maintaining the secrecy required in order to protect this result.

6.2.3. The parties agree to grant power of attorney for the registration of intellectual property rights arising out of this Agreement, whenever necessary and requested by the party responsible for requiring protection.

6.2.4. In the event of there being interest by the parties in obtaining protection of rights mentioned in clause 6.2, their management and costs will be regulated in an addendum term, in accordance with the current legislation.

6.2.5. In the event of there being interest by the parties in the use and licensing of the rights mentioned in clause 6.2, their costs, management licensing, assignment, transference or free use will be regulated in an addendum term, in accordance with the current legislation.

CLAUSE 7— CIVIL LIABILITY

The parties do not assume liability for damages and losses caused by an act of nature or force majeure.

CLAUSE 8— EFFECTIVE TERM

This Agreement shall become effective for a period of five years, as from the date it is executed by the representatives of both Parties. Upon the completion of this term, the agreement may be reedited, upon the assent of both institutions, and such renewal shall take the form of a new Agreement. Any changes herein shall be implemented in the form of an Amendment duly agreed to between the signatory parties.

CLAUSE 9— TERMINATION

This Agreement may be terminated at any time, by either party, by means of a 90-day prior written termination notice. In the event of any outstanding issues, the parties shall define, under an Agreement Termination Instrument, the responsibilities for the closing of each one of the programs affected by the termination, and all other outstanding issues, the activities in course to be continued with until completion. Students already enrolled in the program shall be allowed to complete their term of study.

CLAUSE 10— SETTLEMENT OF DISPUTES

In order to settle any doubts that may arise under the performance or in the construction of this Agreement, the parties shall exert their best efforts to arrive at a solution by mutual consent. In the event such consent is found to be impossible, the parties shall jointly appoint a third party neutral person, to act as mediator.

And having thus agreed, the parties execute this Agreement in two (2) identical counterparts in each version, in English and in Portuguese, to one and same effect.

For UNIVERSITY OF MASSACHUSETTS DARTMOUTH

Robert E. Johnson, PhD
Chancellor

Date: _____

Mohammad A. Karim, PhD
Provost and Executive Vice Chancellor

Date: _____

Steven Lohrenz, PhD
Dean, School for Marine Science & Technology

Date: _____

Tsfay Meressi, PhD
Associate Provost for Graduate Studies,
Coordinator of the Joint Program

Date: _____

For UNIVERSIDADE DE SÃO PAULO

Marco Antonio Zago
Reitor

Date: _____

Carlos Gilberto Carlotti Júnior.
Pró-reitor de Pós-graduação

Date: _____

Elisabete de Santis Braga da Graça Saraiva
Diretora, Instituto Oceanografico

Date: _____

Ilson Carlos Almeida da Silveira
Coordenador do Convênio

Date: _____

ADDENDUM I

Explanation of Course Equivalence for the University of Massachusetts Dartmouth Intercampus Marine Science and the University of São Paulo Institute of Oceanography Ph.D. programs.

The following paragraphs provide the summary of the “mapping of course equivalence” between the two curricula of the partner Ph.D. programs - Intercampus Marine Science (IMS) Ph.D. program at the University of Massachusetts Dartmouth (UMassD) and the Oceanography Ph.D. program at the University of São Paulo (USP), Brazil:

A typical UMassD Ph.D. student is required to satisfy the following credits during his/her tenure:

The Ph.D. Program requires a minimum of fifty-four (54) credit hours. Each student must complete four core courses; one in each of four core areas: biological oceanography, chemical oceanography, physical oceanography, and marine policy and/or management areas (including law and economics). Work in the concentration area includes a minimum of 24 credit hours of formal courses (excluding the core courses and dissertation research but including elective and seminar courses) and helps the student prepare for the written and oral candidacy examinations. Courses may be taken at any IMS-affiliated program on the four campuses, in other departments, and may be included in a student's program of studies as determined by the student's major advisor and/or dissertation committee. It is also required that students apply a minimum of 18 credit hours toward dissertation research. Ph.D. students are not normally accepted as part-time students.

The following equivalency mapping will be used for the UMassD-USP Dual Ph.D. Degree (DD) program.

Core Course (Four Courses in PO, BO, CO and Policy – 12 credits) Equivalency Mapping:

The Core-Course requirement for a USP student enrolled in the DD program is generally satisfied through substitution on the basis of prior coursework for the following reasons:

Most (85%) of the Ph.D. graduate students at the Institute of Oceanography at the University of São Paulo (IOUSP) who are eligible to apply to the DD program from Brazil are students with a B.S. in General Oceanography, which covers the four traditional areas of marine science plus conservation policy and marine affairs. Therefore, the students with such backgrounds receive a waiver of the requirements for the Introduction to Biological Oceanography, Introduction to Chemical Oceanography, and Introductory Physical Oceanography courses. Additionally, because they generally take many courses involving conservation policies and marine affairs topics, these students also receive a waiver of the marine policy course requirement.

The course topics corresponding to the four required UMass IMS core courses are covered in a number of relevant IOUSP advance-level undergraduate courses as detailed in the attached document: [IOUSP UMass Core Courses Syllabus Equivalence](#).

Note that students in the USP undergraduate General Oceanography B.S. program take multiple (if not all) of these courses during their 4 years of course work. Additionally, they take an additional year for their senior thesis research (mandatory) work. The B.S. program in General Oceanography at IOUSP also has a significant field component, which is described at the end of the syllabus description.

IOUSP also has agreements that validate the M.S. programs of Federal University of Rio Grande (FURG), Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro State University (UERJ), and Universidade do Vale do Itajai (UNIVALI). Thus, students completing their undergraduate B.S. from these universities and enrolling in the UMassD-USP DD program at IOUSP have effectively covered the content in the required core courses.

Other graduate courses, including those that may not cover the same material, may be identified as substitutions in place of the core courses to satisfy the core credit requirements.

Elective Courses (24 credits) Equivalency Mapping:

The Ph.D. graduate program at IOUSP requires the students to take a large number of graduate courses in their own program before they come to UMass Dartmouth for their research and residency requirement at UMassD. These graduate courses have multiple credits in a trimester system. Note that each IOUSP credit is equivalent to one UMass credit and they often spend more time in a week (15-week for a trimester) for a course than a typical 3-credit course making their courses credit-heavy. Such courses are to be listed in the tracking sheet as “Electives” or as core course substitutions, and the UMassD IMS Ph.D. requirement of a total of 36 credits for “Core” and “Electives” as well as seminar will have to be satisfied by the student.

Research Credit (18 credits) Equivalency Mapping:

The Ph.D. thesis research requirement at IOUSP is a continuous process during the student’s time in the program and students at IOUSP do not receive credit for dissertation research as is the case for UMassD IMS Ph.D. students. Thus, the totality of the student’s research at IOUSP and the residency at UMass for two semesters along with research credits accumulated while at UMass is considered to satisfy the research credit requirements under the UMassD-USP DD Ph.D. program.

In addition, the students in the DD program are required to attend the seminar (not graded) and give at least one seminar while in residency to local/regional/national or international conferences. Again, they do not receive course credit for this.

Due to the provision of substitution of prior coursework for core courses and non-counting of research credits, an overall GPA count for these DD program students will be reported only for the formal courses taken. Although IOUSP transcripts do not report a GPA, it can be estimated based on the grade received.

Addendum II
University of Massachusetts Dartmouth
Brazil Dual Degree Ph.D. Program Checklist
(IOUSP home campus)

Name:	Student ID:	GPA:
Option Area:	Matriculation Date:	
Advisor:	Expected Date of Graduation:	
Student Status (F/T, P/T, On Leave):	Date Checklist Submitted:	

As per the University of São Paulo Institution of Oceanography (USP-IO) – UMass Dartmouth Agreement:

2.3. Each student shall follow a joint program agreed upon by both institutions as well as by their corresponding co-directors, who agree to fulfill their responsibilities as PhD co-directors of the student. At both institutions, the student will earn the minimum required number of academic credits for the PhD degree. **The terms of this agreement permit appropriate academic credit earned at USP-IO to be accepted also as UMass Dartmouth and likewise those earned at UMass Dartmouth to be accepted also as USP-IO credit, towards the degree, as determined by the curriculum review and approval processes of the university.**

2.4. UMass Dartmouth will require a minimum of two semesters in physical residency in the United States or aboard a research vessel sponsored by UMass Dartmouth. USP-IO will require a minimum of two semesters in physical residency in Brazil or aboard a research vessel sponsored by USP-IO.

2.5. The procedures for co-supervision of PhD students aiming at double diploma/dual degree shall abide by what is stated in the graduate rules and regulations in both institutions. However, students at both institutions under this special agreement will be afforded appropriate flexibility in meeting requirements.

The Ph.D. program at UMass Dartmouth requires a minimum of 54 credit hours. For the dual degree program as per the Agreement, this requirement can be satisfied by an equivalent amount of coursework at USP-IO. The UMass Dartmouth Ph.D. program includes four core courses (12 credits) as well as courses in a concentration area beyond the core, seminars, and dissertation research. The core course requirement may be met through substitution with other courses, including those not covering the same content, provided that the student has completed similar or equivalent courses (including undergraduate courses) in the core areas. Students are still required to complete an equivalent number of credits in their graduate courses. Additional requirements include elective coursework and participation in seminars, which help the student prepare for the written and oral candidacy examinations. UMass Dartmouth Ph.D. students are also required to take a minimum of 18 credits toward dissertation research. USP-IO students do not receive credit for dissertation research at their home institution, but rather meet this requirement through completion of their two-semester residency at UMass Dartmouth and through the required four years of dissertation research at USP-IO. The student must achieve an overall equivalent average GPA of 3.0 in the Ph.D. degree program. Ph.D. students are not normally accepted as part-time students.

Core Courses (12 credits required, four core courses, or demonstrated equivalent) [] Check when complete

Electives (22 credits required, plus additional course substitutions for core courses waived) [] Check when complete

Seminars (2 credit equivalence satisfied by seminar participation during two semester residency at UMass Dartmouth) [] Check when complete

Research Credits (18 credits equivalence satisfied by two semesters in residence at UMass Dartmouth and four years dissertation research at IOUSP) [] Check when complete

Approval Signatures (required after reviewing completed tracking sheet)

Faculty Advisor	Date:
Graduate Program Director	Date:
Dean	Date:

Dissertation Title

--

Committee Members

Name	Affiliation

Committee Meeting Dates

Core Courses

(12 Credits Total)

Notes:

- 3 of the 3 Oceanography courses and 1 Policy course, or equivalent are required.
 - A minimum grade of **B-** is required for all core courses.
 - Enter “waived” if student has received a course waiver for a given course, and supply supporting documentation (e.g., undergraduate Oceanography B.S. degree transcript, waiver letter from Dean, etc.). **Important:** for waived core courses, students need additional elective credits to meet the required total number of credits for the degree.
- OR --
- Enter equivalent IOUSP course number if a core requirement was satisfied by a qualifying equivalent course per the Dual Degree “Curriculum Equivalence Mapping,” and include IOUSP graduate transcript showing equivalent course taken.

<u>Core Course</u>	<u>Credits</u>	<u>Semester Taken</u>	<u>Course Grade</u>
Biological Oceanography (BO)	3 (or 4) (circle appropriate) Actual credits:	_____	_____
Chemical Oceanography (CO)	3 Actual credits:	_____	_____
Physical Oceanography (PO)	3 Actual credits:	_____	_____
Marine Policy Course	3 Actual credits:	_____	_____

Notes:

Concentration and Electives

(22 credits minimum, plus any credits for “waived” core courses, or “waived” seminar credits such that total number of formal course credits (i.e., non-research credits) equals at least 34)

<u>Elective/Concentration Course</u>	<u>Credits</u>	<u>Semester Taken</u>	<u>Course Grade</u>

Total Graduate Credits			

Seminar Series

(Two semesters participation = 2 Credits, or Equivalence Required)

- Enter “waived” if student has received a waiver for seminar course requirement, and supply supporting documentation (e.g., waiver letter from Dean, etc.). **Important:** for waived seminar courses, students need 2 additional elective credits to meet the required total number of credits for the degree.

<u>Seminar Participation</u>	<u>Credits</u>	<u>Semester Taken</u>	<u>Course Grade</u>
_____	_____	_____	_____
_____	_____	_____	_____

<u>Seminar/Presentation Given</u>	<u>Date</u>	<u>Location</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Candidacy Examinations and Dissertation

<u>Candidacy Examination</u>	<u>Completed</u>	<u>Semester</u>	<u>Grade</u>
_____	_____	_____	_____
<u>Dissertation Proposal</u>	<u>Completed</u>	<u>Semester</u>	<u>Grade</u>
_____	_____	_____	_____
<u>Scholarly Dissertation*</u>	<u>Completed</u>	<u>Semester</u>	<u>Grade</u>
_____	_____	_____	_____

**Presentation and defense of a satisfactory dissertation normally to be completed within five years from the date of advancement to candidacy.*

Thesis Research

(Requirement of two semesters residency at SMAST plus four years continuous thesis research while enrolled in IOUSP graduate program = 18 Credits Equivalence)

	<u>Credits</u>	<u>Semester Taken</u>	<u>Course Grade</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Additional Comments:

Dissertation Milestones

Date of Defense	_____
Date Dissertation Submitted to Library	_____
Date Certification of Degree Completed and Sent to Registrar's Office	_____
Conferral Date	_____

Appendix II. USP Accreditation Reference



São Paulo, 14 December 2018

To:
Steven Lohrenz
Dean and
Professor of Oceanography
School for Marine Science and Technology
University of Massachusetts Dartmouth
New Bedford, MA
United States of America

Dear Dean Lohrenz,

Upon your request, attached is a copy of the Brazilian Federal Register ("*Diário Oficial da União*", DOU) stating that the Graduate Program in Oceanography of the University of São Paulo is accredited at national level.

I should also inform you that our program is ranked as the best program in Marine Sciences of Brazil. I should also clarify that all accredited academic graduate programs in Brazil are evaluated every four years by a federal research funding agency "*Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior*"- CAPES. The grades vary from one to seven. Since the 2017 evaluation, the graduate program from the Instituto Oceanográfico obtained grade **CAPES-7**, a mark never reached before by a Marine Sciences program in this country.

Please, feel free to request any additional information necessary for the renewal of our joint effort, the UMassD-USP Double PhD Degree Program in Marine Sciences.

Sincerely yours,

Paulo Yukio Gomes Sumida
Vice-Director
Instituto Oceanográfico
Universidade de São Paulo

PORTARIA

MEC - Nº 1.325

PARECER - CES/CNE

Nº 162/2011

DE - 21.9.2011

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Ministério da Educação

GABINETE DO MINISTRO

PORTARIA Nº 1325 DE 21 DE SETEMBRO DE 2011

O MINISTRO DE ESTADO DA EDUCAÇÃO, no uso de suas atribuições legais, em conformidade com a Resolução CNE/CES nº 1, de 03 de abril de 2001, e tendo em vista o Parecer nº 162/2011, da Câmara de Educação Superior do Conselho Nacional de Educação, proferidos nos autos do Processo nº 23001.000018/2011-68, resolve:

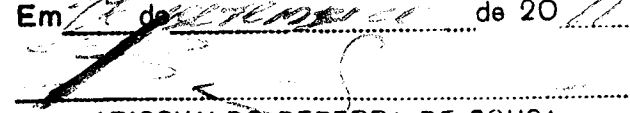
Art. 1º Reconhecer os cursos de pós-graduação stricto sensu, Mestrado e Doutorado relacionados na planilha anexa ao presente parecer, aprovados pelo Conselho Técnico e Científico - CTC da CAPES, nas reuniões realizadas de 29 a 30 de junho de 2010 (119ª Reunião), de 29 de setembro a 1 de outubro de 2010 (121ª Reunião) e de 25 a 29 de outubro de 2010 (122ª Reunião), com prazo de validade determinado pela sistemática avaliativa.

Art. 2º Esta Portaria entra em vigor na data de sua publicação.

FERNANDO HADDAD


DIVISÃO DE REGISTROS ACADÊMICOS

Em 21 de setembro de 20 11


ARIOSVALDO BEZERRA DE SOUSA

Chefe Técnico de Divisão

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50	CIÊNCIAS DA SAÚDE	SAÚDE COLETIVA	SAÚDE NA COMUNIDADE	DO	5	USP/RP	UNIVERSIDADE DE SÃO PAULO/RIBEIRÃO PRETO	SP	SUDESTE
51	CIÊNCIAS EXATAS E DA TERRA	CIÊNCIA DA COMPUTAÇÃO	ENGENHARIA DE COMPUTAÇÃO E SISTEMAS	MP	3	UEMA	UNIVERSIDADE ESTADUAL DO MARANHÃO	MA	NORDESTE
52	CIÊNCIAS EXATAS E DA TERRA	CIÊNCIA DA COMPUTAÇÃO	CIÊNCIA DA COMPUTAÇÃO	ME	3	UFABC	FUNDAÇÃO UNIVERSIDADE FEDERAL DO ABC	SP	SUDESTE
53	CIÊNCIAS EXATAS E DA TERRA	CIÊNCIA DA COMPUTAÇÃO	CIÊNCIA DA COMPUTAÇÃO	ME	3	UFJF	UNIVERSIDADE FEDERAL DE JUIZ DE FORA	MG	SUDESTE
54	CIÊNCIAS EXATAS E DA TERRA	CIÊNCIA DA COMPUTAÇÃO	CIÊNCIA DA COMPUTAÇÃO	ME	3	UFMA	UNIVERSIDADE FEDERAL DO MARANHÃO	MA	NORDESTE
55	CIÊNCIAS EXATAS E DA TERRA	CIÊNCIA DA COMPUTAÇÃO	COMPUTAÇÃO	ME	3	UFPEL	UNIVERSIDADE FEDERAL DE PELOTAS	RS	SUL
56	CIÊNCIAS EXATAS E DA TERRA	GEOCIÊNCIAS	OCEANOGRAFIA	ME/DO	5	USP	UNIVERSIDADE DE SÃO PAULO	SP	SUDESTE
57	CIÊNCIAS EXATAS E DA TERRA	MATEMÁTICA / PROBABILIDADE E ESTATÍSTICA	MATEMÁTICA EM REDE NACIONAL	MP	3	SBM	SOCIEDADE BRASILEIRA DE MATEMÁTICA	RJ	SUDESTE
58	CIÊNCIAS EXATAS E DA TERRA	QUÍMICA	QUÍMICA	ME	3	UFG	UNIVERSIDADE FEDERAL DE GOIÁS	GO	CENTRO-OESTE
59	CIÊNCIAS EXATAS E DA TERRA	QUÍMICA	QUÍMICA	ME	3	UFGD	UNIVERSIDADE FEDERAL DA GRANDE DOURADOS	MS	CENTRO-OESTE
60	CIÊNCIAS EXATAS E DA TERRA	QUÍMICA	CIÊNCIA E TECNOLOGIA DA SUSTENTABILIDADE	ME	3	UNIFESP	UNIVERSIDADE FEDERAL DE SÃO PAULO	SP	SUDESTE
61	CIÊNCIAS EXATAS E DA TERRA	QUÍMICA	QUÍMICA	ME/DO	7	USP/SC	UNIVERSIDADE DE SÃO PAULO/SÃO CARLOS	SP	SUDESTE
62	CIÊNCIAS HUMANAS	ANTROPOLOGIA/ARQUEOLOGIA	ARQUEOLOGIA	ME	4	FUFSE	FUNDAÇÃO UNIVERSIDADE FEDERAL DE SERGIPE	SE	NORDESTE
63	CIÊNCIAS HUMANAS	ANTROPOLOGIA/ARQUEOLOGIA	ANTROPOLOGIA	ME	3	UFPB/J.P.	UNIVERSIDADE FEDERAL DA PARAIBA/ JOAO PESSOA	PB	NORDESTE
64	CIÊNCIAS HUMANAS	GEOGRAFIA	GEOGRAFIA	DO	4	UECE	UNIVERSIDADE ESTADUAL DO CEARÁ	CE	NORDESTE
65	CIÊNCIAS HUMANAS	GEOGRAFIA	GEOGRAFIA	DO	4	UFBA	UNIVERSIDADE FEDERAL DA BAHIA	BA	NORDESTE
66	CIÊNCIAS HUMANAS	GEOGRAFIA	GEOGRAFIA	ME	3	UFRR	UNIVERSIDADE FEDERAL DE RORAIMA	RR	NORTE
67	CIÊNCIAS HUMANAS	GEOGRAFIA	GEOGRAFIA	MP	3	UNESP/PP	UNIVERSIDADE ESTADUAL PAULISTA JULIO DE MESQUITA FILHO/ PRESIDENTE PRUDENTE	SP	SUDESTE
68	CIÊNCIAS HUMANAS	GEOGRAFIA	GEOGRAFIA	ME	3	UNIOESTE	UNIVERSIDADE ESTADUAL DO OESTE DO PARANÁ	PR	SUL
69	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	GESTÃO PÚBLICA	MP	3	UFES	UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO	ES	SUDESTE
70	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	GESTÃO DE ORGANIZAÇÕES PÚBLICAS	MP	3	UFSM	UNIVERSIDADE FEDERAL DE SANTA MARIA	RS	SUL
71	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	ADMINISTRAÇÃO	MP	3	UNA	CENTRO UNIVERSITÁRIO UNA	MG	SUDESTE
72	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	ADMINISTRAÇÃO	MP	3	UNISC	UNIVERSIDADE DE SANTA CRUZ DO SUL	RS	SUL
73	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	GESTÃO E NEGÓCIOS	MP	4	UNISINOS	UNIVERSIDADE DO VALE DO RIO DOS SINOS	RS	SUL
74	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	GESTÃO ESTRATÉGICA DAS ORGANIZAÇÕES	MP	3	URI	UNIVERSIDADE REGIONAL INTEGRADA DO ALTO URUGUAI E DAS MISSOES	RS	SUL
75	CIÊNCIAS SOCIAIS APLICADAS	ADMINISTRAÇÃO, CIÊNCIAS CONTÁBEIS E TURISMO	ADMINISTRAÇÃO	ME	3	UDESC	UNIVERSIDADE DO ESTADO DE SANTA CATARINA	SC	SUL
76	CIÊNCIAS SOCIAIS APLICADAS	PLANEJAMENTO URBANO E REGIONAL/DEMOGRAFIA	DEMOGRAFIA	ME	3	UFRN	UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE	RN	NORDESTE
77	CIÊNCIAS SOCIAIS APLICADAS	PLANEJAMENTO URBANO E REGIONAL/DEMOGRAFIA	PLANEJAMENTO E GOVERNANÇA PÚBLICA	MP	3	UTFPR	UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ	PR	SUL
78	ENGENHARIAS	ENGENHARIAS I	GESTÃO DE RECURSOS HÍDRICOS	MP	3	UFC	UNIVERSIDADE FEDERAL DO CEARÁ	CE	NORDESTE
79	ENGENHARIAS	ENGENHARIAS II	ENGENHARIA DE PROCESSOS E TECNOLOGIAS	ME	3	UCS	UNIVERSIDADE DE CAXIAS DO SUL	RS	SUL

Appendix III. AQAD Response and Action Plan

ACADEMIC QUALITY ASSESSMENT AND DEVELOPMENT RESPONSE AND ACTION PLAN

University of Massachusetts
Intercampus Marine Science Graduate Program



Submitted on behalf of the IMS faculty to
Mohammad Karim
Provost and Executive Vice Chancellor for Academic and Student Affairs
University of Massachusetts Dartmouth

June 28, 2018

I. Introduction

The Intercampus Marine Science (IMS) graduate program Academic Quality Assessment and Development review was conducted during the spring 2018 semester. An external committee conducted the review. Members of the committee included:

Dr. Megan Davis, Associate Executive Director for Academic Affairs and Economic Development, Florida Atlantic University, Harbor Branch Oceanographic Institute

Dr. Christopher F. D'Elia, Dean and Professor, College of the Coast and the Environment, Louisiana State University

Dr. Mary C. Fabrizio (Chair), Professor of Marine Science, Department of Fisheries Science, Virginia Institute of Marine Science

Dr. James O'Donnell, Professor of Marine Sciences and Executive Director, Connecticut Institute for Resilience and Climate Adaptation, University of Connecticut

The committee made a site visit on February 25 and 26, 2018, to the UMass Dartmouth campus, which is the lead administrative campus for the IMS program. Prior to the site visit, the committee was provided with an IMS self-study prepared by faculty and staff from the participating institutions, as well as other supporting documentation (see committee report for list of documentation provided). During the site visit, the committee met on February 25 with faculty and students at the UMass Dartmouth

School for Marine Science and Technology. The following day, the committee visited with deans and other administrators on the UMass Dartmouth main campus and toured the Center for Innovation and Entrepreneurship in Fall River.

Subsequent to the site visit on April 25, the committee submitted their report about the IMS program to the SMAST Dean, who also chairs the IMS Coordinating Committee. The dean subsequently shared the report with the SMAST and IMS faculty, IMS campus coordinators from UMass Amherst, UMass Boston, and UMass Lowell, as well as the Provost and Executive Vice Chancellor for Academic and Student Affairs and the Associate Provost for Graduate Studies at UMass Dartmouth.

We thank the contributors to the self-study, all participants in the site visit, the external committee for their recommendations as well as those who contributed to this response. In addition to providing feedback about the IMS program, a number of the committee's comments dealt specifically with SMAST. They affirmed many strengths of both IMS and SMAST, including relevance of the programs to institutional mission and goals and to regional needs, opportunities for students to be involved in high-impact research and engage with multiple "agencies, corporations, non-profits, research, and academic organizations", and the wide range of academic foci available to students through the intercampus nature of the IMS program. The committee also identified weaknesses that should be addressed. These included lack of centralized administrative authority over the IMS program and stronger linkages between the IMS graduate program and undergraduate education. Various concerns of the graduate students were noted, including the need for fostering more student interactions across the campuses, lack of clear mentorship (although this was at odds with student surveys where they stated that they were receiving a high quality of advising), and concerns about after-hours security at SMAST. Other comments directed at SMAST included the need for a faculty mentorship program, a plan to address faculty succession in order to sustain the program, and clearer articulation of workload expectations for faculty.

Overall, the IMS faculty and program coordinators accepted the committee's conclusions and recommendations, and responses are provided to each of their recommendations in the following sections. There were some statements in the committee report that reflected an incomplete understanding or inaccurate characterization of some aspects of the program. This is understandable given the limited time and large amount of information that the committee had to make their assessment. In these instances, an attempt has been made to provide clarification and correction as well as further interpretation. The SMAST faculty also noted that some of the committee's recommendations were specific to SMAST and UMass Dartmouth, while others were inclusive of the IMS program as a whole. The committee acknowledged that because there was not an opportunity to visit the other campuses, the report is necessarily skewed towards UMass Dartmouth. For this reason, it was decided that the action plan should distinguish between IMS and UMass Dartmouth SMAST issues. It was also agreed that the action plan should identify responses that are achievable with the current facilities, faculty, and level of support versus actions that require programmatic changes and/or new resources.

In the remainder of this document, we summarize the major recommendations of the committee and provide responses. We then propose an action plan organized around four major categories including academic goals, undergraduate instruction, curriculum, and leadership and administration of the IMS program.

II. Response to Committee Recommendations

The committee offered several recommendations. We address each of those here, and those that are specific to SMAST, as opposed to IMS as a whole, are denoted with a “*”:

- 1) ***Develop a strategic plan and implementation plan*** – We fully support the recommendation to develop a strategic plan and implementation plan for SMAST and the IMS graduate program. Related to the IMS program, ultimately each campus has to decide if it will support the IMS program with faculty hires and to some extent this falls to the participating departments on those campuses. With regard specifically to SMAST, a meeting was held prior to the AQAD review with the UMass Dartmouth Chancellor and Provost where it was agreed that an implementation plan should be developed that includes a strategy for resource allocation and faculty succession that will sustain the program. SMAST faculty and administration have already begun this development process, which will continue in the coming months with the goal of presenting an implementation plan to the Chancellor and Provost in September 2018.
- 2) ***Centralize program administration*** – The current administrative structure of the IMS program designates UMass Dartmouth as the lead campus, with responsibility for a coordinating role. There are general policies for the IMS program, which were recently updated and apply to the program as a whole. Additionally, any curricular or policy changes are subject to approval by all the participating campuses. Beyond that however, each campus is responsible for its own admissions process and adherence to campus graduate policies. This revision of IMS policies was implemented in 2016 and is considered to have improved the administration of the program. Although we understand the committee’s reasoning for favoring a more centralized program administration, the reality is that each campus is expected to administer to its own students within the framework of the IMS. We agree with the committee that the website should be improved, and we have made progress in that area as a result of the committee’s recommendation, including a central web repository for documents and guidance for participating faculty and students. We also agree that more efforts should be made to increase opportunities for IMS faculty and students to interact and for intercampus collaborations. The annual IMS symposium has in recent years been a mechanism to bring IMS faculty and students together.
- 3) ***Re-evaluate the intercampus structure of the IMS program*** – The IMS program was established specifically to foster more interactions among the campuses. We believe that the IMS program has been effective in promoting such interactions both in teaching and advising and in fostering cross-campus research. The faculty consensus is that eliminating the intercampus structure would be a detriment to cross-campus engagement. We agree that there may be ways to improve the structure of the program, but we feel strongly that it should continue as an intercampus program.
- 4) ****Forge a solid connection with the undergraduate program at UMass Dartmouth*** – The committee advocated more involvement of SMAST faculty with undergraduate programming, and we fully agree. SMAST has been involved in teaching undergraduate courses, mentoring NSF REU students, and providing internship and work-study experiences for undergraduates. We will continue to seek out these types of opportunities and expand our connections with the UMass Dartmouth undergraduate community.

- 5) ****Develop an undergraduate major*** – Following the committee’s recommendation, SMAST faculty have taken the lead on the development of a preproposal for an undergraduate major in Marine Science and Environmental Sustainability (MSES). We now have the support of the UMass Dartmouth administration for this endeavor and are working to engage support and participation of other colleges and faculty on the main campus. This will continue to be a priority and a key part of a viable business model for SMAST.
- 6) ***Address the economic reality of the UMass System*** –The committee felt that there was a lack of understanding on the part of faculty about the economic urgency facing the University system. They recommended that mediation be undertaken to help achieve transparency and accountability and improve communication. They cited the need for a “culture shift” to recognize current economic limitations and used the example of actively recruiting research faculty to increase research capacity. This is already happening to some extent. As part of enhancing understanding, more frequent and open exchanges with the Provost and Chancellor are being sought, with one already scheduled for September 2018 (see also #8, below).
- 7) ****Develop plan to address classroom space constraints at UMass Dartmouth*** – Adequate space in foundational lab courses has been a constraint at UMass Dartmouth for development of new undergraduate STEM degree programs. However, there are plans underway to secure support for a new academic building on the main campus that should alleviate this problem. Alternatively, there may be other mechanisms to increase the capacity of such courses, including offering sections at SMAST, which has teaching laboratory space. This would also require arranging transportation for students from and to the main campus. Discussions among the appropriate deans is underway to address this issue to support the proposed MSES major.
- 8) ****Improve communication between faculty and administration*** – SMAST faculty met with Chancellor Johnson and Provost Karim on March 26, and this meeting was a positive step towards improving communication and has generated positive momentum among the faculty. The following were major points from that meeting:
 - a. The Chancellor affirmed that marine science would continue to be one of the major thrusts of the University of Massachusetts Dartmouth academic and research enterprise, and SMAST would continue to be central to the marine science effort.
 - b. The faculty in both departments within SMAST raised concerns about declining numbers of faculty, a factor that has negatively impacted graduate student enrollment in recent years and threatens the sustainability of the program. The Chancellor emphasized the need to develop a plan with clearly articulated next steps for how this and related issues of concern raised by the SMAST faculty would be addressed in alignment with the University’s priorities and fiscal capabilities, including plans for appropriate allocation of resources and faculty lines to sustain the SMAST program.
 - c. The Chancellor noted that a report being developed by Associate Provost for Research and Economic Development Alex Fowler about establishment of a marine and environmental research innovation center as well as the IMS AQAD report would provide important guidance for development and implementation of an action plan for SMAST.
 - d. The Chancellor was supportive of the development of a marine science undergraduate program (including an option for a 4+1 M.S. program), noting that his experience suggested this could be an important recruitment tool for the University. SMAST faculty

responded that an earlier version of a preproposal for an interdisciplinary marine science program had been put forward, but stalled at the administrative level. The Chancellor asked faculty to revise and re-submit the preproposal ASAP to move the initiative forward, which has been done.

- e. The Chancellor requested that there be regular meetings each semester with SMAST faculty beginning in September 2018 to assess progress on key action items identified above as well as to address new initiatives and concerns.
- 9) ***Establish an Ombuds position** – The committee recommended the establishment of an ombuds position at UMass Dartmouth to provide an impartial and confidential avenue to address disputes and concerns. We concur with the committee’s recommendation. As the committee noted, this will be particularly important as diversity among both students and faculty increases. However, authorization for such a position will be a decision for the University administration.
- 10) ***Address safety issues at SMAST** – Various actions have been taken to address concerns raised by students, faculty and staff about security of the buildings and grounds on the SMAST campus. New camera systems have been installed for both SMAST West and East, and lighting of parking areas is being upgraded to provide better coverage. The security gates have now been activated, and will automatically open during working hours and close in the evening. The gates can be opened using employee pass cards, and will eventually also be able to be activated using a Bluetooth function that can be operated from an employee’s cell phone. Doorways at SMAST West will have pass card entry systems installed or will be equipped with an alarm to avoid having doors propped open, particularly after hours. Doors that are not operating properly are being repaired or replaced as appropriate. We also held an all hands meeting to discuss safety issues and talked about best practices for maintaining personal safety.
- 11) **Enhance funding opportunities for faculty** – The committee emphasized the importance of fostering an active research enterprise (e.g., through small innovation grants or seed funding to explore high-risk opportunities, gather and analyze data to support development of larger grants, etc.). Some of these opportunities already exist, but additional similar types of approaches should be considered. Many IMS students are supported through research funding and benefit from experiential learning opportunities afforded by being involved in research projects with faculty. At UMass Dartmouth, SMAST accounts for more than one-third of the University’s external research budget and thus plays a critical role in maintaining the University’s Carnegie research profile.
- 12) ***Develop a formal program for faculty mentorship and a plan for faculty succession** –We fully agree with this recommendation. SMAST is at a critical juncture and there is an urgency to bring in new faculty to replace faculty retirements and to introduce new perspectives in research and academics. This should be done in parallel with the development and implementation of a faculty mentoring plan to help retain and support early career faculty.
- 13) ***Establish clear workload expectations for faculty** –This comment appears to pertain to the SMAST faculty, who noted that workload expectations were already well established, based on guidelines outlined in a 2005 memo from then Provost Esposito that laid out the administrative structure of SMAST and expectations for workload (Appendix A). This memo has served as a governing document through the tenure of five different Provosts and four Chancellors and is well known to the faculty. Although the AQAD external committee did not provide a comparison

to peer institutions, the faculty noted that current workloads are comparable to those at peer institutions with established reputable marine science graduate programs.

- 14) ***Re-evaluate areas of specialization within IMS*** – The faculty agree that it would be a useful exercise to reexamine the concentration areas for their relevance to student and market demand, as well as the compatibility with current areas of faculty expertise. This should be addressed as an agenda for an IMS-wide faculty meeting.
- 15) ***Codify and improve access to academic program policies and procedures*** – SMAST has implemented a new web portal since the AQAD site visit, which provides access to a central repository of policies and forms, including IMS policies. We are also simplifying the IMS website to make it more mobile-friendly and easier to maintain and update. A public portal with forms and policies relevant to the IMS program can also be developed for the broader IMS community.
- 16) ***Identify additional funding for IMS graduate students*** – Since the external committee's visit, the UMass system office has announced that it will gradually phase out the funding for the IMS program. This will shift more of the burden of funding IMS students to the campuses and will also eliminate any programmatic support funds. The small pool of IMS funds provided short-term support to recruit new students and provide bridge funding to established students to complete the program. IMS faculty have serious concerns about the impact this will have, particularly noting that with a current enrollment of ~70 students across the system, the IMS program is one of the largest STEM graduate programs in the system. We agree with the committee's recommendation that other sources of support for students should be sought, and this is even more imperative now. This will be a high priority for the program.
- 17) ***Explore expansion of the aquaculture program*** – We fully agree with the committee's recommendations that opportunities to expand both academic and research programs in aquaculture should be pursued. Leveraging the SMAST seawater facilities, UMass Boston's new aquaculture program, and the UMass Amherst laboratory in Gloucester could provide a foundation for an IMS-wide initiative in aquaculture in concert with field aquaculture research programs currently underway at SMAST. The committee suggested that on-line graduate courses related to aquaculture might have a strong appeal and we agree this should be evaluated.
- 18) ***Forge closer ties with private colleges in the Commonwealth*** – UMass Amherst has an undergraduate certificate program in marine science, the Five College Coastal and Marine Sciences Program that has participation from University of Massachusetts-Amherst, Smith College, Mount Holyoke College, Hampshire College, and Amherst College. This program could serve as a model for other campuses to engage with private colleges in their region.
- 19) ***Develop standardized methods of tracking progress and assessing the academic program*** – The committee noted that reporting of tracking progress and assessment of academic programs provided in the IMS self-study was not uniform across the four participating campuses. The committee recommended that the following information be provided by all campuses annually: (1) annual student enrollments and number of graduates; (2) educational opportunities for students; (3) placement of graduates; (4) role of the University in marine science policymaking; (6) annual grants and contracts expenditures; (7) percent of time faculty spend on IMS; (8) number of faculty in IMS; and (9) funding sources that support students. Information such as number and scope of student presentations, student awards, and service activities should also be provided. The committee also suggested that information be provided about the number of

faculty receiving development (e.g., seed) funds and release time from courses, and this should be evaluated in the context of program mission and goals. Having a dedicated position, such as an Associate Dean, to oversee this process would be beneficial.

- 20) ***Increase diversity of the faculty and IMS graduate students*** – The committee noted that both UMass Boston and UMass Dartmouth have significant numbers of students from underrepresented groups, and we agree that increasing recruitment efforts of students from our own campuses may provide a means to increase the diversity of our students. They mentioned specific programs (NOAA-Hollings, AFS-Hutton) that could provide opportunities to recruit students of diverse backgrounds. The committee also noted that SMAST faculty had low diversity, both gender and racial. Any efforts to bring on new faculty should seek to recruit candidates of different backgrounds and types.
- 21) ***Continue to provide opportunities to non-degree seeking graduate students*** – This recommendation apparently refers to non-degree seeking students, but the committee referenced the Professional Science Master's program, which is an IMS degree program. There is also a non-thesis M.S. degree option. The faculty agree that these programs as well as developing new certificate programs and encouraging non-degree students to take courses should be encouraged. Models such as the UMass Boston certificate program in sustainable aquaculture or the UMass Amherst marine sciences certificate program might be applicable to other campuses.
- 22) ***Form Advisory Committees that include agencies, corporations, and industry*** – We agree with this recommendation. There is already an Advisory Council for the Massachusetts Marine Fisheries Institute, which includes representation from UMass Amherst and UMass Boston as well as state and federal agencies, non-governmental organizations, and industry representatives. In addition, we recently formed a Professional Science Master's program external advisory board to provide guidance in seeking external partnerships with different organizations to broaden the range of opportunities for our students and ideally provide for internship opportunities as well as engagement of external professionals as student advisors.
- 23) ***Continue partnerships with CIE (Center for Innovation and Entrepreneurship)*** – The CIE has been effective in building a network of groups in the maritime sector.
- 24) ***Explore alternative means of knowledge acquisition for graduate students*** – The SMAST and IMS faculty agree that efforts should be made to explore novel approaches to developing knowledge for graduate students. The recently released report "Graduate STEM Education for the 21st Century" by the National Academies of Sciences may provide a valuable resource.
- 25) ***Improve quality of core-course teaching*** – In response to this recommendation, the SMAST faculty have formed an ad hoc committee to review student feedback in core course evaluations and to examine and implement strategies to enhance the content and delivery of course material.

III. Action Plan

The IMS faculty felt it was important that the IMS Action Plan have a clear linkage to the strategic vision and mission of the IMS:

Vision – The vision of the IMS is to provide an interdisciplinary program in marine science and technology integrated across the four campuses of the UMass system.

Mission – The program mission is to improve the quality of graduate education in marine sciences and related technology within the University as well as foster research and public service in support of the Commonwealth's efforts in protection, preservation, restoration, and sustainable economic development of its extensive coastal and ocean lands, waters, and resources.

A subset of the external committee's recommendations address urgent issues that are critical to the future success and sustainability of the IMS program, and we focus on those. We have organized the following Action Plan around four major areas, including:

- Academic Goals
- Undergraduate Instruction
- Curriculum
- Leadership & Administration

A. Academic Goals

Goal 1: Improve enrollment and retention

The committee noted that that the IMS failed to meet its explicit enrollment goals (50 PhD + 100 MS by 2006). This projection, which was given in the "Final Application for the M.S. and Ph.D. Degree Programs in Marine Science and Technology" (September 2000), was based on an estimated total of 68 IMS-affiliated faculty across the four campuses. As noted in the committee report, the current estimate of IMS faculty is 48, although not all of these are fully dedicated to the IMS program. Current IMS enrollment is estimated at 70 students. At UMass Dartmouth, there are 12 full-time regular SMAST faculty and four affiliate faculty in other departments advising approximately 50 IMS graduate students. From 2012-2017, at UMass Dartmouth the IMS program graduated 24 Ph.D. students, more than any other STEM Ph.D. program at UMass Dartmouth. Hence, again the IMS program has played a critical role in the UMass Dartmouth Carnegie Doctoral Research University status.

Currently, SMAST faculty are advising an average of about 4 graduate students per faculty member. If SMAST faculty advising load was maintained or increased to an average of 5 students per faculty, current capacity would be a graduate population of about 60 students and an average Ph.D. production of about 4 per year, similar to current conditions. A space assessment of SMAST facilities found that 19 tenure-track faculty could be accommodated with minor re-allocations of existing SMAST space (7 vacant faculty offices, 3 vacant labs and available shared lab space). Major space re-allocations could accommodate 30 faculty and 160 graduate students and researchers. A tenure-

track faculty of 19 should be able to support a population of 80-100 graduate students. Assuming a similar level of degree productivity, this would produce an average of 8 Ph.D. graduates per year.

Specific action: *Increase the number of full-time tenure track SMAST and IMS faculty through strategic hiring and succession planning*

In order for this approach to be successful, it will be necessary to maintain and grow funding sources for students. This is particularly critical given the anticipated reduction in Intercampus Marine Science funding from the President's office. The AQAD committee report incorrectly quoted the percentages of different student funding sources. The correct percentages as given in the IMS self-study were 4% fellowships; 12% IMS budget; 12% unrestricted; 13% self-funded, 19% employed (mainly as grant-funded SMAST technical associates), and 40% grant. Increasing the number of tenure-track faculty would also lead to a proportional increase in research productivity and funding for students. This would further reinforce the Carnegie Doctoral Research University status of UMass Dartmouth. In addition to increasing grant-support for students, suggested avenues for expanding funding for students includes providing access to teaching assistantships for IMS students, tuition and fee waivers, and raising private funds for student fellowships and scholarships.

Specific action: *Seek to expand sources of funding for students through increased grant productivity, access to teaching assistantships, tuition and fee waivers, and private funding sources*

Other specific actions to improve enrollment include:

- *Expand enrollment in the PSM and non-thesis M.S. degree programs*
- *Promote international academic partnerships – Brazil, Azores, Indian Institutes of Technology, etc.*
- *Increase efforts to recruit students from existing B.S. programs at UMass Dartmouth and the other IMS campuses*
- *Develop 4+1 and 4+2 programs with Massachusetts Maritime Academy*
- *Develop new undergraduate academic programs in marine science (see Undergraduate Instruction, below) that will provide a conduit for students to transition into the graduate program*

Regarding retention, the self-study reported an overall student retention for the IMS program at UMass Dartmouth of about 70% (29% of students leaving the program compared to total number graduated). The AQAD committee noted that this was a high loss rate. Further analysis of retention data was conducted by considering only students at SMAST, excluding those who left for medical or health reasons, and including students that returned and completed their degrees. In that case, the retention rate of SMAST students was considerably higher (~85% retention). Nevertheless, it was agreed that ensuring timely progress towards degree and addressing student well-being and satisfaction with the program must be a priority. Efforts are being made to ensure that student progress is being tracked on a regular basis. Results from the fall 2017 student survey as well as recommendations from the AQAD external committee will also be considered in efforts to improve student satisfaction with the program.

Goal 2: Set clear expectations for faculty workload

The AQAD external committee stated in their report that there were not clear expectations for faculty workloads, noting in particular the reduced teaching loads of SMAST faculty relative to other units on campus. In fact, the SMAST faculty noted that clear expectations for a reduced teaching load for SMAST faculty are expressed in the 2005 Esposito memo (Appendix A), which also established the administrative structure for the School:

“Within the UMass Dartmouth academic community, SMAST plays a unique role in that it is a graduate-only academic unit with higher expectations than other units in research, as measured by externally funded grants, publications in refereed outlets, and graduate student advising & financial support. The standard contractual teaching assignment for UMass Dartmouth faculty is 18 units per academic year. For SMAST faculty that teaching obligation is met through classroom instruction, and the mentoring and funding of graduate students. Expected classroom instruction is lower relative to other campus faculty. The minimum is (a) one formal, solo taught 3 unit or greater course per academic year; (b) an additional 1 or 2 unit course or a team-taught 3 or 4 unit course per semester; and (c) serving as the primary advisor to and providing funding for at least two full-time graduate students each semester. Faculty with fewer funded graduate students will be expected to carry heavier classroom instructional responsibilities, including participation in undergraduate and graduate instruction on the main campus.”

The memo also stated that:

“It [SMAST] must incorporate “bridges” to the academic programs on the main campus that will allow faculty on the main campus to both contribute to the instructional, research and outreach programs at SMAST but also access SMAST’s physical and human resources.”

and:

“It [SMAST] must establish specific ways in which the SMAST faculty can contribute to academic programs on the main campus.”

The AQAD committee noted that in some cases, SMAST faculty were not meeting these expectations, and it was agreed that efforts should be made to more rigorously enforce these standards through the annual faculty evaluation process and role of department chairs in assigning course teaching responsibilities. Flexibility should be maintained in the process to allow for more or less faculty teaching to balance research and advising loads.

Specific action: *Enforce consistent standards for faculty workload including involvement in course teaching that will provide marine science-related courses to the main campus population*

B. Undergraduate Instruction

Goal 3: Increase the contributions by SMAST faculty to undergraduate instruction

From the AQAD external committee report:

“SMAST contributes greatly to the UMass Dartmouth System and to the community as a whole by conducting relevant research in fisheries and estuarine science, teaching and mentoring graduate students on real-world issues, and bringing in the highest percentage of research dollars for UMass Dartmouth. These are exactly the right directions for the marine research school, however, without more interactions with undergraduate academics it is unlikely that SMAST will see more faculty hires through the Provost’s office unless they are soft-funded positions.”

The SMAST faculty agree with the committee’s recommendation. SMAST is the only academic unit in the IMS program that is not affiliated with an undergraduate degree program. Since the AQAD review, SMAST has developed a draft preproposal with the College of Engineering and College of Arts and Sciences to establish a new B.S./B.A. degree program in Marine Science and Environmental Sustainability (MSES). While the SMAST faculty endorse the idea of expanding the undergraduate curriculum, they also feel it is important to ensure that the graduate program and research enterprise is sustained, given its importance to the status of the University as a Carnegie Doctoral Research University. Enhancing the undergraduate instructional efforts should be done in such a way as to provide new programmatic opportunities to undergraduate students, while also contributing to strategic goals for the graduate program (e.g., recruitment of undergraduate students into the IMS program, opportunities for graduate students to engage in teaching, etc.).

Specific actions related to undergraduate instruction include:

- *Continue to advance the proposal for an undergraduate degree program in Marine Science and Environmental Sustainability*
- *Continue the undergraduate internship program (the AQAD external committee report did not recognize the current undergraduate internship program at SMAST, which served 23 students in 2017) and has traditionally served as a feeder to the graduate program.*
- *Expand undergraduate course offerings through cross-listing existing graduate courses as MAR 400/500 and continuing to expand the number of undergraduate University Studies courses currently being offered*
- *Participate in the UMass Dartmouth Honors program*
- *Recruit UMass Dartmouth B.S. students for the graduate program*

C. Curriculum

Goal 4: Take steps to ensure that students have access to a coherent curriculum that meets programmatic needs and is delivered with high quality

From the AQAD external committee report:

“Although applications and enrollments are strong, graduate students are very dissatisfied with the quality of the instruction and the coherence of the curriculum and logistics related to operations.”

This statement was apparently based on feedback the committee received from a meeting with students during the site visit. It is inconsistent with the fall 2017 student survey results as well as other statements made in the AQAD external committee report about elective course instruction (i.e., *“SMAST students rated the quality of instruction of the elective courses much higher than the core courses.”*). The fall 2017 survey of student well-being had a 71.4% response rate, thus representing solid majority of the students. Of the 24 questions in the survey, 19 had predominantly (>50%) positive responses, and only 5 had >40% negative responses:

1. The quality of instruction is high for the core courses (53% disagree)
2. I am able to balance my work and family life (46% disagree)
3. The Ph.D. qualifier exam was useful in preparing me for my dissertation research (45% disagree).
4. I know where to get help on campus if I have a counseling, psychological or other mental health needs (44% disagree)
5. I'm on track to complete my degree on time (40% disagree).

Specific actions related to curriculum include:

- *Improve current core courses through a comprehensive analysis of student evaluations and, where appropriate, a revision of student syllabi that is consistent with the IMS strategic academic goal of interdisciplinary marine science education*
- *Better coordination of core and elective courses so that students have ready access to information about regular core course offerings (and explicit options) and expected offerings of elective courses*
- *Provide information to students about the sequence of core and elective courses to support concentration areas at the various IMS campuses including distance-learning options*
- *Conduct a gap analysis of courses needed to support concentration areas, including recommendations for strategic hiring to address critical areas*
- *Consult with IMS faculty about a reconsideration of core requirements to allow more flexibility (biological, physical, chemical, geological, fisheries oceanography, policy), while maintaining the interdisciplinary nature and academic rigor of the program*

D. Administration & Leadership

Goal 5: Continually evaluate and improve IMS administrative processes and maintain a clearly defined leadership structure

From the AQAD external committee report:

“While the SMAST has a particularly large stake in the IMS program, it does not appear to have been granted sufficient autonomy or authority to run the program for the system in an effective or efficient way.”

and:

“Many students were grumpy and frustrated over the program’s lackadaisical and weak administration. Over and over we heard a single refrain: the program lacks clear leadership and consistent administration.”

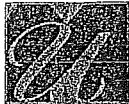
Some of these frustrations reflect challenges with IMS administration, but the faculty also feel that more assertive leadership is needed at SMAST. The faculty noted that SMAST previously had an Associate Dean, who assumed principal responsibility for overseeing the academic programs including IMS. However, the UMass Dartmouth administration eliminated this position, placing the responsibilities including the coordination of the IMS system-wide program on the SMAST Dean. Some faculty expressed concern that this limits time for the SMAST Dean in other important areas such as research development, fundraising, and new academic program development.

Specific actions related to administration and leadership include:

- *Reinstate the SMAST Associate Dean or similar position to oversee academic administration, student issues, and IMS academic coordination*
- *Provide contact information for the IMS coordinators for each campus on the IMS website to provide students with a point-of-contact when they have questions on their respective campuses*
- *Maintain communication between the UMass Dartmouth administration and SMAST Dean and faculty through regular meetings of faculty, Dean, Provost and Chancellor*
- *Develop a succession plan for retiring faculty and plan for strategic hiring to address critical gaps in programmatic areas*
- *Advocate for a University Ombuds position to improve communication*
- *Develop a web portal for access to program policies and resources for SMAST and IMS*
- *Consider a formal faculty mentorship program (e.g., using the Rutgers model as a template)*
- *Continue to address security issues identified by students*
- *Lobby for more diverse funding from MIT and WHOI Sea Grant (e.g., fisheries funding)*

Many of these actions (centralized web page with information and forms, regular communication with Chancellor and Provost, improved security) are already being implemented.

Appendix A. 2005 Reorganization of SMAST (Esposito)



University of
Massachusetts
Dartmouth

Office of the Provost and
Vice-Chancellor
for Academic Affairs

285 Old Westport Road
North Dartmouth
Massachusetts 02747-2300

508 999-8024
508 999-8375 Fax

TO: SMAST Faculty and Staff
FROM: *L. E.*
Louis Esposito, Provost
DATE: June 30, 2005
SUBJECT: Reorganization of SMAST

The administrative structure of a college/school depends to a significant degree on its mission. I believe that the optimal administrative structure for the School for Marine Science and Technology must possess the following characteristics:

- a) It must enable and facilitate the achievement of the school's mission and goals in instruction, research and outreach.
- b) It must allow both the school as well as individual faculty to respond appropriately to new opportunities.
- c) It must incorporate the concept of shared governance, properly understood.
- d) It must recognize and be capable of addressing the specific needs of the region.
- e) It must not inhibit or impede the professional development, academic freedom and creativity of individual faculty.
- f) It must not only recognize but also accommodate uneven growth and development in the school's areas of research focus due to differences in grant and contract opportunities as well as differences in the entrepreneurial activities of its faculty.
- g) It must incorporate "bridges" to the academic programs on the main campus that will allow faculty on the main campus to both contribute to the instructional, research and outreach programs at SMAST but also access SMAST's physical and human resources.
- h) It must establish specific ways in which the SMAST faculty can contribute to academic programs on the main campus.

After two years of observing the operation of SMAST as well as evaluating its achievements during that period, I have concluded that SMAST's current administrative structure is not optimal, i.e., it does not possess, to a sufficient degree, those characteristics listed above. Indeed, I have concluded that the current administrative structure does not maximize the growth and development of (a) the school as a whole, (b) its different research programs and (c) individual faculty. I believe, and Chancellor MacCormack agrees, that an administrative structure similar, in many respects, to that of the colleges on the main campus is more appropriate.

Reorganization of S Mast

June 30, 2005

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Therefore, a new administrative structure for S Mast will be established with the following elements, policies and procedures:

- 1) S Mast's chief academic officer will have the title of Dean.
- 2) There will be an Associate Dean, who will be selected from among S Mast's primary and joint appointment faculty. The primary responsibility of the Associate Dean will be to assist the Dean in curriculum matters and faculty personnel matters. This will be a part-time administrative position. The Associate Dean will be expected to continue with their research activities but will have reduced instructional responsibilities.
- 3) There will be an Assistant Dean whose primary responsibilities will be in the operation of the physical facilities, oversight of the S Mast budget and grant & contract support for the faculty. This will be a full-time professional staff position.
- 4) The S Mast faculty, both primary and joint, will be organized into three academic departments.
- 5) The three departments will be (a) Marine Biogeochemistry and Estuarine Science, (b) Fisheries Oceanography, and (c) Ocean Sciences.
- 6) Each department will have a Chair elected according to the procedures in the Faculty Federation Agreement.
- 7) Primary faculty will, subject to the concurrence of the Dean, select the department that will serve as the "home" for personnel actions affecting them, as well as for their participation in matters of departmental governance.
- 8) Joint appointment faculty will, with the concurrence of the Dean, select the department, which will serve as their home for their participation in matters of departmental governance.
- 9) Each department shall establish a Faculty Evaluation Committee (FEC) according to the procedures in the Faculty Federation Agreement.
- 10) The S Mast Academic Council will consist of two primary faculty from each department.
- 11) The S Mast Curriculum Committee will consist of two primary faculty and one joint appointment faculty from each department.
- 12) The Departmental Faculty Evaluation Committees, the S Mast Academic Council and the S Mast Curriculum Committee will operate according to the procedures in the Faculty Federation Agreement.
- 13) There shall be an Executive Committee, consisting of the Associate Dean, the Department Chairs and the Assistant Dean, that will meet monthly with the Dean to provide advice to the Dean on all academic matters as well as operational matters.
- 14) Initially, the three departments will share a single full-time secretary.
- 15) All departments will have increased budgetary authority. Beginning September 1, 2005, the "departmental" indirect costs distributions will be credited to the department where a faculty member, who is recipient of an indirect cost bearing grant or contract, holds principal appointment.

Reorganization of SMAST

June 30, 2005

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- 16) SMAST will develop an internal chargeback system (telephone, supplies, copying, etc.) so departments can be credited with a portion of SMAST's non-indirect cost operating budget.
- 17) A review of SMAST space will be made and offices and laboratories will be distributed to departments for allocation. Allocations will ordinarily be made on the basis of faculty activity, including funded research, graduate student supervision, and numbers of support staff employed by the faculty member. Faculty will have a private office; however, laboratory space will often be shared by two or more investigators depending on the factors identified above. The Dean will meet with the three department chairs to allocate office and laboratory space.
- 18) Some SMAST space will not be considered for allocation to a department: the acoustic/optic tank, the seawater room, the machine shop, the greenhouse, the kitchen, and the storage rooms are examples.
- 19) Within the UMass Dartmouth academic community, SMAST plays a unique role in that it is a graduate-only academic unit with higher expectations than other units in research, as measured by externally funded grants, publications in refereed outlets, and graduate student advising & financial support. The standard contractual teaching assignment for UMass Dartmouth faculty is 18 units per academic year. For SMAST faculty that teaching obligation is met through classroom instruction, and the mentoring and funding of graduate students. Expected classroom instruction is lower relative to other campus faculty. The minimum is (a) one formal, solo taught 3 unit or greater course per academic year; (b) an additional 1 or 2 unit course or a team-taught 3 or 4 unit course per semester; and (c) serving as the primary advisor to and providing funding for at least two full-time graduate students each semester. Faculty with fewer funded graduate students will be expected to carry heavier classroom instructional responsibilities, including participation in undergraduate and graduate instruction on the main campus.

Timetable for Implementation

- July –
- 1) Provost will have meetings with individual SMAST faculty to solicit their reaction and suggestions with respect to the new administrative structure.
 - 2) Faculty will be assigned into departments
 - 3) Appointment of Screening Committee for Associate Dean and initiation of screening process
- August –
- 1) Appointment of Associate Dean
 - 2) Election of Department Chairs

September 1, 2005 – New Administrative Structure Takes Effect

Appendix IV. Course listings and selected syllabi for the UMass Dartmouth and USP-IO programs

List/Description of Core Courses

MAR 510 – Introduction to Chemical Oceanography - Chemical oceanography starting with the basic chemical and physical properties of sea water and going through the major processes shaping chemical distributions in the ocean. A brief review of basic thermodynamics and chemical equilibria precedes a discussion of carbonate equilibria and trace metal speciation. Throughout much of the course an interdisciplinary approach is taken and pertinent material on the interaction between ocean chemistry and marine physics, biology, and geology will be presented. Whenever possible, the results of recent studies will be incorporated into class material and the last few class periods are devoted to special topics.

MAR 515 – Geological Oceanography (core option for Professional Science Master's) – Process-oriented geological oceanography starting with the history of ocean floor exploration, theories of ocean basin formation, determination of geologic time and going through the major dynamic processes shaping and characterizing the seafloor - from beaches to basins, reefs to estuaries. Overviews of marine geophysics and plate tectonics, sea level variation and the formation of coastlines and reefs, and the importance of paleoceanography to assessing climate change will be presented and discussed. Throughout the course an interdisciplinary approach is taken and pertinent material on the interaction between marine geology/sediments/sedimentation processes and marine chemistry, physics, and biology will be presented. Wherever possible, the results of recent studies and special topics will be incorporated into the class material and tailored to the students' areas of research.

MAR 545 - Biological Oceanography - The cycle of productivity in the marine environment and the physiological and morphological adaptations of plant, animal and bacterial populations within various oceanic regions. Interrelationships of the plankton, the nekton, and the benthos are stressed. BIO 545

MAR 555 – Introduction to Physical Oceanography - A descriptive treatment of ocean atmosphere interactions, water properties, general wind driven and thermohaline circulation, waves and tides, and coastal processes. Simplified conceptual models demonstrate the important principles.

Marine Policy Core Requirement (choice of one below or other approved policy-related course):

MAR 525 - U.S. Ocean Policy - Review of contemporary issues in U.S. Ocean Policy. The course is organized into general topics. Students are largely responsible to lead class discussion, and material will be derived from specific publications including books, papers, and other media. When possible specialists will visit or will be interviewed via teleconference, and discuss specific topics relating to U.S. National Ocean Policy. Specific class topics will require a brief written analysis. The course concludes with an oral synthesis paper and discussion.

POL 663 Ocean Policy and Law - The interrelation between law and policy in the particular context of the marine environment. Course surveys coastal zone management, offshore resource management, marine pollution, and domestic and international ocean policy. Students are offered a broad perspective on legal and administrative issues affecting the oceans worldwide.

UMass Dartmouth Courses

Course descriptions are available at <http://catalog.umassd.edu/index.php>.

Marine Science Courses:

MAR 510 – Introduction to Chemical Oceanography
MAR 513 - Numerical Methods in Ocean Sciences I
MAR 514 - Quantitative Methods for Multidisciplinary Marine Applications
MAR 515 - Geological Oceanography
MAR 520 - Thesis Proposal Development
MAR 524 - Marine Ecosystem Modeling
MAR 525 - U.S. Ocean Policy
MAR 527 - Fisheries Management
MAR 530 - Ecosystem-Based Fisheries Management
MAR 535 - Biological Statistics I
MAR 536 - Biological Statistics II
MAR 540 – Introduction to Fisheries Science
MAR 542 - Marine Invertebrate Fisheries
MAR 544 - Stock Assessment of Fishery Resources
MAR 545 - Biological Oceanography
MAR 547 - Fisheries Survey Sampling
MAR 549 - Analysis of Tagging Data
MAR 550 - Laboratory in Oceanography - Data and Methods
MAR 554 - Physics of Fluids
MAR 555 – Introduction to Physical Oceanography
MAR 557 - Geophysical Fluid Dynamics
MAR 558 - Waves and Tides
MAR 560 - Acoustical Oceanography
MAR 562 - Satellite Oceanography
MAR 565 - Pollutant Transport in the Environment
MAR 572 - Environment and Resource Economics and Policy
MAR 580 - Special Topics: Fisheries Oceanography
MAR 585 - Special Topics: Estuarine and Ocean Sciences
MAR 590 - Masters Non-Thesis Research Project
MAR 595 - Independent Study
MAR 596 - Directed Study
MAR 599 - Special Topics
MAR 600 - Master's Thesis Research
MAR 603 - Pre Dissertation Research
MAR 610 - Ocean Turbulence
MAR 615 - Dynamics of Estuarine Circulation
MAR 620 - Studies Estuarine Dynamics
MAR 622 - Case Studies in Fisheries Science and Management
MAR 630 - Estuarine Biogeochemistry
MAR 640 - Global Marine Biogeochemistry
MAR 645 - Ocean Circulation and Modeling

MAR 650 - Marine Ecosystem Dynamics
MAR 655 - Numerical Methods in Ocean Sciences II
MAR 656 - Ocean Atmosphere Dynamics
MAR 660 - Coastal Physical Oceanography
MAR 661 - Physical Oceanography of Shallow Seas
MAR 662 - Physical-Biological Interactions in the Ocean
MAR 670 - Advanced Marine Time Series Analysis
MAR 675 - Scientific Writing
MAR 698 - Projects in Environmental Science
MAR 700 - Graduate Seminar
MAR 701 - Doctoral Dissertation Research
MAR 720 - Applied Statistics
MAR 721 - Remote Sensing
MAR 722 - Environmental Model Raster GIS
MAR 725 - Estuarine Ecology & Management
MAR 726 - Introduction to Geographic Information Systems
MAR 727 - Boundary Layer Meteorology
MAR 731 - Environmental Policy & Administration
MAR 732 - Environmental Law & Policy
MAR 733 - Chemistry of Natural Waters
MAR 734 - Coastal and Ocean Law
MAR 735 - Legal Foundations for Ecosystem Management
MAR 736 - The Role of Science in the Policy Process
MAR 738 - Coastal Zone Management

Biology Courses:

BIO 514 - Biology of Marine Mammals
BIO 540 - Env Physio Marine Animal
BIO 554 - Biology Of Sharks
BIO 571 - Marine Microbiology

Engineering Courses:

ECE 597 - Underwater Acoustics I
ECE 598 - Underwater Acoustics II
MNE 557 - Geophysical Fluid Dynamics

CHEMICAL OCEANOGRAPHY

UMD MAR510/UML 84.653

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SYLLABUS

COURSE DESCRIPTION:

The purpose of this course is to provide students with a basic understanding of the principles and processes controlling the distribution and speciation of chemical constituents in natural waters with primary emphasis on coastal marine waters. The first part of the course provides an overview of the chemical composition of natural waters and is descriptive in nature. A brief review of basic thermodynamics and chemical equilibria precede a discussion of carbonate equilibria and forms the basis for a more detailed examination of the distribution and speciation of nutrients, trace metals, trace organic compounds and radioisotopes. Finally in the last part of the course, the student is introduced to a number of "critical" processes that are of primary importance in controlling the distribution, transport and fate of chemicals in the aquatic environment. It is assumed that the student is well prepared in chemistry (undergraduate courses at least through organic) and has at least some familiarity with the physical and biological dynamics of aquatic systems (Physical and Biological Oceanography preferred but not required).

Active participation and discussion is encouraged. Resources include the primary text (Emerson, S.R. and Hedges, J.I., Chemical Oceanography and the Marine Carbon Cycle), selected texts, readings from the primary literature and other resources. Student progress is assessed through performance on a combination of homework problem sets, mid-term and final exams, and participation in class discussions.

COURSE FORMAT:

The course is offered in a distance learning format with lectures originating from either UMass Lowell or UMass Dartmouth. Many Course Materials are provided on this web site (http://faculty.uml.edu/david_ryan/84.653/) including copies of PowerPoint slides for each lecture, handout materials, homework assignments as well as audio and video recordings of previous class sessions. This semester on a trial basis, certain lectures will be provided in video format only. Students will be notified in advance that they must watch the lecture video before coming to class. Class time may then be used for a discussion of material, question and answer sessions, quizzes, sample calculations or other related activities.

TEXT and READING MATERIALS:

Required:

- Emerson, S.R. and Hedges, J.I., Chemical Oceanography and the Marine Carbon Cycle, Cambridge University Press, 2008

Supplementary Reading:

- Millero, Frank J. Chemical Oceanography, 3rd Edition, CRC Press 2006 or 2nd Edition, CRC Press, 1996.
- Atkins, P.W. *Physical Chemistry*, 4th Edition, W.H. Freeman and Company, 1990.
- Broecker, W.S. and Peng T.H. Tracers In The Sea, Eldigio Press, 1982.
- Libes, Susan M. *An Introduction to Marine Biogeochemistry*, 2nd Edition, Wiley, John & Sons, 2009.
- Morel, F.M.M. & Hering, Janet G. *Principles and Applications of Aquatic Chemistry*, Wiley-Interscience, 1993.
- Pilson, Michael E.Q. *An Introduction To The Chemistry Of The Sea*, Prentice Hall Professional Technical Reference, 1998..
- Schwarzenbach, Rene P., Gschwend, Philip M. & Imboden Dieter M. *Environmental Organic Chemistry*, Wiley, John & Sons, 2002.
- Stumm, Werner & Morgan James J. *Aquatic Chemistry*, John Wiley & Sons, 1996.

A list of general references as well as specific reading assignments will be provided before each class. Reading assignments will be generally provided a week in advance. Students should be prepared to discuss the content of the reading material assigned for each lecture. Lecture presentations assume you have read and digested the material before class.

In addition to the principal text (Emerson and Hedges) there will be frequent readings selected from other more advanced texts and the primary literature. Those intending to go on to more advanced work in environmental and/or marine chemistry are strongly encouraged to purchase a copy of Stumm and Morgan (1996) and Schwarzenbach et al. (1993) for their libraries (see general reference list for full citations). Those wishing to refer to a more basic text should consider purchasing Libes (2009) available through numerous web sites (try ecampus.com). This text is designed as an upper level undergraduate, beginning graduate level text. In addition, where appropriate, references to useful Web sites will be provided. It is assumed that you have access to a computer and to the internet. You should be familiar with the use of word processors and spreadsheet software as well.

VIRTUAL LABS/WORKSHOPS:

To help students understand the theory and application of powerful modeling and calculation tools, Virtual Labs or Workshops are planned for each campus (Dartmouth & Lowell). The time and location of each Virtual lab session will be announced in class and posted on this website well in advance of its meeting. Sessions are anticipated to last from 2 to 3 hours and will enable students to conduct hands-on problem solving exercises with the guidance of faculty instructors. Each Virtual Lab will be scheduled around an assigned take-home Problem Sets in order that students can perform necessary calculations in advance of the Lab meeting. Additional details concerning Virtual Labs will be provided in class.

GRADING POLICY:

- Midterm and final exam count for 25% each of total grade. Four problem sets count for 50% of total grade. (see schedule page for details)

OFFICE HOURS:

Students are encouraged to contact anyone of the instructors at any time to discuss any aspects of the course and course work. **Because of the rapid pace and broad nature of the course, students are strongly encouraged to seek help sooner rather than later to avoid getting too far behind.** Similarly it is strongly recommended that students stay abreast of the substantial reading assignments and bring questions regarding the readings to our attention in a timely fashion. Phone and email contacts will be posted on the web site.

CONTACTING THE INSTRUCTORS:

Dr. Mark Altabet	Dr. David Ryan
maltabet@umassd.edu (508) 999-8197 (Fax) (508) 999-8622 (SMAST)	david_ryan@uml.edu (978) 934-3698 (Tel) (978) 934-3569 (FAX)

TOPICS:

- 1) Descriptive Chemical Oceanography (fundamentals)
 - large scale circulation and water masses (conveyer belts) - 2 layer
 - vertical and horizontal distributions (basin scale)
 - nutrient-like behavior
- 2) Physical Chemistry of Seawater (elementary or basic chemistry)
 - physicochemical properties
 - properties and structure of water
 - major, minor, trace components
 - units, types of concentration
 - macroscopic, colligative properties

- salinity, chlorinity, density (influence on circulation), vertical stability - PSU
- constancy of composition
- optical properties

3) Equilibrium Concepts

- remember your chemistry
- chemical potential
- activity and fugacity
- Henry's Law

4) Geochemical Cycles (Broecker & Peng)

- residence time concept
- nitrogen and phosphorous cycles
- controls on biological production and organic matter export
- influence on atmospheric CO₂
- sources and sinks (weathering, atmospheric, hydrothermal, biosynthesis)
- organic production/decomposition (Redfield Stoichiometry)
- dissolved gases - solubility f(T,S,etc), AOU, gas exchange
- nutrient biogeochemical cycles (N,P,Si)
- seasonal cycles (coastal processes)
- eutrophication

5) Carbonate System

- equilibria
- basic equations, alkalinity, Henry's Law
- influence of master variables (pH, 3CO₂, Alkalinity)
- effects of organic production/decomposition
- forcing of p CO₂ variations
- CCD and seafloor CaCO₃ distributions
- global carbon cycle

6) Organic Geochemistry

- basic organic chemistry of seawater
- early diagenesis (humics)
- production
- degradation
- preservation
- modification
- vertical transport
- DOM and sediment organic matter

7) Trace Metals/Metal Geochemistry

- biochemical rules
- Fe limitation and HNLC region
- speciation
- toxicity
- anthropogenic influence

8) Tracers (water column and sediment)

- radioisotopes
- stable
- molecular

9) Special Topics (case studies from instructors research in a model construct)

- early diagenesis
- carbon sequestration

Course Number: MAR 514
Course Title: Quantitative Methods for Marine Applications
Instructors: Geoff Cowles
Contacts: School for Marine Science & Technology, SMAST East - 227
706 South Rodney French Boulevard
New Bedford, MA 02744 U.S.A.
(508) 910-6397
gcowles@umassd.edu
Class Time: Tuesday/Thursday 9:30-10:45
Office Hours: flexible: contact instructor, preferred days are T/R

Course Description: This course provides instruction, demonstration and exercises in quantitative methods critical to advanced studies in marine science. A wide range of subjects will be covered to provide an overview and build skills and familiarity with the course material. Content will be based on topics in calculus, function approximation, linear algebra, and differential equations. The curriculum will emphasize application of these methods to problems in marine science through classroom examples and homework content. Students will employ Matlab extensively for homework and in-class exercises.

Course Objectives:

1. Provide exposure and practice in fundamental quantitative methods
2. Enhance skills in assessment and solution of mathematical problems
3. Improve the ability to characterize, evaluate, and solve dynamical systems
4. Introduce the students to quantitative software

Evaluation procedures:

1. Weekly assignments based on material presented, evaluated based on approach, correctness of solution and, where relevant, interpretation (30%)
2. Projects: Mid Term (30%) and Final (30%)
3. Class participation (10%)
4. Attendance at all lectures is the best way to understand topics and assignments, but is not required for evaluation.
5. University policy on academic dishonesty, including plagiarism, applies.

Principle text:

Calculus for the Life Sciences, Bittinger, Brand and Quintanilla, Pearson Press, ISBN 0-321-27935-2. Available from most online bookstores.

Matlab - A Practical Introduction to Programming and Problem Solving, Stormy Attaway, Third edition ISBN9780124058767.

Course Website

myCourses

MAR 514: Quantitative Methods for Marine Scientists

Week	Date	Unit	Room
1	9/3	Introduction	CTL
2	9/8	Matlab – Vectors and Matrices	CTL
	9/10	Matlab – Writing Scripts / Basic Input and Output	CTL
3	9/15	Matlab – Conditional Control	CTL
	9/17	Matlab – Loops and Vectorizing	CTL
4	9/22	Differentiation - Background	156
	9/24	Discrete Derivatives	CTL
5	9/29	Derivative Techniques	156
	10/1	Root Finding	CTL
6	10/6	Derivative Techniques 2	156
	10/8	Polynomial Interpolation and Regression	CTL
7	10/13	NO CLASS / MONDAY SCHEDULE	-
	10/15	Multivariate Functions / Partial Derivatives	CTL
8	10/20	Integration - Concept and Practice	156
	10/22	Numerical Integration	CTL
9	10/27	Linear Algebra - Background	156
	10/29	Matrix Powers and Norms	CTL
10	11/3	Systems of Linear Equations - Theory	156
	11/5	Systems of Linear Equations - Practice	CTL
11	11/10	Eigenvectors and Eigenvalues	156
	11/12	Applications of Eigenvecs/vals	CTL
12	11/17	Differential Equations of One Variable	156
	11/19	Solving Nonlinear Initial Value Problems with Matlab	CTL
13	11/24	The Competing Species Model	CTL
	11/26	NO CLASS THANKSGIVING	-
14	12/1	Analysis of the CS Model	CTL
	12/3	Solution Space of the CS Model	CTL
15	12/8	Reserved	TBD
-	12/15	Final Project Presentations: 8-11	156

MAR 515: Introduction to Geological Oceanography
Course Outline/Syllabus
Professor Cindy Pilskaln: 508-910-6327; cpilskaln@umassd.edu

~2 lectures per topic area

Course introduction; History of geological oceanography and the geologic time scale and rock types. Read Chapter 1 in *The Ocean Basins*.

Sea floor scenery, continental drift, bathymetry, echosounding. Read Chapter 2 in *The Ocean Basins*.

Marine geophysics (seismics and plate action). Read Chapter 3 in *The Ocean Basins*.

Seafloor spreading and plate tectonics; types of faults. Read Chapter 4 in *The Ocean Basins*.

Hot spots; plumes; hydrothermal vents biogeochemistry. Read Chapter 5 in *The Ocean Basins*.

Introduction to passive margins and sediments. Additional reading will be provided: Open Univ. book: *Seawater: Its composition, properties and behavior*, pages 100-108.

Continental margins; submarine canyons; slumping; Gulf of Mexico. Read Chapter 4 and pages 95-98 in *Ocean Chemistry and Deep-Sea Sediments*.

Coring and sediment sampling.

Mid-term (short answer/essay/closed book/in classroom).

Go over exam; Deep-sea sediments. Read Chapters 1, 2 and 3 in *Ocean Chemistry and Deep-Sea Sediments*.

Particle transport to deep-sea; biogeochemical particle fluxes, marine snow. Reading will be provided.

Arctic and Antarctic basin geology and sedimentation processes; closed and semi-closed ocean basins and marginal seas; anoxic deposition (Baltic Sea, Mediterranean, Black Sea, Cariaco Basin, Guaymas Basin, etc.). Reading will be provided.

Carbonate margins and platforms, carbonate deposition and precipitation. Reading will be provided.

Sea level rise and effects on marine sediments and rocks, coastal barrier island systems; ocean acidification. Reading will be provided.

Coastal sedimentation dynamics; river-input & shoreline sedimentation; methane seeps.

The Gulf of Maine sedimentation & biogeochemistry; Intro. to paleoceanography and paleoclimatology. Read Chapter 6 in *The Ocean Basins* and re-review p. 95-98 in *Ocean Chemistry and Deep-Sea Sediments*. (15)

Paleoceanography and paleoclimatology continued/isotope geochemistry.

Economic aspects of marine geology; ocean burial and sequestration of CO₂. Read p. 98-114 in *Ocean Chemistry and Deep-Sea Sediments*.

Student presentations and group discussion of independent paper readings.

Complete an independent reading of a scientific paper-of-your choice on any topic in geological oceanography/marine geology (i.e., a journal paper on original work published in any major scientific journal, a review paper in Nature, Science or Oceanography, or an individually authored book chapter in special a special volume, etc.—no popular magazine or newspaper articles).

Review for final. Read Chapter 7 in *The Ocean Basins*.

Final exam will be take-home/details and due date will be provided.

Other Details: Course grade will be based on exam performances (mid-term and take-home final), and participation in class discussions.

Two field trips will be planned (participation not mandatory) to the Woods Hole Oceanographic Inst. Deep-Sea Coring Facility and to Beavertail State Park, Jamestown, RI and/or Horseneck State Beach and Dune Reserve.

Texts:

Required:

1) *The Ocean Basins: Their Structure and Evolution*, Second Edition, 2004.

By Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, paperback.

ISBN-13: 978-0-7506-3983-5

ISBN-10: 0-7506-3983-0

2) *Ocean Chemistry and Deep-Sea Sediments*, Open University, 1995

By Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, paperback.

ISBN-13: 978-0080363738

ISBN-10: 0080363733

OPTIONAL/some overlap with above 2 texts but this one is more recent and has more detail where overlap occurs:

MARINE BIOGEOCHEMICAL CYCLES, Second Edition, 2005

By Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, paperback.

ISBN-13: 978-0-7506-6793-7

ISBN-10: 0-7506-6793-1

MAR 520: Research Proposal Development SYLLABUS: Spring 2018

Course Instructor *Wendell S. Brown*

wbrown@umassd.edu 508-910-6395 SMAST-East 229

Tuesday & Thursday 1:00pm-2:15pm
SMAST-East 103

Course Description

Course Goals:

To provide students with a framework for *preparing an acceptable research proposal*.

This course seeks to:

- a) provide structure and motivation to develop, with the guidance of your faculty advisor, an *acceptable proposal* for MS thesis, Ph.D. dissertation, or PSM intern research; and
- b) help integrate the SMAST graduate academic community through student-faculty and student-student interactions concerning research interests and abilities.

Course Objectives: To improve skills that are needed by students to develop a research proposal, conduct research and defend the research. These skills include literature-researching, giving oral presentations and technical writing.

Course Framework: During the semester, students will work closely with their primary research advisor in defining and refining their thesis/dissertation research ideas. The student and advisor will recruit probable graduate research committee members, who will help guide the research development process.

Course Outline: The final acceptable student research proposal will be built step-by-step through the course's *three milestone papers*; whose topics are:

- 1) Literature Search and Research Problem Definition
- 2) Proposed Research Goals, Objectives, and Approach
- 3) Proposed Research Methodology & Plan

Each of these milestone papers will be logical/physical extensions of the preceding milestone papers. That is, you will “bolt” successive *milestone papers* together to form your full *research proposal*.

Course Text:

I have chosen the following reasonably-priced reference

Schultz, David M., 2009. “Eloquent Science - A Practical Guide to Becoming a Better Writer, Speaker and ...Scientist”, American Meteorological Society - 45 Beacon St, Boston, MA 02108, pp 412.

ISBN 978-1-878220-91-29 (pbk.)

to provide a lucid voice concerning the various aspects of the process of research proposal development *and* conducting/reporting research.

Course Evaluation Standards: Most of your course grade will depend on the quality of your final research proposal in terms of clarity and content as determined by me and your research advisor. The following weighting on oral presentations, “milestone” papers and in-class discussions,

Milestone Paper #1- Problem Definition	10%
Milestone Paper #2- Problem Definition Research Proposal Framework	10%
Milestone Paper #3- Research Plan	10%
Oral presentations	20%
In-Class Participation	10%
FINAL PROPOSAL	40%
	100 %

MAR 520 Class Schedule – Spring Semester 2018

	<u>Class Meetings</u>	<u>Recommended Readings</u>
<u>January</u>		
Tues. 23	COURSE INTRODUCTION	Schultz (2009)
Thur. 25	TUTORIAL-1: Getting Started <i>Submit your RESEARCH TOPIC AREA</i>	22, & 23
Tues. 30	TUTORIAL-2: Oral Presentations <i>Submit your draft TOPIC AREA-BIBLIOGRAPHY</i>	24, 25, & 26
<u>February</u>		
Thur. 1	STUDENT TALKS: Critique of one of your most relevant papers	3, 5, & 6
Tues. 6	STUDENT TALKS: Critique of one of your most relevant papers	
Thur. 8	TUTORIAL-3: Paper Titles, Abstract, First Draft Writing	7 & 8
Tues. 13	STUDENT TALKS: “Lit-Based Research Problem Definition”	8, 9 & 10
Thur. 15	STUDENT TALKS: “Lit-Based Research Problem Definition” <i>Submit draft Paper #1 via email</i>	11, 12, & 13
Tues. 20	<u>ONE-ON-ONE DISCUSSIONS</u> : Paper #1 Drafts (<i>Monday Class Schedule</i>)	
Thur. 22	<u>ONE-ON-ONE DISCUSSIONS</u> : Paper #1 Drafts (<i>No Formal Class</i>)	
Tues. 27	NO CLASS	
<u>March</u>		
Thur. 1	TUTORIAL-4: Posters: an outline of your RES. PROB. -> APPROACH -> PLAN <i>Submit “Final” Paper #1 via email</i>	
Tues. 6	STUDENT TALKS: Research Justification/Goal/Objectives/Approach	
Thur. 8	STUDENT TALKS: Research Justification/Goal/Objectives/Approach <i>Submit Draft Paper #2 via email</i>	
Tues. 13	NO CLASS - SPRING BREAK	
Thur. 15	NO CLASS - SPRING BREAK	
Tues. 20	<u>ONE-ON-ONE DISCUSSIONS</u> : Paper #2 Drafts	
Thur. 22	<u>ONE-ON-ONE DISCUSSIONS</u> regarding posters	
Tues. 27	STUDENT POSTER PRESENTATIONS: Full Proposal Outline <i>Submit “Final” Paper #2 via email</i>	14
Thur. 39	TUTORIAL-5: Scientific Ethics	15
<u>April</u>		
Tues. 3	STUDENT TALKS: Research Plan	
Thur. 5	STUDENT TALKS: Research Plan <i>Submit draft Paper #1/#2/#3: a synthesis of papers #1/#2/#3 via email</i>	
Tues. 10	STUDENT TALKS: Full Research Proposal	Revisit Chap. 3
Thur. 12	STUDENT TALKS: Full Research Proposal	
Tues. 17	<u>ONE-ON-ONE DISCUSSIONS</u> : Full Research Proposal	
Thur. 19	<u>ONE-ON-ONE DISCUSSIONS</u> : Full Research Proposal	
Tues. 24	STUDENT TALKS: Finalized Research Proposal	
Thur. 26	STUDENT TALKS: Finalized Research Proposal	
<u>May</u>		
Tues. 1	PUBLIC ORAL PRESENTATION OF PROPOSALS	

Final Research Proposals Due via email by EOB May 5

Phase 1 – Research Problem Definition

Oral Presentation #2 outlines ...

Milestone Paper #1 (5-10 pages of text 12font w/1.5 line spacing)

In this paper, you are asked to explain the significance of your selected research problem (i.e., justify), in terms of your critical review of the literature on the topic. Start by reading widely in your topic area – winnowing your bibliography to a handful (3-6) of articles that are most relevant to research problem that you would like to address.

To build a case for your research topic/problem, do the following:

- *Study* the *relevant* literature thoroughly;
- *Identify* the *main contributions* (or focus) of this previous research;
- *Describe* the main contributions of this previous research to a technically competent audience that is unfamiliar with your particular research area.
(This means that you must *define jargon*!)
- *Determine* the “*problem areas*” of the previous research. For example:
Which methods did not quite work?
Which key assumptions weakened the conclusions of that research?
- *Identify* the *scientific/technical questions* raised by this previous research?
- Describe generally how research on your selected scientific/technical problem will improve upon previous research.

Phase 2 – Research Goal, Objectives & Approach Overview

Oral Presentations #3 & #4 (poster) outline

Milestone Paper #2 (3-5 pages)

In this *short paper*, you are asked to outline (i.e., map-out) the approach that you will take to address the set of research questions of interest. Justify your selected research topic/problem by answering the following questions:

- What scientific/technical questions do you seek to answer?
- How will answers to these questions extend scientific knowledge?
- Why will answers to these questions be interesting and/or important?

Describe how you plan to generally attack your research problem via answers to the following questions:

- What is the *research goal* of your proposed research?
- Are there hypotheses to be tested? ...if so, what are they?
- What are your proposed *research objectives* (i.e., steps in your research plan)?
- What are the elements of your overall *research approach*
(This is the “roadmap” of your research plan);
- What theoretical or practical reasons justify your proposed research?
- What are the *logical connections between* your research questions and your overall research goal and research objectives?

Phase 3 – Research Plan

Oral Presentation #5 outlines

Milestone Paper #3 (5-10 pages of text)

In this *short paper*, you are asked to describe in detail how you will achieve your specific objectives – in short your research plan. Include the methodologies to be employed; and indicate if other people have had success with similar approaches.

The following questions may serve as guidance as you prepare Paper #3.

- In addressing each research question/objective:
 - A. What assumptions will you make? Are they justified?
 - B. What methods will be used and why?
 - 1) What data will be needed?
 - 2) What data will be collected directly?
 - 3) Will your data lead to a unique solution?
 - C. If specialized equipment, methodologies, and/or models are needed, then who will teach you how to use them?
- Is additional funding/support required? *If so, what will be its source(s)?*
- Will your plan enable you to finish your proposed research within an acceptable time period?

Phase 4- Full Proposal Production

- Draft Full Research Proposal
Draft research proposal (15-20 text pages).

The draft of your full research proposal should be a synthesis of thoroughly revised milestone papers #1, #2, and #3 with an added abstract (i.e., summary) and a reconciled reference list. In this draft, the background first section should focus on the past research that logically “sets-the-stage” for your proposed research. Factor into this draft the comments and suggestions of your advisor, classmates, research proposal readers/research committee members, and the course instructor.

- Public Oral Presentation of Your Research Proposal
Public presentation of full research proposal
(Formal comments - 20 minutes; 5-10 minutes for questions & discussion)

The oral presentation of your research proposal to the general SMAST community should summarize the essential elements of your research proposal in a 20-minute illustrated talk. This final public presentation may be to a much larger and diverse audience than your in-class ones. Interested members of this audience –hopefully including your advisor and perhaps including your tentative research committee members – all of whom will be encouraged to ask questions.

In this short presentation focus on the main story line, using key points of your previous in-class talks.

Thus you are presenting a “road map” of your proposed research, which includes:

- A. Scientific (and/or technical) questions that you have posed;
- B. The field data, model results, and/or other data and information that you intend to obtain and how;
- C. Examples results from your analysis/interpretation and how it addresses your scientific/technical and links to objectives. Use illustrations for clarity.

- Submission of Final Research Proposal / Evaluation

Final Research Proposal (10-15 text pages + references & appendices)

Your final research proposal should be complete, stand-alone document including title, one-page non-technical summary, introduction, review of most relevant previous work, your research goal(s)/objectives, research approach and detailed methods for achieving objectives, examples of expected results, and references (see Appendix A for detailed expectations). In addition (i.e. not counting towards the page total), it should include figures with captions, tables with captions, and where relevant a budget with budget justification.

Finally, write a short personal statement explaining how your research fits into their scientific and career plans and how their previous experience and education qualify you to undertake the proposed research.

Appendix GRADUATE STUDENT RESEARCH PROPOSAL OUTLINE

A good graduate research proposal (including those for an MS thesis or PhD dissertation) (1) poses specific questions, (2) explains why answers are important and (3) presents a plan to obtain them. All the preparation work that you do now will save effort and frustration later. In most cases, a research proposal is ten to twenty pages long and contains at least the following elements.

SUMMARY

This should be one-page version of the proposal containing the major points of the complete paper. Because it may be read by many non-specialists, it should be written so that any general scientist can understand it. That means to avoid specialized terminology and jargon in the summary.

INTRODUCTION/BACKGROUND

Start by stating the general purpose of your project. What is the big question that you wish to answer? Then go on to briefly set intellectual context by reviewing the past research most relevant to your proposed research. Often in such a review, you will want to describe your study area so that the specific goals and questions will make sense. (This will help the reader understand your purpose and judge whether your methods are appropriate). Having set the stage, now list specific questions that (1) derive naturally and logically from the past research and (2) you seek to address in your research. In explaining the importance of each question, you will have to refer to previous studies.

RESEARCH GOAL(s) and OBJECTIVES

Having set the stage, you can now proceed by articulating the specific goals and objectives. State these clearly and explain why each is important. Are there practical reasons for answering them? Will answers help to fill in a gap in theoretical understanding of a process, earth material, geological history or landform?

RESEARCH APPROACH

In this section briefly outline your research approach, emphasizing its rationale, essential elements and highlighting innovations. Set the stage for the following detailed description of how you are going to achieve each research objective.

METHODS AND DATA ANALYSIS

In this section, you should describe the sequence of measurements, data reduction and modeling that will produce answers to your questions. An emphasis on the logical connections between the questions, the necessary data and the answers is more helpful than detailed explanations of how the methods work. Try to produce a flow-chart or road map that takes the reader through the whole process of answering your questions.

What data will you need? How will you analyze the data? Where will the data come from? Is background public domain data (weather, wells, stream flow, etc.) available? Write the letters and make the telephone calls now! Develop your personal contacts now, not when you have finished the fieldwork!

Convince the reader that your plan will succeed by referencing to as many similar studies as possible. Include references to papers for which the goal, method, and science/engineering were similar. Your previous extensive literature search and careful reading will help you avoid many traps and pitfalls. Be aggressive with interlibrary loans, computer bibliographic resources. Read several recent University of Massachusetts Dartmouth theses if applicable. More recent abstracts for talks at professional meetings are excellent sources for recent work and names of active researchers.

You may have results from a "pilot study", class lab or other source that will help convince the reader that your project will succeed. Be sure to include reference to these.

SCHEDULE OF WORK

This doesn't have to be a separate section but writing one will help with your flow-chart and with the budget.

REFERENCES

Only include papers and books that you have personally read. Cite references in the text and list in a format similar to your journal articles.

FIGURES AND TABLES

You probably will want to include several figures to clarify the text. In most cases, new original figures are more effective than grubby little photocopies (for your oral presentation use large, simple, colorful PowerPoint graphics).

BUDGET (if relevant)

What funding do you need? Why? From where will it come? Answer these questions in as much detail as possible. You probably will be able to make minor changes as the project progresses.

Remember to include travel costs, spare instrument batteries, maps, air photos, computer disks, and other small items. It is unlikely that funding agencies will pay for field assistants, living expenses or large equipment items. If in doubt, check it out.

FALL 2016

MAR 525 – U.S. Ocean Policy

Emphasis on ocean and marine fisheries management policies, approaches, and role of science for ocean development, sustainable fisheries and habitat protection (3 credits)

Overview

Review of contemporary issues in U.S. Ocean and Marine Fisheries Policy. This course is organized into general topics. Students will be expected to lead class discussion, and material will be derived from specific publications including books, papers, and other media.

This course provides an overview of U.S. ocean management with an emphasis on the Commonwealth of Massachusetts and an understanding of marine fisheries policy and management by federal fishery management councils (viz. New England and Mid-Atlantic) and the Atlantic States Marine Fisheries Commission. It includes a description of fishery management in the Commonwealth and the manner in which Massachusetts manages marine fisheries through its own state waters' initiatives and involvement with councils and ASMFC. It deals with ongoing Northeast Ocean Council policies and planning as well as Presidential National Monument designations conflicting with current ocean and fisheries management initiatives.

The class is tailored to introduce students to ocean and fishery management initiatives now underway and contemplated – initiatives that will dominate ocean and marine fisheries management policy and debate for at least the next five years.

Another emphasis of this course will be the manner in which scientific and technical information and providers of that advice/information affect ocean and marine fisheries management decisions and policy-making. Effects on decisions and policy of scientific uncertainty will be explored.

This course is primarily oriented towards students with an interest in managing ocean use and marine fisheries and providing timely, influential scientific advice to ocean and marine fishery policy-makers.

Professor

David E. Pierce, Ph.D., Director Massachusetts Division of Marine Fisheries

251 Causeway St. Boston, MA 02114

David.Pierce@state.ma.us (work)

(617) 626-1532 or (617) 413-2361 (cell)

Course Description

Objectives:

- Identify current policy-setting initiatives affecting ocean use and fishery management and understand how scientific and technical information continues to influence those initiatives.
- Identify public and government agendas and environmental and political issues accelerating demand and urgency for revised and new ocean management and fishery management policies and initiatives for the Commonwealth of Massachusetts, New England, and the nation.
- Evaluate existing and proposed ocean and marine fishery management policies especially with regards to ecosystem-management, marine protected areas (MPAs), ocean zoning, and the precautionary management approach.
- Describe the marine fishery management process in general and examine actual, on-going fishery management situations.
- Assess the role and importance of scientific and technical information in the ocean and fishery management processes.
- Identify ways and skills in which scientists can increase their effectiveness in the ocean and fishery management processes, e.g., successfully engage policy makers – such as fishery managers – and influence policies and management decisions.

- Become familiar with state, federal, and international ocean and marine fishery management organizations.

Exams

There will be mid-term (written) and final (oral) exams. An ocean or marine fisheries management issue paper will be required.

Class Participation

Extensive class participation will be required. Students will be expected to lead class discussions on articles and other assigned material pertaining to class lectures provided by the instructor. Point/counterpoint debates will be held with students taking opposing sides on ocean use and marine fisheries management issues such as groundfish sectors, catch share management, wind "farms," impacts of fishing gear on marine fisheries habitat, and marine reserves.

Evaluation

Grades will be based as follows: Class participation (30%); Mid-term exam (25%); Final exam (25%); and Policy issue paper (20%)

Schedule

Classes will be held once a week for 2 ½ hours (Friday 9:00 a.m – 11:30 a.m.) (9:00 – 10:00; break; 10:15 – 11:30). A few classes may have to be rescheduled to another day subject to students' availability

Class 1 September 9

Introductions and review of course objectives and workload.

Policy defined and policy process

Policy makers

Refer to New England Fishery Management Council (NEFMC), NOAA Fisheries, Atlantic States Marine Fisheries Commission (ASMFC), Marine Fisheries Institute (MFI), and Division of Marine Fisheries websites.

U.S. Commission on Ocean Policy Final Report: "An Ocean Blueprint for the 21st Century (September 2004)

Read Blueprint's Executive Summary and Chapter 31

Massachusetts Ocean Management Plan (2009)

Refer to website of Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs

Class 2 September 16

Interagency Ocean Policy Task Force Final Recommendations (July 19, 2010)

President Obama's Executive Order establishing National Policy for Stewardship of the Ocean, Coasts, and Great Lakes (July 19, 2010)

National Ocean Council (NOC)

Refer to: (1) "Priority Objectives" of Implementation Strategy and Coastal and Marine Spatial Planning (CMSP) & NOC Legal Authorities Relating to the Implementation of CMSP, and (2) Nine NOC Strategic Action Plans, e.g., Ecosystem-Based Management, Coastal and Marine Spatial Planning, Inform Decisions and Improve Understanding, Resiliency and Adaptation to Climate Change and Ocean Acidification and Ocean, Coastal, and Great Lakes Observations, Mapping, and Infrastructure (www.whitehouse.gov/administration/eop/oceans/sap).

Class 3 September 23

Continuation of Class 2, plus

Magnuson-Stevens Fishery Conservation and Management Act as Amended through January 12, 2007

New England Fishery Management Council & NOC's CMSP
Policy makers & policy entrepreneurs
Scientists in the policy process

Refer to: (1) June 21-23, 2011 Washington, D.C. CMSP Workshop and view four Workshop power point presentations at <http://www.whitehouse.gov/administration/eop/oceans/cmsh-workshop> and (2) U.S. Regional Fishery Management Councils: Decades of Knowledge and Experience in Coastal and Marine Spatial Planning at www.fisherycouncils.org [Excellent site with books *Managing our Nation's Fisheries* (2003 & 2005); Scientific and Statistical Committee (SSC) Workshops in 2008, 2009, and 2010; Councils' CMSP Flyer; and booklet, "US Regional Fishery Management Councils: Opportunities and Challenges;" plus more], (3) COMPASS website (Communication Partnership for Science and the Sea), (4) Scientific Consensus Statements on "marine ecosystem-based management" and marine protected areas; (5) NOAA Scientific Integrity Policy (Draft); (6) National Research Council's *Responsible Science: Ensuring the Integrity of the Research Process*, Vol. 1 (1992) and *On Being a Scientist: A Guide to Responsible Conduct in Research*, 3rd ed. 2009 (see youtube video), and (7) "Climate heretic: Why can't we have a civil conversation about climate." Lemonick. *Scientific American*. November 2010.

Class 4 September 30

Policy debates: Biodiversity protection, Wind energy "farm" promotion, Seals & Great White sharks, Coral reef loss and deep-sea corals

Refer to: (1) *Robert's Rules of Order* for making motions and rules of debate, (2) *Global Marine Biological Diversity: A Strategy for Building Conservation into Decision Making*. 1993. ed. Elliott Norse, (3) *The Future of Life*. 2002. E.O. Wilson, (4) *Consilience: The Unity of Knowledge*. 1998. E.O. Wilson, (5) "Status of Deep Sea Corals in US Waters: With Recommendations for Their Conservation and Management." 2006. Morgan, Tsao, and Guinotte. Marine Conservation Biology Institute, (6) "NOAA Strategic Plan for Deep Sea Coral and Sponge Ecosystems: Research, Management, and International Cooperation." 2010, (7) NOAA's Coral Reef Program: Conserve, Protect, Restore. September 2002 (www.coris.noaa.gov), (8) "A National Coral Reef Action Strategy: Report to Congress on Implementation of the Coral Reef Conservation Act of 2000. NOAA June 2002, (9) "Commonwealth of Massachusetts Ocean Management Plan" (e.g., wind energy), and (10) Cape Cod Times articles on great white sharks and seals and Discovery Channel "Jaws Comes Home" featuring DMF's Dr. Gregory Skomal, (11) "Catching the Wind: The world's fastest-growing renewable energy source is coming of age." *The Environmental Magazine*. January/February 2005, (12) Cape Cod Times "Special Report: Big Wind – With its future in the balance, wind farm project awaits Army Corps' impact report." Sunday, September 5, 2004, and Cape Cod Times. "Cape Wind Approved" Thursday, April 29, 2010.

Class 5 October 7

Catch-share management policy

Refer to: (1) NOAA Catch Share Policy (2009), (2) Ecotrust Canada (see "Fisheries" and "cautionary tale"), (3) American Fisheries Society publication *Fisheries* (www.Fisheries.org) June 2009 (34:6), "Abdicating responsibility: the deceits of fisheries policy," (4) "Can catch shares prevent fisheries collapse" (*Science* Vol. 321, Sept. 2008), and (5) "Catch shares in New England: Key questions and lessons learned from existing programs." Meridian Institute & MRAG Americas February 2010.

Class 6 October 14

Policy debates: Ecosystem-based fishery management, Climate change (e.g., Ocean acidification, NAO index, El Nino and Nina), Marine sanctuaries and MPAs, Oil & gas development (e.g., Gulf of Mexico)

Refer to: (1) "Ecosystem Status Report for the Northeast U.S. Continental Shelf Large Marine Ecosystem" July 2009. Ecosystem Assessment Program. NEFSC Reference Doc. 09-11, (2) El Nino La Nina: Nature's Vicious Cycle. *National Geographic*. March 1999. 195(3), (3) "Ecosystem-Based Fishery Management: A Report to Congress by the Ecosystem Principles Advisory Panel," April 1999. NOAA/NMFS, and (4) *Progress in Oceanography* articles: Recent climate forcing and physical oceanographic changes in Northern Hemisphere regions: A review and comparison of four marine ecosystems" (Drinkwater et al. 2009) and "Understanding climate impacts on recruitment and spatial dynamics of Atlantic cod in the Gulf of Maine: Integration of observations and modeling" (Runge et al. 2010), (5) DMF "Policies for Marine Protected Areas" January 2004, and (6) "Inter-annual Variability of Gulf Stream Warm Core Rings in response to the North Atlantic Oscillation," 2009 *Continental Shelf Research* (29:7) and "Contrasting response of the eastern and western North Atlantic to the North Atlantic Oscillation," 2011. *Journal of Physical Oceanography* both by Chaudhuri, Gangopadhyay and Bisagni.

Class 7 October 21 – Mid-Semester

Peer review & mechanisms for scientific advice for policy choices

Refer to: (1) Science, Policy, and the Coast: Improving Decision-making. National Research Council, National Academy Press, 1995, (2) "The Center for Independent Experts: The National External Peer Review Program of NOAA's National Marine Fisheries Service" *Fisheries*. 31(12):590-600. December 2006, (3) "Building Capacity of the NMFS Science Enterprise." Sissenwine and Rothschild. January 2011., and (4) "Statement to the U.S. Commission on Ocean Policy: Scientific Challenges in Supporting Living Marine Resource Management." 2002. Steven Murawski. Testimony for U.S. Commission on Ocean Policy.

Class 8 October 28 – Mid-Term Exam Due

Obstacles for use of scientific information in public policy making

Refer to: (1) "Obstacles..." Hammond, Mumpower, Dennis, Fitch, and Crumpacker. 1983 (handout), (2) How to Lie with Statistics 1954, (3) Think for Yourself: An Essay on Cutting through the Babble, the Bias, and the Hype. Hines. 2005, (4) "C.R.A.P. (Convoluting Reasoning and Anti-Intellectual Pomposity) detectors" in Biostatistics: The Bare Essentials. 2000. Norman and Streiner, (5) Beyond Reason: Using Your Emotions as You Negotiate. 2005. Fisher and Shapiro, and (6) The Power of a Positive No: Save the Deal, Save the Relationship – and Still Say No. 2007. Ury.

Class 9 November 4

Sustainable fisheries policy

Refer to: (1) Managing Our Nation's Fisheries: Past, Present and Future – Proceedings of a Conference on Fisheries Management in the United States, Washington, D.C., November 13-15, 2003, (2) Managing Our Nation's Fisheries II: Focus on the Future – Proceedings of a Conference on Fisheries Management in the United States, Washington, D.C., March 24-26, 2005, (3) Handbook of Marine Fisheries Conservation and Management. 2010. eds. Grafton, Hilborn, Squires, Tait, and Williams, (4) The Future of Fisheries Science in North America. 2009. eds. Beamish and Rothschild, (5) Fisheries Ecology and Management. 2004. Walters and Martell, and (6) ASMFC website

No Class November 11

Ocean or Marine Fisheries Management Issue Paper due

Class 10 November 18

Seafood contaminants and safety policy

Refer to: (1) "Policy and guidance for seafood safety risks posed by polychlorinated biphenyls (PCBs) and related organochlorines," David Pierce Ph.D. Dissertation June 1996, (2) Massachusetts Department of Public Health Division of Food and Drugs website regarding fish consumption advisories, and (3) Seafood Safety. 1991. National Academy of Sciences.

November 25 **Thanksgiving recess** – no class

Class 11 November 13

Choose policy debates for Class 13

Stellwagen Bank National Marine Sanctuary management policies

Endangered species

Refer to: (1) Final Management Plan and Environmental Assessment Stellwagen Bank National Marine Sanctuary. June 2010, (2) Stellwagen Banknotes Spring/Summer 2011 especially pages 6-7 and 13-14, (3) Website "Condition report" for Stellwagen and other sanctuaries, (4) "Stellwagen Bank Marine Historical Ecology Final Report (Top fish predators decline in Stellwagen Bank National Marine Sanctuary) Claesson and Rosenberg. May 2010, (5) *Commercial Fisheries News*, September 2011. Bluefin tuna.

Class 12 December 2

Environmental ethics

Semester review

Policy debates: Students' choices

Class 13 December 9

Fall classes end: December 12

Study Day: December 13

Examinations: December 14-20

December 23: Final grades due.

Oral exam (perhaps written) to be scheduled week of December 12-18

Course Number: MAR 530
Course Title: Ecosystem-Based Fisheries Management
Instructor: Gavin Fay, Assistant Professor
Contacts: School for Marine Science and Technology, SMAST-East 228
(508) 910-6363
gfay@umassd.edu
Class Location: SMAST-East, New Bedford. Room 101
Class Time: Wednesdays/Fridays 10:30-11:45,
(Wed: literature discussion, Fri:lecture/lab)
Office Hours: by appointment
Website: UMD myCourses

Course Description: Discussion and lectures highlighting the theory, challenges, and approaches for implementing Ecosystem-Based Fisheries Management (EBFM). The course will examine the history and background of fisheries management, leading to why more holistic approaches are being considered. A series of operational methods being used to implement EBFM, emphasizing technical efforts and models, will be reviewed. The role of institutional structures and societal considerations in decision-making will be explored to identify situations where EBFM can be successful. The course emphasizes current literature and case studies as main learning elements.

Course Objectives:

1. Understanding of major issues facing global fisheries, fisheries science, and fisheries management
2. Familiarity with the theory, history, background, and socio-economic issues driving EBFM
3. Develop knowledge of major modeling and technical approaches for implementing EBFM.
4. Develop skills for critically evaluating current literature and contextualizing it and associated theory with real world case studies.

IMS Core Course: This course satisfies the UMass Intercampus Marine Science Program core policy course requirement.

Prerequisites: Introduction to Fisheries Science (e.g. MAR 540) **OR** General Ecology (e.g. BIO 314) and permission of instructor.

IMS graduate students taking this for the core course requirement who have not taken Introduction to Fisheries Science should prepare for the course by reading:

Smith, T.D., 1994. Scaling fisheries: the science of measuring the effects of fishing, 1855-1955. Cambridge University Press.

Evaluation procedures:

1. Weekly assignments (25%) – nine brief (one page maximum) writing assignments that provide a response to and/or synthesize current literature relevant to the week's discussion topic. Assignments are due prior to class on Wednesdays.
2. Class project (25%) – a written report (20%) on either a case study where EBFM is being implemented, or an analysis/review of an emerging EBFM topic. Descriptions of project

topics are due in week 4, and a 2-3 page project outline (5% of course grade), with key references, is due by the end of week 7. Projects may be carried out individually or in small groups (2-3 students). The scope of group projects should reflect the number of participants. Gavin Fay has a list of possible project topics.

3. Final Exam (10%) – A verbal presentation of the class project.
4. Participation, attendance, ethics (40%) – In addition to attending lecture and participating in discussions, students are required to lead at least two of the weekly class discussions of the literature.
5. Late submissions will be penalized 10 points (out of a 100) for each day that an assignment is late – assignments submitted later than three days after the deadline will not be graded.
6. Failure to complete any of these requirements for evaluation will result in a score of zero for missing components. A final grade of ‘incomplete’ may be recorded at the request of the student and the discretion of the professor.
7. If you have read this far, please use google images to find a picture of a thylacine, and send it to me attached to an email with the subject line “Here is a thylacine”
8. No academic dishonesty, including plagiarism, will be tolerated and the University Academic Integrity policy applies:
<http://www.umassd.edu/studentaffairs/studenthandbook/academicregulationsandprocedures/>

Principal text:

Link, J. 2010. Ecosystem-based fisheries management: confronting tradeoffs. Cambridge Univ. Press, Cambridge.

To be supplemented by articles from the peer-reviewed literature.

Recommended reading list:

Ecosystem Principles Advisory Panel (EPAP). 1999. A report to Congress by the Ecosystem Principles Advisory Panel. NMFS Silver Spring, MD.

FAO. 2003. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2. Rome, FAO. 112p.

Garcia, S.M, Zerbi, A., Aliaume, C., Do Chi, T. & Lasserre, G. 2003. The ecosystem approach to fisheries. Issues, terminology, principles, institutional foundations, implementation, and outlook. FAO Fisheries Technical Paper, No. 443, Rome, FAO. 71p.

McLeod, K., & Leslie, H. (Eds.). 2009. Ecosystem-based management for the oceans. Washington, DC, USA: Island Press.

National Marine Fisheries Service 2009. Report to Congress: The State of Science to Support an Ecosystem Approach to Regional Fishery Management. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-96, 24 p.

Course outline and schedule of lectures and assignment (subject to change)

<i>Date</i>	<i>Session</i>	<i>Topic</i>	<i>Reading</i>
23-Jan	D	Introductory material; Instructor led discussion of literature	Larkin 1996, Botsford et al. 1997, Pikitch et al. 2004
25-Jan	L	What is EBFM?	Chap 1
30-Jan	D	Student led discussion of literature	Guerry 2005, Browman & Stergiou 2004, Yaffee 1999
1-Feb	L	Challenges facing fisheries, origins & history of EBFM	Chap 2
6-Feb	2	Student led discussion of literature	Christensen et al. 1996, Arkema et al. 2006, Tallis et al. 2010
8-Feb	1	When to consider doing EBFM, EBFM in the USA	Chap 5
13-Feb	2	Student led discussion of literature	Francis et al. 2007, Tear et al. 2005, Garcia & Cochrane 2005
15-Feb	1	Types of advice, decision theories, goal setting Project topics due	Chap 4
20-Feb	2	Student led discussion of literature	Edgar et al. 2014, Hilborn et al. 2004, Lester et al. 2009, McCay & Jones 2011
22-Feb	1	Bycatch, habitat, and spatial management	Hilborn 2011
27-Feb	2	Student led discussion of literature	Jennings 2005, Halpern et al. 2012, Samhouri et al. 2010, (Shepard et al. 2015)
1-Mar	1	Ecosystem Indicators	Chap 6, Link 2005
6-Mar	2	Student led discussion of literature	Hollowed et al 2000, Schnute & Richards 2001, Plagányi et al. 2014
8-Mar	1	Single- and multispecies assessment models Project outlines due	Chap 7
		No Class – Spring Break	
20-Mar	2	Student led discussion of literature	Hyder et al. 2015, Steele et al. 2013, Collie et al. 2014
22-Mar	1	Aggregate and whole-of-system models	Chap 8
27-Mar	2	Student led discussion of literature	Holsman et al. 2017, Hare et al. 2016
29-Mar	1	Ecological risk assessment	Chap 9
3-Apr	2	Student led discussion of literature	Endter-Wada et al. 1998, Fulton et al. 2011, Branch et al. 2006
5-Apr	1	Societal and economic considerations	Chap 10
10-Apr	2	Student led discussion of literature	Costanza et al. 1998, Sainsbury et al. 2000, Sissenwine & Mace 2003, Garcia & Cochrane 2005
12-Apr	1	Governance and management institutions	Chap 11
17-Apr	2	No Class – Monday schedule	
19-Apr	1	Evaluating tradeoffs; Student led discussion of literature	Chap 12; Sainsbury & Sumaila 2003, de la Mare 2005, Worm et al. 2009, Fulton et al. 2014
24-Apr	2	Student led discussion of literature	Leslie & McLeod 2007, Murawski et al. 2007, Berkes 2011, Bunnefeld et al. 2011
26-Apr	1	Moving toward EBM, Regional Ocean Planning	
01-May		Course Review	
08-May	1	Final exam: <i>Student verbal presentations of class projects</i> Project reports due	

Title IX statement: The purpose of a university is to disseminate information, as well as to explore a universe of ideas, to encourage diverse perspectives and robust expression, and to foster the development of critical and analytical thinking skills. In many classes, including this one, students and faculty examine and analyze challenging and controversial topics.

If a topic covered in this class triggers post-traumatic stress or other emotional distress, please discuss the matter with the professor or seek out confidential resources available from the Counseling Center, <http://www.umassd.edu/counseling/>, 508-999-8648 or -8650, or the Victim Advocate in the Center for Women, Gender and Sexuality, <http://www.umassd.edu/sexualviolence/>, 508-910-4584. In an emergency contact the Department of Public Safety at 508-999-9191 24 hrs./day.

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For confidential counseling support and assistance, please go to <http://www.umassd.edu/sexualviolence/>

Course Number: MAR 536
Course Title: Biological Statistics II
Instructors:
Gavin Fay, Assistant Professor
School for Marine Science & Technology
SMAST East 228; (508) 910-6363; gfay@umassd.edu

Class Location: SMAST East Room 247
Class Time: Tuesday/Thursday 10:30-11:45
Wednesday 10:30-12:30 (January 24 to Feb 28)
Office Hours: By appointment

Course Description: Student-led learning in statistical analysis of ecological data. This course provides guided learning in advanced statistical analysis, as applied to ecological research and other fields of marine science. Advanced concepts in probability, hypothesis testing, and estimation will be presented by students, including analyses of example data sets and problems. Students will be required to learn selected methods independently, present topics to the class that are relevant to their graduate research and complete a class project. A computer lab, focused on introductory and intermediate programming and analysis using R, will be held for the first half of the semester.

Course Objectives:

1. Self-learning in advanced quantitative concepts and methods
2. Familiarity with advanced statistical methods
3. Experience communicating advanced quantitative topics
4. Experience in statistical programming

Credits: 4

Prerequisites: Students should have taken an introductory graduate statistics course (e.g. MAR 535 Biological Statistics I or equivalent), or seek permission from the instructors.

Evaluation procedures:

1. An advanced statistical analysis of data relevant to the student's graduate research topic, including a detailed report and oral presentation (65% of course grade).
 - a. Brief description of the topic including a statement of the problem, proposed statistical method, and supplemental reference(s) is due March 1 (5% of course grade).
 - b. Student lecture and project presentation chapter assignment or supplemental reading on the statistical method used in the project. A 40-minute lecture on the method, and demonstration of the method using the project dataset. Leading class discussion. Lectures will be graded based on the instructors' evaluation of accuracy, clarity, and comprehensiveness. Feedback from other students will also be considered in evaluation of presentations (35% of course grade).
 - c. Project report (due May 4). A written description of the methods and results of the project in the form of a draft scientific manuscript (Introduction, Methods, Results, Discussion). (25% of course grade).

2. Mid-term examination on statistical concepts and literacy (20% of course grade). Take home exam. Due 3/20/18.
3. Participation in class discussions (5% of course grade). Attendance at all lectures and labs is the best way to understand topics and assignments, but is not required for evaluation.
4. Computer lab exercises (10% of course grade). Completion of short laboratory exercises using R during the first half of the semester. Lab assignments are due before lab session the following week.
5. Late submissions will be penalized 10 points (out of a 100) for each day that an assignment is late – assignments submitted later than three days after the deadline will not be graded.
6. Failure to complete any of these requirements for evaluation will result in a score of zero for missing components. A final grade of ‘incomplete’ may be recorded at the request of the student and the discretion of the professor.
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<http://www.umassd.edu/studentaffairs/studenthandbook/academicregulationsandprocedures/>

Required Hardware: laptop computer

Required Software:

1. R (free download at <http://r-project.org>) and RStudio, an integrated development environment for R (free download at <http://www.rstudio.com>)

Principal Text:

Zuur, A.F., Ieno, E.N. and Smith, G.M. (2007). *Analysing Ecological Data*. Springer. 700p.
 Series: Statistics for Biology and Health. (available as ebook through the UMass Amherst library system, or hard copy ~\$100 online).
 Support website for book (<http://highstat.com/index.php/analysing-ecological-data>)

The form for students to request access to UMass Amherst ebook collection is available at:
<http://www.umassmarine.net/wp-content/uploads/2014/04/NENS-Form-for-UMass-Amherst.pdf>

Supplementary Text (others as needed):

Bolker, B.M. 2008. *Ecological Models and Data in R*. Princeton University Press.
 (<http://ms.mcmaster.ca/~bolker/emdbook/index.html>, <http://emdbolker.wikidot.com/>)
 James, G., Wittem, D., Hastie, T., and Tibshirani, R. (2014). *An Introduction to Statistical Learning With Applications in R*. Springer. (ebook available online)
 Support website for book (<http://www-bcf.usc.edu/~gareth/ISL/>)
 Wickham, H. and Grolemund, G., 2016. *R for data science*. O'Reilly. (<http://r4ds.had.co.nz/>)

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Course outline and tentative schedule of lectures/labs (the schedule of advanced topics later in the semester is expected to change based on student needs):

Type	Day	Date	Reading	Topic
Lecture	Tue	Jan 23	Zuur et al. Chap. 1-4	Introduction, data exploration
Lab	Wed	Jan 24		Introduction to R and R Studio, working with data
Lecture	Thur	Jan 25	Zuur et al. Chapter 5	Linear regression review
Lecture	Tue	Jan 30	Bolker 2008 Chap. 4	Probability review
Lab	Wed	Jan 31		Introduction to plotting, manipulating data
Lecture	Thur	Feb 1	Hilborn & Mangel Chapter 7	Likelihood
Lecture	Tue	Feb 6	Zuur et al. Section 6.1	Extending the linear model (GLM)
Lab	Wed	Feb 7		Probability, Linear modeling in R
Lecture	Thur	Feb 8	Zuur et al. Section 6.2	GLMs II, logistic regression
Lecture	Tue	Feb 13	Zuur et al. Chapter 12	Matrix Algebra Review
Lab	Wed	Feb 14		Programming practices, conditional statements
Lecture	Thur	Feb 15	Zuur et al. Chapter 12	Principal Components Analysis
	Tue	Feb 20	NO CLASS	Monday Schedule
Lab	Wed	Feb 21		Creating functions, debugging
Lecture	Thur	Feb 22	Zuur et al. Chapter 14	Classification, Linear Discriminant Analysis
Lecture	Tue	Feb 27	James et al. Chapter 5	Resampling methods, Cross-Validation

Lab	Wed	Feb 28		More on functions, Advanced plotting
Lecture	Thur	Mar 1	James et al. Chapter 7	Nonlinear models, splines Project descriptions due
Lecture	Tue	Mar 6	Zuur et al. Chapter 7	GAMs (guest lecture, M. Winton) Mid-tem exams distributed
	Wed	Mar 7	NO LAB	
	Thur	Mar 8	Zuur et al. Chapter 7	GAMs II (guest lecture, M. Winton)
Lecture	Tue	Mar 20	Zuur et al. Chap. 11-15	Ordination methods (guest lecture, S. Cadrin) Mid-term exams due
Lecture	Thur	Mar 22	TBD	Zero-inflated models
Lecture	Tue	Mar 27	Zuur et al. Chapter 8	Linear mixed effects models
Lecture	Thur	Mar 29		No Class. Rescheduled.
Lecture	Tue	Apr 3	Zuur et al. Chapter 9	Trees
Lab	Wed	Apr 4		Midterm review Spatial mixed effects models
Lecture	Thur	Apr 5	James et al. Section 10.3	Cluster Analysis
Lecture	Tue	Apr 10	Student Presentations	Sofia (breakpoint analysis)
	Wed	Apr 11	Student Presentations	Maggie (GLMMs)
Lecture	Thur	Apr 12	Student Presentations	Beth (PCoA)
Lecture	Tue	Apr 17	Student Presentations	Nish (GLMs – Survival analysis)
Lecture	Thur	Apr 19	Student Presentations	Allex (GLMMs)
Lecture	Tue	Apr 24	Student Presentations	Becca (Permutation tests)
Lecture	Thur	Apr 26	Student Presentations	Joe (State-space movement models)
Lecture	Tue	May 1		Review

Course Title: Stock Assessment of Fishery Resources
Course Number: MAR 544-01 (13995)
Semester: Fall 2018
Class Time: Tuesday/Thursday 2:00-3:15
Class Location: SMAST-East 101
Instructor: Steve Cadrin, Associate Professor
School for Marine Science & Technology
SMAST-East 121; (508)910-6358; scadrin@umassd.edu
Office Hours: Tuesday/Thursday afternoon or by appointment
Guest Lectures: Greg DeCelles (gregory.decelles@state.ma.us), Brooke Wright (brooke.wright@umassd.edu), Alex Hansell (ahansell@umassd.edu), and Cate O'Keefe (catherine.o'keefe@state.ma.us)

Course Description: This course provides instruction, demonstration and exercises in population modeling, as applied to fishery resources. First principles of population dynamics are reviewed from the perspective of model building, and several dimensions of complexity are explored. A wide range of conventional stock assessment methods are introduced, as well as several advanced topics. The course is designed to train students to *"have the ability to conduct high-quality scientific research in stock assessment, fishery population dynamics and related fields"* (U.S. Dept. Commerce and U.S. Dept. Education 2008 NOAA Tech. Mem. NMFS-F/SPO-91)

Course Objectives and Learning Outcomes:

1. Understanding the role of stock assessment in fisheries science
2. Familiarity with conventional stock assessment models
3. Experience in basic model building and parameter estimation

Evaluation procedures:

1. Homework assignments on stock assessment models are evaluated based on analytical approach, correct solution and appropriate interpretation (60% of grade). Class time is allocated to discuss assignments (if necessary) during the next class after they are assigned and are due the following class. Submissions of all analytical assignments should include:
 - a. A brief report with text, tables and figures (e.g., Word or pdf file emailed before class AND a hard copy submitted in class) stating the problem, methods (modeling approach), results (parameter estimates, evaluation of goodness-of-fit), and interpretation of model results.
 - b. Documentation of complete analytical results (e.g., Excel file emailed before class).
2. Final exam to test adequate completion of course objectives, including all topics presented in lecture and readings (30%). The exam will be distributed December 6 and the completed exam should be emailed to the instructor by December 13.
3. Presentation of a stock assessment, preferably for a species of interest or relevant to graduate research topic (10%). Presentations will be scheduled on December 4 and 6, and each presentation will be 20 minutes.
 - Extra credit opportunities will be provided in some homework assignments and the final exam (up to 10% of assignment or exam grade).
 - Failure to complete any of these requirements for evaluation will result in a score of zero for missing components.
 - Grades will be reduced for all unexcused late submissions of homework assignments, exams or presentations, with a 10% reduction for each day after the deadline. Requests for excused late submissions will be considered up to one day before the deadline.

- At the student's request, and no more than 48 hours after the final exam or class, an incomplete grade may be given only in exceptional circumstances at the discretion of the instructor. The student must be passing the course at the time of the request or be sufficiently close to passing that the instructor believes that upon completion of the work, the student will pass the course. If the work is not completed within one year of recording the I, the grade will become an F(I).
- Attendance at all lectures is the best way to understand topics and assignments, but is not required for evaluation.
- This 3-credit class involves three hours per week of in-class work and at least six hours per week of out-of-class work are expected.
- Course materials, instructions, and submissions will be made via email. Students are responsible for all official correspondence sent to their standard UMD e-mail address (@umassd.edu).
- All UMass Dartmouth students are expected to maintain high standards of academic integrity and scholarly practice. The University does not tolerate academic dishonesty of any variety, whether as a result of a failure to understand required academic and scholarly procedure (www.umassd.edu/policies/activepolicylist/academicaffairs/academicintegritypolicyandreportingform/), or as an act of intentional dishonesty.

Course Resources (required reading):

Haddon, M. 2011. *Modelling and Quantitative Methods in Fisheries*, 2nd ed. CRC Press.
(available for purchase online: <https://www.amazon.com/Modelling-Quantitative-Methods-Fisheries-Second/dp/1584885610>)

Reference reading list (copies provided by instructor):

ASMFC. 2000. *Fisheries Stock Assessment User's Manual*. Atlantic States Marine Fisheries Commission Special Report No. 69 (Chapters 9 and 11).
Keyl, F. and M. Wolff. 2008. Environmental variability and fisheries: what can models do? *Rev Fish Biol Fisheries* 18:273–299
Mace, P.M. 2001. A new role for MSY in single-species and ecosystem approaches to fisheries stock assessment and management. *Fish and Fisheries* 2: 2-32.
Punt, A. E., Butterworth, D. S., deMoor, C. L., De Oliveira, J. A. A., and Haddon, M. 2014. Management strategy evaluation: Best practices. *Fish and Fisheries*. 17: 303-334.

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Course content and outline:

Day	Date	Lecture	Topic	Assignment	Reading
Thurs	6-Sep	1	Stock Assessment Objectives		Chap. 1
Tues	11-Sep	2	Resource Surveys		ASMFC IX
Thurs	13-Sep	3	Fishery Sampling		ASMFC IX
Tues	18-Sep	4	Exponential mortality		Sec.2.7
Thurs	20-Sep	5	Individual growth		Chap.9
Tues	25-Sep	6	Recruitment		Chap.10
Thurs	27-Sep	7	Fitting models to data		Chap.3
Tues	2-Oct		<i>Guest Lecture - surveys</i>		
Thurs	4-Oct		<i>Guest Lecture - CPUE</i>		
Tues	9-Oct	8	Population Growth		Sec.2.1-6
Thurs	11-Oct	9	Biomass dynamics models	modeling	Chap.11
Tues	16-Oct	10	Simple age-based methods		Sec.12.1
Thurs	18-Oct	11	Simple size-based methods	BD	Chap. 13
Tues	23-Oct	12	Virtual population analysis		Sec.12.2
Thurs	25-Oct	13	Statistical catch at age analysis		Sec.12.3
Tues	30-Oct	14	Stage-based models	VPA	ASMFC XI
Thurs	1-Nov	15	Integrated analysis		Sec.12.3
Tues	6-Nov		<i>Guest Lecture - Data_limited Assessment</i>		
Thurs	8-Nov	16	Dynamic pool models	CSA	Sec.2.8
Tues	13-Nov	17	Age-based MSY		Mace 2001
Thurs	15-Nov	18	Projection & Simulation	YPR	Sec.11.7,12.3
Tues	20-Nov	20	Management Strategy Evaluation		Punt et al. 2014
Thurs	22-Nov		no class Thanksgiving		
Tues	27-Nov		<i>Guest Lecture - Management</i>	MSY	
Thurs	29-Nov	21	Multispecies & Ecosystem Models		Keyl&Wolff 2008
Tues	4-Dec		Student Presentations		
Thurs	6-Dec		Student Presentations		

This syllabus is a guide and every attempt is made to provide an accurate overview of the course. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester and may depend, in part, on the progress, needs, and experiences of the students. Changes to the syllabus will be made with advance notice.

BIOLOGICAL OCEANOGRAPHY (BIO 545/MAR 545) – Spring Semester, 2019

**Lectures, MWF 9:00-9:50 AM (Science & Engineering, Group II-318),
Laboratory M 10:00-12:50 PM (Science & Engineering, Group II-318)**

Dr. Jefferson T. Turner (jturner@umassd.edu)

UMD Office: Violette 202, Phone: (508) 999-8229 (MWF)

SMAST West 212 (generally Tuesdays and Thursdays), (508) 910-6332

Office Hours: MWF 08:00-08:50, Violette 202, W 14:00-15:00, SMAST West 212

Pertinent chapters in the Townsend text (T) are given in parentheses below each topic

Biological Oceanography: History

(T Chapter 1)

Ocean Ecology: Fundamental Aspects

(portions of T Chapters 1, 4, and 5) (T Chapter 7)

Phytoplankton: Taxa, Autecology,

Primary Productivity, Harmful Algal Blooms

(T Chapter 8)

TEST #1 (19 February) (Tue. with Mon. Schedule)

Microbial Oceanography

(M&W Chapter 5)

Zooplankton: Taxonomic Inventory

(T Chapter 9)

Zooplankton: Copepod Feeding Ecology

(T Chapter 9)

Gelatinous Zooplankton

(T Chapter 9)

TEST #2 (25 March)

Fish and Fisheries

(T Chapters 11 & 14)

Fisheries Oceanography

(M&W Chapter 17)

Sea Birds

(T Chapter 13)

Marine Mammals

(T Chapter 13)

Marine Environments

(T Chapter 12)

Climate Change & the Sea

(T Chapter 15,

M&W Chapter 16)

TEST #3 (29 April - 9 AM)

- **THE 3 TESTS ARE NON-CUMULATIVE, ESSAY FORMAT, AND TESTS WILL BE GIVEN DURING LABORATORY PERIODS (on 19 Feb., 25 Mar., & April 29) TO GIVE YOU 3 HOURS.**

- **A term paper counts as a 4th test, or 25% of your grade.**

Papers are due at the time of Test #3 during exam week (29 April).

- THE REQUIRED TEXT *Oceanography and Marine Biology. An Introduction to Marine Science* BY D. W. TOWNSEND, 1st Ed. (2012) (ISBN 978-0-87893-602-1) SINAUER PUBLISHERS (abbreviated "T")

- CERTAIN CHAPTERS FROM *Biological Oceanography* BY C. B. MILLER & P. A. WHEELER, (abbreviated "M&W")

2nd Ed. (2012) (ISBN: 978-1-4443-3302-2) BLACKWELL PUBLISHING WILL BE DISTRIBUTED AS HANDOUTS.

- ADDITIONAL READINGS (BOOKS) WILL BE PLACED ON RESERVE IN THE LIBRARY. HANDOUT COPIES OF SOME PARTICULARLY IMPORTANT ARTICLES WILL BE PROVIDED TO ALL STUDENTS.

- A LABORATORY NOTEBOOK WILL BE TURNED IN FOR GRADING.

- **LABORATORY ATTENDANCE IS REQUIRED**, AS IT TAKES CONSIDERABLE EFFORT TO SET UP LABORATORY EXERCISES FOR THIS CLASS, MAKE-UPS OR RESCHEDULING WOULD BE EXTREMELY INCONVENIENT, AND NOT FAIR TO THOSE WHO DO MAKE THE EFFORT TO ATTEND.

- **FREQUENT ABSENCES FROM LECTURES CAUSES YOU TO MISS TESTABLE MATERIAL. LATE ARRIVAL TO CLASS IS DISRUPTIVE AND DISRESPECTFUL. IF YOU CANNOT COME TO CLASS ON TIME, DO NOT COME!**

Syllabus:

Introductory Physical Oceanography

MAR-555

Fall 2018

Instructor: Miles Sundermeyer	Instructor: Geoffrey Cowles
x8892	x6397
msundermeyer@umassd.edu	gcowles@umassd.edu
SMAST-West 110	SMAST-East 227
office hours: Appt.	office hours: Appt.

Class Schedule, Office Hours and Location

This course is available to be taken: Blended or Face-to-Face.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Recitation	Lecture		Lecture		
	4:00-5:15 p.m.	3:30-4:45 p.m.		3:30-4:45 p.m.		
	SMAST-West Rm 204	SMAST-West Rm 204		SMAST-West Rm 204		

Course Description

Course Description:

A descriptive treatment of ocean atmosphere interactions, water properties, general wind-driven and thermohaline circulation, waves and tides, and coastal processes. Simplified conceptual models demonstrate the important principles.

Prerequisite:

None.

Course Credits: 3

Required Texts:

1. Introduction to Physical Oceanography - Bob Stewart (freely available)
http://oceanworld.tamu.edu/resources/ocng_textbook/contents.html
2. Shelf and Coastal Oceanography - Matthias Tomczak (freely available)
<http://www.mt-oceanography.info/ShelfCoast/index.html>
3. Ocean Circulation, Open University Press, ISBN 978-0-7506-5278-0. Available new and used from major online vendors. We have used this book for 5+ years so there are a number of SMAST students that have a copy.

Note: *Ocean Circulation* is officially out of print, but can still be purchased both new and used online. Also, the full Ocean Circulation text is available online through the UMass Amherst library. IMS students can obtain access to the Amherst library database by filling out and signing the "NENS" form.

Course Objectives

This course provides a descriptive treatment of ocean atmosphere interactions, water properties, general wind-driven and thermohaline circulation, waves and tides, and coastal processes. Simplified conceptual models demonstrate the important principles. Taught via distance learning, from the UMass Dartmouth Campus.

Upon successful completion of the course, the student will be able to:

- Describe/explain the primary physical processes governing ocean circulation, including the effects of wind, waves, tides, stratification, surface heat fluxes, and evaporation and precipitation.
- Use the equations of motion and mass conservation to explain basic force balances in the ocean, including geostrophy, inertial motion, Ekman transport; and to characterize various types of ocean waves, mixing, benthic processes.
- Describe and interpret data collected from various physical oceanographic instrumentation, including measurements of temperature, salinity, density, pressure, and velocity.
- Describe major ocean features, including major currents, water masses, and what governs their locations/distributions.
- Discriminate between wind-, tide- and density-driven oceanographic phenomena and other non-physical oceanographic phenomena in real oceanographic data sets encountered in their research.

Communication Plan

Expectations for Electronic Communication

- Please use email **ONLY** when the subject is of a personal and confidential matter. If you have a question for which others in the course could benefit from the answer, please post the question in the appropriate discussion board forum.
- The instructors and TA generally check email Monday through Friday during normal business hours. Please copy both instructors and the TA on any correspondence. You can expect a reply from one of us within 24 hours during the work week. Replies on weekends are less dependable, but are generally also given within 24 hrs.
- Instructors will also check the discussion forums daily during the work week. We will post often during the first weeks of the course and then drop off in activity while expecting participants to fill any void. Rest assured however, we **will** be participating in what we hope will be lively discussions and will **always** reply to any discussion comment directed specifically at us.
- Instructors will not generally email students to confirm receipt of assignments. If you do not hear from us after you submit your work, consider it a good thing.

Methods of Instruction

Evaluation and Grading Breakdown:

- Homeworks: 30% (reading/online content quizzes=15% + problem sets=15%)
- Mid-Term (take home): 30%
- Final Exam (take home): 30%
- Participation: 10%

Syllabus – Introductory Physical Oceanography- MAR-555 – Miles Sundermeyer, Geoff Cowles

Policy on Late Assignments and Missing Assignments:

Per Instructor

The Weekly Schedule

Given the timing of lecture vs. recitation, homework assignments will be due on Tuesdays at the beginning of lecture, and new assignments given at the end of lecture on Tuesday, due the following Tuesday. Recitation on Mondays will cover material discussed the previous week, and will address topics covered in homework due the next day (Tuesday). As such, the course “week” begins on Tuesdays, and ends on Mondays.

Time Considerations

Students should be prepared to spend between 3-6 hours per week on reading and course assignments outside of regular lecture/recitation.

Attendance Policy

Attendance:

This course is a 3 credit course. Attendance in weekly lecture is mandatory. Attendance at Monday recitations is optional, but strongly encouraged.

Incomplete Policy

According to the university catalogue, an incomplete may be given only in exceptional circumstances at the instructor's discretion. The student must be passing at the time of the request or be sufficiently close to passing. If the work is not completed within one year of the recording of the incomplete grade, the grade will become an F(I). The incomplete policy for this course is that at least 70% of the course must be already completed and an exceptional circumstance (i.e. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

Student Academic Integrity Policy

All UMass Dartmouth students are expected to maintain high standards of academic integrity and scholarly practice. The University does not tolerate academic dishonesty of any variety, whether as a result of a failure to understand required academic and scholarly procedure or as an act of intentional dishonesty.

A student found responsible of academic dishonesty is subject to severe disciplinary action which may include dismissal from the University. The procedure for responding to incidents of academic dishonesty may be found in Section III of this document. You may also refer to the Student Handbook for information about the judicial process.

A high standard of academic integrity promotes the pursuit of truth and learning and respect for the intellectual accomplishments of others. These are values that are fundamental to the mission of this University. Such values are undermined by academic dishonesty.

Academic freedom is a fundamental right in any institution of higher learning. Honesty and integrity are necessary preconditions of this freedom. Academic integrity requires that all academic work be wholly the product of an identified individual or individuals. Joint efforts are legitimate only when the assistance of others is explicitly acknowledged and deemed appropriate by the instructor of the course. Ethical conduct is the

obligation of every member of the University community, and breaches of academic integrity constitute serious offenses.

Maintenance of the standards of academic integrity and the successful administration of this policy depend on the mutual cooperation of faculty and students.

Faculty cooperation is essential for successful application of the procedures defined by this Academic Integrity Policy. Faculty members promote academic integrity by making clear on their syllabi their expectations concerning homework assignments, collaborative student efforts, research papers, examinations, computer-based infractions, and the like. Efforts should be made to detect and to prevent cheating and plagiarism in all academic assignments. If faculty members have evidence of academic dishonesty, they are expected to report such evidence promptly.

Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Students are also expected to report incidents of academic dishonesty to the instructor or dean of the instructional unit.

The intent of this policy is to make clear the standards of academic integrity at UMass Dartmouth.

****For additional information on violations, infractions, and consequences visit the UMass Dartmouth Student Academic Integrity Policy at the link below.***

<http://www.umassd.edu/studentaffairs/studenthandbookintroduction/studentconductpolicies/academicintegritypolicy/>

Center for Access and Success

In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access in this course, please meet with the instructor at the beginning of the semester and provide the appropriate paperwork from the [Center for Access and Success](#). The necessary paperwork is obtained when you bring proper documentation to the Center, which is located in Liberal Arts, Room 016; phone: 508.999.8711.

<http://www.umassd.edu/dss/>

Resources

Tutoring

If you are having difficulty with the class please:

- Post a message on the Discussion Board – be sure to use your classmates for troubleshooting and problem solving.
- Make an appointment to come in and meet with the instructors during my office hours.
- Contact the Academic Resource Center (ARC) for support:

Academic Resource Center, Liberal Arts – Room7
Phone: 508.999.8708, Fax: 508.910.6404

Technical Help

If you are in need of technical assistance the IT Service Desk is available to students.

Syllabus – Introductory Physical Oceanography- MAR-555 – Miles Sundermeyer, Geoff Cowles

Claire T. Carney Library, lower level

508.999.8884 (x8884) or [Email](#)

Sunday:	12:00pm-2am
Monday thru Thursday:	7:30am-2am
Friday:	7:30am-11pm
Saturday:	9:30am-1pm

Students living in the Residence Halls may also contact the Residential Technology (ResTech) Support Center:

Visit [ResTech](#) in Elmwood Hall, lower level
Call the ResTech Help Line at 508.999.8040 (x8040)

CEN 456/556 & MAR 558
Waves and Tides
Spring 2018

Instructor: Daniel MacDonald Violette 107B / SMAST East 233* Office: 508-910-6334 Email: dmacdonald@umassd.edu Office Hours: T (12:30-2:00), W*(2:00-3:30), R(3:30-4:30)	Prerequisite(s): CEN 303, CEN 325 or Permission of Instructor Time & Location: TR 9:30-10:45 TXT 101
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Description:

Analytical study of the physical processes governing waves in the marine environment. Covered topics include surface gravity waves, internal gravity waves, energy flux, group velocity, long waves, linear and nonlinear shallow water waves, and atmospheric forcing. This course will be of interest to any engineer or ocean scientist interested in the physics of waves and coastal engineering.

This course provides the student with a fundamental understanding of surface gravity waves in the marine environment. The course will include a review of fundamental fluid mechanic principles, followed by a derivation of the linearized wave equations. A detailed analysis of linear wave theory follows, including the following topics: dispersion relationship, phase velocity, particle orbits, superposition, wave energy, energy propagation, group velocity, interactions with bottom stress, and refraction. The course will also cover the generation of waves via wind stress, and practical applications of wave spectra. Advanced topics may include an introduction to nonlinear waves and wave breaking. Tidal generation, an introduction to tidal harmonics, and the propagation of tides (long waves) in coastal areas may also be covered. The course will rely predominantly on classroom lectures and the identified reference texts.

Texts: Dean R.G., and R.A. Dalrymple, 1991. *Water Wave Mechanics for Engineers and Scientists*. World Scientific Publishing, Singapore.
Kundu, P.K., I.M. Cohen, and D. Dowling 2015. *Fluid Mechanics*, 6th Edition. Elsevier.
Madsen, O.S. Chapter I: Basic Wave Theory. Unpublished notes.
Ippen, A.T., 1966. *Estuary and Coastline Hydrodynamics*. McGraw-Hill, New York.
Holthuijsen, L.H., 2007. *Waves in Oceanic and Coastal Waters*. Cambridge University Press, Cambridge, UK.
Officer, Charles B., 1976. *Physical Oceanography of Estuaries (and Associated Coastal Waters)*. John Wiley and Sons Ltd., New York.
Silvester, R., 1974. *Coastal Engineering, I: Generation, propagation and influence of waves*. Elsevier, Amsterdam.
Sorensen, R.M., 1993. *Basic Wave Mechanics for Coastal and Ocean Engineers*. John Wiley and Sons Ltd., New York.
US Army Corps of Engineers, 2002. Coastal Engineering Manual (primarily Part II)
(<http://chl.erdc.usace.army.mil/chl.aspx?p=s&a=ARTICLES;101>)

Evaluation:

1. Homework assignments	30%
2. Exam I	15%
3. Exam II	20%
3. Final Exam	30%
4. Class participation	5%

Expectations:

The goal for this course is for the student to build an analytical and conceptual understanding of ocean waves, and to be able to relate that understanding to others. To reach that goal we will rely heavily on mathematics and mathematical solutions that can describe waves and related phenomena. The math is critical in building intuition about the physics, but always keep in mind that the math is only a tool. Remember to always ask yourself: “What does this (math, model, etc.) tell me about what’s really going on?”

CEN 456 vs. CEN556/MAR558: There are different requirements for the undergraduate vs. graduate versions of this course. CEN 456 students are encouraged to form homework teams of up to four students. These teams must be designated and reported to the Professor by email no later than Monday January 29. Teams are allowed to turn in one homework assignment for the team, with the entire team receiving the same grade. All students should engage equally in the homework process – those who rely on their teammates to complete the homework might receive an acceptable grade for the homework assignment, but will be at a significant disadvantage during exams.

	CEN 456	CEN 556/MAR 558
Homework	HW teams must complete all problems.	Individuals must complete all problems.
Exam I	In-Class Component Only	In-Class and Take-Home Components
Exam II	In-Class Component Only	In-Class and Take-Home Components
Final Exam	In-Class Component Only	

Class: Students will attend class regularly and ask questions freely.

Homework: The ability to communicate effectively in science is as important as the ability to do good science. Therefore, make sure that your homework assignments are clearly, neatly, and concisely written in a professional manner. Show your work clearly whenever necessary. Treat your homework assignments as an opportunity to *teach me* about what you have learned in this course, and how well you know it. In general, late homeworks will not be accepted, except by advance request and permission of the instructor.

University Policy on Academic Dishonesty: All students should be aware of the university’s policy on academic dishonesty, including plagiarism. This policy appears in both the undergraduate catalogue and the student handbook.

Academic Support: Academic support services are available through appropriate offices on main campus. These include services for learning and physically disabled students, which are available through the Disabled Student Services office.

CEN 456/556 & MAR 558: Waves and Tides
Spring 2018

Section	Lecture #	Date	Topic	Source ¹	HW DUE ²
1 BACKGROUND	1	1/23/18	Conservation of mass/momentum	1.1-1.2	
	2	1/25/18	Velocity potential, Laplace Eq., Bernoulli Eq.	1.3	
	3	1/30/18	Boundary conditions	1.4	
	4	2/1/18	Linearization of equations	2.0	
2 LINEAR WAVES	5	2/6/18	Linear wave theory (constant depth)	2.1	HW#1
	6	2/8/18	Dispersion relationship	2.1.1	
	7	2/13/18	Short waves, long waves	2.1.1	
	8	2/15/18	Pressure, velocity, particle orbits		
	9	2/20/18	No Class - President's Day		
		2/22/18	Superposition of progressive waves	2.2	HW#2
		2/27/18	REVIEW		
		3/1/18	EXAM I (Lectures 1-9)		
3 ENERGY	10	3/6/18	Wave energy, energy flux	2.3	
	11	3/8/18	Energy propagation, group velocity, energy conservation		
		3/13/18	No Class - SPRING BREAK		
		3/15/18	No Class - SPRING BREAK		
4 WAVE TRANSFORMATION	12	3/20/18	Refraction, Snell's law	3.2	HW#3
	13	3/22/18	Shoaling waves	3.1	
	14	3/27/18	Diffraction (breakwaters, harbors, etc.)	Notes	
5 NL WAVES	15	3/29/18	Non-linear waves	4.1-4.3	
	16	4/3/18	Wave Breaking	4.4	HW#4
		4/5/18	REVIEW		
		4/10/18	EXAM II (Lectures 10-16)		
7 OTHER TOPICS	17	4/12/18	Wind stress & wave generation	Notes	
	18	4/17/18	Wave spectra	Notes / CEM II-1-3(c)	
	19	4/19/18	Wave spectra		
	20	4/24/18	Wave Forces on Piles		
	21	4/26/18	Tides - Generation	Notes	HW#5
	22	5/1/18	Tides - Coastal Propagation		
		5/8/18	FINAL EXAM, 8:00-11:00 (Comprehensive)		

1. Unless otherwise noted, sections indicated refer to Madsen, Basic Wave Theory; CEM refers to USACOE Coastal Engineering Manual

2. Homeworks will be due in class on the day specified.

MAR 565/CEN 430-01
Spring Semester 2016
Pollutant Transport in the Environment
Tuesday/Thursday 12:30-1:45, Dion 114

Instructor: Daniel MacDonald
Prerequisite(s): Undergraduate Fluid Dynamics
or Permission of Instructor

Description: This course provides the student with a fundamental understanding of physical processes responsible for transport in the fluid environment. The first half of the course focuses on molecular and turbulent diffusion processes, and an understanding of the advective-diffusion equation. Examples will be provided to illustrate transport and mixing processes in real-world applications. The second half of the course will include transport across fluid boundaries, including air-water, and water-sediment exchange, as well as a brief description of reaction kinetics and other topics. The course is designed to provide the student with a thorough theoretical and applied understanding of how transport processes occur, and is geared towards students interested in engineering practice and/or further graduate studies.

Office Hours: TBA

Reference Texts:

- Csanady, G.T., 1973. *Turbulent Diffusion in the Environment*, D. Reidel Publishing Company, Dordrecht, Holland.
- Dyer, Keith R., 1997. *Estuaries: A Physical Introduction*, 2nd Edition. John Wiley and Sons Ltd., Chichester, UK.
- Fischer, Hugo B., E. John List, Robert C.Y. Koh, Jorg Imberger, and Norman H. Brooks, 1979. *Mixing in Inland and Coastal Waters*. Academic Press, San Diego.**
- Kundu, P.K. & Cohen, I.M., 2002. *Fluid Mechanics*, 2nd Edition, Academic Press, San Diego, CA.
- *Socolofsky, S.A. & G.H. Jirka, 2005. *Special Topics in Mixing and Transport Processes in the Environment*, available on MyCourses site, and online (see #2 below).**
- Tinsley, I.J., 2004. *Chemical Concepts in Pollutant Behavior*, Wiley Interscience, Hoboken, NJ.
- van Dyke, M., 1982. *An Album of Fluid Motion*, The Parabolic Press, Stanford, California.

Reference Web Sites:

1. Course website for Transport Processes in the Environment (MIT):
<http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-061-transport-processes-in-the-environment-fall-2008/index.htm>
2. Course website for Mixing and Transport in the Environment (Texas A&M):
https://ceprofs.tamu.edu/ssocolofsky/OCENx89/Downloads/Book/Socolofsky_Jirka.pdf

Evaluation:

- | | |
|-------------------------|-----|
| 1. Homework Assignments | 30% |
| 2. Midterm Exam | 30% |
| 3. Final exam | 30% |
| 4. Class participation | 10% |

Expectations:

The goal for this course is for the student to build a conceptual understanding of pollutant transport issues, and to be able to relate that understanding to others. To reach that goal we will rely heavily on mathematics and mathematical solutions that can describe the relevant natural phenomena. The math is critical in building intuition about the physics, but always keep in mind that the math is only a tool. Remember to always ask yourself: “What does this (math, model, etc.) tell me about what’s really going on?”

MAR 565 vs. CEN 430-01: There are different requirements for the undergraduate (MNE 490-03) vs. graduate (MAR 558) versions of this course. CEN 430-01 students are allowed (and even encouraged) to form homework teams of up to four students. These teams must be designated and reported to the Professor by email no later than Monday February 1. Teams are allowed to turn in one homework assignment for the team, with the entire team receiving the same grade. Team homeworks will be held to a higher standard than solo homeworks with regards to written explanations, neatness of work, and completeness. All students should engage equally in the homework process – those who rely on their teammates to complete the homework might receive an acceptable grade for the homework assignment, but will be at a significant disadvantage during exams.

	CEN 430-01	MAR 565
Homework	Certain problems will be marked as optional for solo HW completion. HW teams must complete all problems.	Must work all problems.
Exam I	In-Class Component Only	In-Class and Take-Home Components
Literature Summary	Not Required	Required
Final Exam	In-Class Component Only	

Class: Students will attend class regularly and ask questions freely.

Homework: The ability to communicate effectively in science and engineering is as important as the ability to do good science and engineering. Therefore, make sure that your homework assignments are clearly, neatly, and concisely written in a professional manner. Show your work clearly whenever necessary. Treat your homework assignments as an opportunity to *teach me* about what you have learned in this course, and how well you know it.

University Policy on Academic Dishonesty: All students should be aware of the university’s policy on academic dishonesty, including plagiarism. This policy appears in both the undergraduate catalogue and the student handbook.

Academic Support: Academic support services are available through appropriate offices on main campus. These include services for learning and physically disabled students, which are available through the Disabled Student Services office.

Instructor Contact Information:

Daniel MacDonald
Violette 107B
Office: 508-910-6334
Email: dmacdonald@umassd.edu

**MAR 565/CEN 430-01: Pollutant Transport in the Environment
Spring 2016**

Time and Place: Tuesday/Thursday 12:30 - 1:45, DION 114

Note: Schedule subject to change

Week	Date*	Lectures	HW Due
1	1/26/16	Introduction/Motivation	
	1/28/16	Concentration and Intensity	
2	2/2/16	Molecular diffusion/random walk/diffusivity	
	2/4/16	Diffusion Equation	
3	2/9/16	Advective diffusion equation	
	2/11/16	Turbulent diffusion	HW #1
4	2/16/16	No Class: Monday Schedule	
	2/18/16	Image sources / Superposition	
5	2/23/16	No Class (Topic to Make Up: Instantaneous Sources I)	
	2/25/16	No Class (Topic to Make Up: Instantaneous Sources II)	
6	3/1/16	Continuous Sources	
	3/3/16	. . .	HW #2
7	3/8/16	Applications: Rivers	
	3/10/16	Horizontal Diffusion (Scale-Dependent)	
	3/15/16	No Class: Spring Break	
	3/17/16	No Class: Spring Break	
8	3/22/16	Reaction Kinetics I	
	3/24/16	Reaction Kinetics II	HW #3
9	3/29/16	Review	
	3/31/16	EXAM I	
10	4/5/16	Boundary Exchange	
	4/7/16	Gas Transfer	
11	4/12/16	Gas Transfer	
	4/14/16	Thermal Pollution I	
12	4/19/16	Thermal Pollution II	HW #4
	4/21/16	Sediment erosion/deposition processes	
13	4/26/16	Groundwater Dispersion	
	4/28/16	Groundwater Dispersion	
14	5/3/16	Review	HW #5
	5/6/16	FINAL EXAM (11:30-2:30)	

*Note: Topics during the last three weeks of class (4/14 - 4/28) may be adjusted depending on prior pace of instruction and student interest.

Course Number: MAR 595
Course Title: Bayesian Statistics & Hierarchical Modeling for Ecology
Faculty Sponsor: Gavin Fay, Assistant Professor
School for Marine Science & Technology
SMAST East 228; (508) 910-6363; gfay@umassd.edu
Class Location: SMAST East Room 103
Class Time: Thursdays 13:00-15:00
Office Hours: By appointment

Course Description: Independent study in Bayesian statistics and hierarchical modeling with an emphasis on a mathematical statistics. Bayesian modeling has become an indispensable tool for ecological research. This course will provide an overview of the principles of Bayesian statistics and concepts. Students will work through the recent textbook by Hobbs & Hooten (2015) with additional supplementary reading from the literature. A set of problems in the textbook will be worked through using multiple methods, including writing out properly factored statistical expressions representing the Bayesian models, as well as implementation of models using current state-of-the art algorithms and software. Advanced topics in Bayesian methods will also be covered. Weekly meetings will be used to review chapter readings, discuss additional key papers on weekly topics, and work through problems as a group.

Course Objectives:

1. Obtain understanding of principles of Bayesian statistics, and the relationship of Bayesian methods to other statistical concepts and estimation methods.
2. Be able to use basic statistical distributions to write joint and conditional posterior distributions for Bayesian models.
3. Practical experience implementing Markov chain Monte Carlo (MCMC) methods to estimate the posterior distributions of parameters. Conduct worked examples using problems from textbook to create sets of computer code in R, JAGS, ADMB, and STAN.
4. Apply Bayesian methods to own research.

Prerequisites:

Students should have taken coursework in applied statistics (e.g. MAR 536) and population dynamics (e.g. MAR 544), or seek permission from the instructor.

Principal Text

Hobbs, N.T. and Hooten, M.B., 2015. *Bayesian models: a statistical primer for ecologists*. Princeton University Press.

Credits: 3

Evaluation procedures:

1. Attendance and participation in discussion at weekly meetings to review chapter readings (30%).
2. Compilation of key papers on assigned advanced topics, most pertinent to student thesis research (10%).

3. Contribution to online repository of worked-through solutions to textbook problems, including computer code to run examples in R, JAGs, and STAN (10%).
4. Project detailing implementation of code for a Bayesian analysis applied to student's dataset of choice (50%).
5. Late submissions will be penalized 10 points (out of a 100) for each day that an assignment is late – assignments submitted later than three days after the deadline will not be graded.
6. Failure to complete any of these requirements for evaluation will result in a score of zero for missing components. A final grade of 'incomplete' may be recorded at the request of the student and the discretion of the professor.
7. University policy on academic dishonesty, including plagiarism, applies (see: <http://www.umassd.edu/studenthandbook/academicregs/ethicalstandards.cfm>).

Required Hardware: laptop computer

Required Software:

1. R (free download at <http://r-project.org>, students may also wish to install Rstudio, an integrated development environment for R, free download at <http://www.rstudio.com>)
2. JAGS
3. STAN
4. AD Model Builder (free download at <http://admb-project.org>)

Schedule and tentative list of topics (subject to change)

Week	Topic	Reading
9/6	Introduction, course planning	Chap 1
9/13	Probability, Likelihood, Bayes Theorem	Chaps 1-4
9/20	Simple Bayesian models	Chap 5
9/27	Hierarchical Bayesian models 1	Chap 6
10/4	Hierarchical Bayesian models 2	Chap 6
10/11	Bayesian computation, Markov Chain Monte Carlo 1	Chap 7
10/18	Markov Chain Monte Carlo 2, Model checking	Chap 8
10/25	Sampling-Importance-Resampling, other methods	McAllister et al. 2001
11/1	Model selection, Model averaging	Chap 9
11/8	Hamiltonian Monte Carlo & Stan	Hoffman & Gelman 2014
11/15	Model fitting in R with Stan using brms	TBD
11/22	Sampling tryptophan priors (no class)	
11/29	Empirical Bayes, ADMB & INLA	Carlin & Louis 2009 (Ch 5) Skaug & Fournier 2006
12/6	Project presentations, Finalize code/example repository	

Title IX statement: The purpose of a university is to disseminate information, as well as to explore a universe of ideas, to encourage diverse perspectives and robust expression, and to

foster the development of critical and analytical thinking skills. In many classes, including this one, students and faculty examine and analyze challenging and controversial topics.

If a topic covered in this class triggers post-traumatic stress or other emotional distress, please discuss the matter with the professor or seek out confidential resources available from the Counseling Center, <http://www.umassd.edu/counselling/>, 508-999-8648 or -8650, or the Victim Advocate in the Center for Women, Gender and Sexuality, <http://www.umassd.edu/sexualviolence/>, 508-910-4584. In an emergency contact the Department of Public Safety at 508-999-9191 24 hrs./day.

UMass Dartmouth, following national guidance from the Office of Civil Rights, requires that faculty follow UMass Dartmouth policy as a “mandated reporter” of any disclosure of sexual harassment, abuse, and/or violence shared with the faculty member in person and/or via email. These disclosures include but are not limited to reports of sexual assault, relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus, disclosure by the student to the faculty member requires that the faculty member inform the University’s Title IX Coordinator in the Office of Diversity, Equity and Inclusion at 508-999-8008 to help ensure that the student’s safety and welfare is being addressed, even if the student requests that the disclosure not be shared.

For confidential counseling support and assistance, please go to <http://www.umassd.edu/sexualviolence/>

MAR 596 Independent Study: **REVISED SYLLABUS**

Topic => Advanced Time Series Analysis of Ocean Systems (MAR 670)

Instructor: Wendell Brown
SMASST-East 229
508-910-6395
wbrown@umassd.edu

Course Focus: The statistical analysis of geophysical time-series, with specific application to oceanographic and meteorological data sets.

(Other applications include: ocean waves, ocean acoustics, satellite imagery, hydrological observations, seismic records, magnetic anomaly distributions, ice core profiles, and sun spot variability.)

Course Structure: *To access the below directories get an account on SVERDRUP
CONTACT Mike Deignan for an account*

- Readings - Course Notes at:
[/hosts/sverdrup.smast.umassd.edu/data/users/wsbrown/classes.dir/mar670.dir/CLASS_2017_DIR/ClassNotes_2008](https://hosts/sverdrup.smast.umassd.edu/data/users/wsbrown/classes.dir/mar670.dir/CLASS_2017_DIR/ClassNotes_2008)
- Bendat & Piersol, "Random Data: Analysis & Measurement Procedures"
- Practical Exercises - Analysis of equally-spaced (time/space) data series
with documented software & computer access.
hosts/sverdrup.smast.umassd.edu/data/users/wsbrown/classes.dir/mar670.dir/CLASS_2017_DIR/EXERCIZES_2017/
- Weekly (*Wed -2pm*) Discussions of Questions SMASST-East Conference Rm 235
hosts/sverdrup.smast.umassd.edu/data/users/wsbrown/classes.dir/mar670.dir/CLASS_2017_DIR/LECTURES_2008/
- Data Analysis Project

REFERENCES

Course Notes:

- Brown, W.S., 2008, “MAR 670 Advanced Time Series Analysis of Ocean Data Lecture Notes”. [BN]

Course References:

- Bendat, J.S. and A.G. Piersol, “Random Data: Analysis and Measurement Procedures”, Wiley - Interscience, 2nd Ed., NY, NY., 1986 [BP]
- Jenkins, G.M. and Watts, D.G., “Spectral Analysis and its Applications”, Holden-Day, San Francisco, 1968. [JW]

Course Computational Software Documentation:

- Brown, W.S. & J.D. Irish, “An Introduction to the Ocean Analysis Software Package (OASP)”. [BI]

Applications:

- Findley, D.F., “Applied Time-Series Analysis”, Academic Press, NY, 1978. [F]

Mathematical:

- Bracewell, R., “The Fourier Transform and its Applications”, McGraw-Hill, NY, 1965. [B]
- Churchill, R.V., J.W. Brown, and R.F. Verhey, “Complex Variables and Applications”, 3rd Edition. McGraw-Hill book Co., NY, 1976. [CBV]

Course Schedule

MAR 596 (670) Independent Study of Adv. Time Series Analysis of Ocean Data

Fall 2017

READING TOPICS & EXERCIZES

You find the assigned Exercises in the directory
 /hosts/sverdrup.smast.umassd.edu/data/users/wsbrown/classes.dir/mar670.dir/CLASS_2017_DIR/EXERCIZES_2017

Week of

Sep	10	Introduction to Random Data Analysis [BN-Ch1] Introduction to the Ocean Analysis Software Package (OASP) Fourier Series & Fourier Transformation: Properties & Interpretation [BN-Ch2]
Sep	17	<i>Exercise 1- Synthetic Series: MAKET, ARITH, STATS, LSTATS</i> (...../ex1_syn_time_ser.dir/EX1_synSeries_3apr17.docx) Convolution & Sampling [BN-Ch2] Probability Density, Auto-covariance, Spectral Density Functions [BN-Ch3] Joint Probability Density, Cross-covariance & Cross-spectral Density Functions [BN-Ch4]
Sep	24	Impulse and Frequency Response Functions [BN-Ch6] Discrete Sampling and Aliasing [BN-Ch6] Digital Filtering [BN-Ch6]
Oct	01	<i>Exercise 2- Computational Methods I: CORREL</i> (...../ex2_correl_fcn.dir/Ex2_covariance_3apr17.docx) Discrete Covariance, Spectral, and Cross-Spectral Density Functions [BN-Ch6] Statistical Errors: Sampling Distributions [BN-Ch5] Statistical Errors: Sample Mean and Mean Square Estimators [BN-Ch5]
Oct	08	<i>Exercise 3- Computational Methods II:</i> (...../ex3_res_pressures.dir/ex3_realData_assignment_3apr17.docx)
Oct	15	<i>Exercise 4- Computational Methods III: FILTER</i> (...../ex4_filtering.dir/ex4_filtering_25mar17.docx) Statistical Errors: Cross-covariance Estimators [BN-Ch5] Statistical Errors: Spectral and Cross-spectral Energy Density [BN-Ch7]
Oct	22	<i>Exercise 5- Computational Methods IV: SPECTER</i> (...../ex5_spectra.dir/ex5_spectra_29mar17.docx) <i>Field Acquisition of Discrete Data: Project Discussion</i> Spectral Density Confidence Limits [BN-Ch8] Coherence Uncertainty Limits [BN-Ch8]
Oct	29	<i>Exercise 6- Computational Methods V: SPECTER</i> (...../ex6_coherence.dir/ex6_coherence_5oct17.docx) <i>Elements of Data Analysis: Project Discussion</i> Frequency Response Function Uncertainty Limits [BN-Ch8]
Nov	05	<i>Exercise 7- Computational Methods VI: EIGEN</i> (...../ex7_freqResponse.dir/.....) Coherence and Transfer Function Analysis [BN-Ch8] Partial Coherence
Nov	12	<i>Exercise 8- Computational Methods VII: MULCOH</i> (...../ex8_multipleCOH.dir/.....)

		Estimating Spectra/ Cospectra in the Presence of “Noise” I	
		Estimating Spectra/ Cospectra in the Presence of “Noise” II	
		Empirical Orthogonal Functions (EOFs) I	[BN-Ch9]
Nov	19	<i>NO MEETING - THANKSGIVING</i>	
Nov	26	<i>Exercise 9 -Computational Methods VIII: EOFs via EIGENT & EIGEN</i> (...../ex9_eof.dir/ EX9_EOF_atmosPrs_5oct17.docx)	
		Empirical Orthogonal Function Analysis II	[BN-Ch9]
		Time-Domain & Frequency-Domain EOFs	[BN-Ch9]
Dec	03	Project Presentations	

Student Data Analysis Project Report Outline

I. ABSTRACT

A pithy paragraph describing the project and a summary of its principal results

II. INTRODUCTION

Description of pertinent technical background, technical questions being addressed, project goals/objectives, and organization of report

III. DESCRIPTION OF DATA SET

A concise description that should include where relevant:

- (a) Maps and tables describing primary data; where relevant
 - measurement locations
 - basic statistics
 - (b) Description of basic data processing/statistical analyses
 - (c) Plots of selected time series
- (Note: Choose plot scales on different plots that enable easy plot comparisons)

IV. PRESENTATION OF STATISTICAL RESULTS Just the facts!

This section should be concise and readable. Present the facts, with relatively little interpretation and no speculation. "Perk" reader interest with alerts to "suggestive" results. However, reserve most interpretation and discussion to later sections. So as not to interrupt the "flow" of the presentation, use appendices for voluminous or highly technical evidence.

In writing this section, consider the following guidelines:

- (a) Describe the statistical results (including uncertainty estimates where pertinent) which support your answers to the questions posed in Section II above.
- (b) Be selective about your presentations of spectra, coherences, transfer functions, EOF's, etc. Don't include all your computations!
- (c) Make comparisons relatively simple and easy for the reader to understand whether on plots or in tables, etc. Don't forget units on your plots!
- (d) Be sure descriptions of the statistical presentations are complete; uncertainty, limits, degrees of freedom, etc.

V. DISCUSSION

- (a) Here is where you synthesize the different kinds of evidence presented in sections III and IV to make your point or points.
- (b) Speculation concerning your results appears in this section, as long as you distinguish it from fact.

VI. SUMMARY OF CONCLUSIONS

VII. APPENDICES

VIII. REFERENCES

An Introduction to the Ocean Analysis Software Package (OASP)

MAR 670 Computational Software Documentation

W. S. Brown

Purpose: OASP is a set of general purpose computer programs designed for scientists and engineers to process and analyze equally-spaced data series.

Characteristics: OASP programs have been written in Fortran 77 and compiled for use on a contemporary Linux workstation called "Iselin".

Ocean Format: OASP programs operate on data files that are stored in "Ocean Format", which consists of an ASCII header followed by data in binary format. The Ocean Format header consists of a:

- Filename
- File Creation Time and Date (supplied by the computer)
- Start time (or position) of data series
- End time (or position) of data series
- Number of terms in data series
- Interval between data series terms

Time Definition: In principal, OASP users can use any consistent time (or space) convention. We have a "Julian hour" timing system.
NOTE: Julian hours are the number of hours since the turn of the century referenced to Greenwich hours.
For example, 09:30 EST on 11 July 1961 will convert to a Julian hour time of 539318.5 hours Greenwich Mean Time (GMT or Z). An OASP program "l_dates" can be used to convert Gregorian time to Julian hours and visa versa.

Data Formatting: Any ASCII data file can be converted to Ocean Format using the OASP program "l_readin".

OASP Use: Application of OASP programs require user-input via:
(1) sequences of command lines or (2) parameter files.

Output of Results: Data processing and analysis results are output in a variety of ways, including:
(1) workstation screen dumps;
(2) ASCII file outputs via OASP program "l_output";
(3) Matlab-generated plots.

DIRECTORY of OASP ROUTINES

A. Basic Series Input & Conversion Routines

- l_readin** - creates an Ocean Format file from an ASCII file.
- l_header** - enables user to inspect & modify Ocean Format file headers.
- l_dates** - converts Gregorian to Julian times and vice versa.

B. Series Output Routines

- l_output** - enables outputs selected Ocean Format files in ASCII form.
- Matlab** - a suite of Matlab plotting programs.

C. Series Manipulation Routines

- l_editt** - enables users to edit series using a variety of algorithms.
- l_intirp** - interpolates between series values.
- l_maket** - generates user-prescribed sine-wave and ramp series.
- l_joinof** - joins two series end to end.
- l_piece** - truncates series.
- l_merge** - merges or unmerges series.
- l_comon** - extracts common length series from a series set.

D. Analysis of Data Series

- l_arith** - performs several kinds of arithmetic operations on a series.
- l_filter** - applies user-tailored digital filters to series.
- l_regress** - performs linear least squares regressions & removes them.
- l_stats** - computes basic bulk statistics of a single scalar series.
- l_lstats** - computes basic bulk statistics multiple scalar series.
- l_vstats** - computes basic bulk statistics of a single vector series.
- l_correl** - computes correlation functions between scalar series.
- l_vcorrel** - computes correlation functions between vector series.
- l_specter** - computes auto- & cross-spectral energy density functions;
AND coherence and phase spectral functions.
- l_mulcoh** - computes multiple coherence and frequency response functions.
- l_foucof** - computes Fourier transforms.
- l_eigen** - computes frequency-domain empirical orthogonal functions of a
suite of scalar series.
- l_eigent** - computes time-domain empirical orthogonal functions of a suite
of scalar series.
- l_eoftim** - computes time-domain empirical orthogonal function of a suite
of vector series.

E. Specialized Applications

- l_airsea** - computes wind stress, heat and mass flux series.
- l_tiharc** - performs a tidal harmonic analysis on scalar or vector time series.
- l_tidhar** - predicts tidal time series given the harmonic constants.

Course Number: MAR599
Course Title: Ecological Mechanics
Instructors: Dr. Geoff Cowles
Offered: Spring Semesters
Contacts: School for Marine Science & Technology, SMAST-East 227
(508) 910-6397
gcowles@umassd.edu
Prerequisites: Introductory College Physics (e.g. PHY 101)
Introductory Calculus (e.g. MTH 149)

Course Description: This course covers the physics and engineering principles underlying form and function in the natural world. The curriculum will emphasize application of these principles through classroom examples, homework content, and projects. Although applicable to terrestrial organisms, the majority of course examples will focus on marine organisms.

Course Objectives:

1. Provide an introduction to the mechanics of fluids, heat, and materials using a descriptive approach
2. Analyze concrete ecological applications of mechanics including adaptation, morphology, locomotion, metabolism, and feeding across a wide range of scales.
3. Develop conceptualization and analytical skills to conduct analyses of ecological systems.

Principal Text and Materials:

The principal text will be Ecological Mechanics: Principles of Life's Physical Interactions, Mark Denny, 2015 ISBN-10: 9780691163154. This will be supplemented with papers relevant to the class topic.

Tentative Course Topic Outline:

Unit 1: Background

In this unit we will do a review of physics and math and look closely at some of the functional forms that are used to model system response and interactions.

Unit 2: Fluid Mechanics

In this unit we will examine the conservation laws that govern the motion of fluids and look at several phenomena including diffusion, boundary layers, and turbulence. We will estimate forces generated by fluids use these to examine the methods of locomotion of animals at small and large scale.

Unit 3: Thermal Mechanics

In this unit we will look at heat budget models and study mechanisms for heat transport in the context of metabolism and thermal regulation.

Unit 4: Solid Mechanics

In this unit we will study key properties of materials such as stress, strain, and breaking strength. We will apply these to the application of fundamental statics problems including adhesion and bending.

Projects:

This course will include two projects. Students will analyze biological phenomena using the tools and concepts used in the course.

Grading:

Online Quizzes	5%
Homeworks:	30%
Project 1:	30%
Project 2:	30%
Participation:	5%

Approach:

My approach to this course is to use, to the extent possible, Blackboard / MyCourses as an aid to providing content electronically through reading assignments, instructional videos, and other online content. My strategy in doing this is to enable you, the student, to gain a basic level of understanding of the material *before* you come to class so that *during* class we can discuss the material at a higher level and delve deeper into applications of the concepts (as opposed to introducing the information for the first time). With this model, your “homework” time outside of class will be a mix of reading and viewing online content in MyCourses plus traditional problem sets.

I have organized the course content into weekly units. Tuesday will be more focused on background and theory with some simple sample problems and Thursdays will tend to be more focused on problem solving. We will also have several class periods during the semester that are purely dedicated to problem solving. up into two or three groups in the library and work through problems.

A typical class period is structured as follows:

Before Class:

- Work through the associated learning module in MyCourses, including any reading assignments and online content
- Take the associated learning assessment Quiz in MyCourses. The Quiz will not be accessible after the start of class.

During Class:

- We will recap the main topics for the current unit and answer questions from the reading and/or online content
- We will work through sample problems, provide further examples & demonstrations to illustrate principles

Incomplete Policy:

Incomplete may be given only in exceptional circumstances at the instructor's discretion. The student must be passing at the time of the request or be sufficiently close to passing. If the work is not completed within one year of the recording of the incomplete grade, the grade will become an F(I). The incomplete policy for this course is that at least 70% of the course must be already completed and an exceptional circumstance (i.e. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

Academic Integrity:

University policy applies: see link [here](#).

Electronic Gadgets:

Usage of electronic devices (tablets, Surfaces) for taking notes or problem solving is permitted. Any other use of devices is not permitted. Phones must be off or on vibrate. No texting, tweeting, surfing, etc. during class time. We will be doing number crunching for problem solving in class so bring calculators.

Course Number: MAR599/MNE490
Course Title: Fundamentals of Flight
Instructors: Dr. Geoff Cowles
Contacts: School for Marine Science & Technology
SMASST-East Room 227
706 South Rodney French Boulevard
New Bedford, MA 02744 U.S.A.
(508) 910-6397
gcowles@umassd.edu
Class Time: 9:30 - 10:45, Tuesday/Thursday
Office Hours: 10:45-12:00 Tuesday/Thursday (SENG 116D)
Website: UMD blackboard/mycourses
Textbook: Introduction to Flight, J. Anderson, version 6,7,8.
Prerequisites: MNE 332 or equivalent or permission from instructor

Course Description:

This course will provide a technical introduction to the mechanics of flight. Units will include: a review of fluid mechanics in the context of aerodynamics, two-dimensional and finite-span wing theories, low speed, transonic, and high speed flight characteristics and air breathing propulsion. The course will emphasize computation in both homework and team-oriented projects.

Course Objectives:

1. Provide an introduction to aeronautical engineering with a technical perspective
2. Help the students gain a critical understanding of the aerodynamics of lifting bodies
3. Instruct the students on how to calculate fluid forces on a body in flight
4. Demonstrate how aerodynamics and purpose drive configuration design
5. Provide experience in the computational modeling of aerodynamic flows.

Topics:

- Properties of the Atmosphere
- Basic Aerodynamics
- Incompressible Flow – Speed Measurement
- Compressible Flow – Isentropic Mach Relations
- Viscous Flow – Boundary Layers and Skin Friction
- Pressure Coefficient – Definitions Aerodynamic Coefficients
- 2D Airfoils
- 3D Wings
- Transonic and High Speed Flight
- Propeller and Turbojet/fan Propulsion

Projects:

This course will include two projects. You will have approximately 4 weeks to complete each project.

- Midterm Project: Design study for 2D foil section using Xfoil (individual)
- Final Project: Design Project for 3D planform using Tornado (group)

Grading:

Quizzes:	5%
Homeworks:	20%
Midterm Project:	15%
Midterm Exam:	20%
Final Project:	15%
Comprehensive Final Exam:	25%

Homeworks (~10, lowest grade dropped):

- Turn in your work on time at the beginning of class (typically Tuesdays)
- Write neatly and box your answers
- I encourage you to work with others but you must write up the solutions on your own. Explanations must be in your own words.

Approach:

My approach to this course is to use, to the extent possible, Blackboard / MyCourses as an aid to providing content electronically through reading assignments, instructional videos, and other online content. My strategy in doing this is to enable you, the student, to gain a basic level of understand of the material *before* you come to class so that *during* class we can discuss the material at a higher level and delve deeper into applications of the concepts (as opposed to introducing the information for the first time). With this model, your “homework” time outside of class will be a mix of reading and viewing online content in MyCourses plus traditional problem sets.

I have organized the course content into weekly units. Tuesday will be more focused on background and theory with some simple sample problems and Thursdays will tend to be more focused on problem solving. We will also have several class periods during the semester that are purely dedicated to problem solving. up into two or three groups in the library and work through problems.

A typical class period is structured as follows:

Before Class:

- Work through the associated learning module in MyCourses, including any reading assignments and online content
- Take the associated learning assessment Quiz in MyCourses. The Quiz will not be accessible after the start of class.

During Class:

- We will recap the main topics for the current unit and answer questions from the reading and/or online content

Week	Day		Topics
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- We will work through sample problems, provide further examples & demonstrations to illustrate principles

Incomplete Policy:

Incomplete may be given only in exceptional circumstances at the instructor's discretion. The student must be passing at the time of the request or be sufficiently close to passing. If the work is not completed within one year of the recording of the incomplete grade, the grade will become an F(I). The incomplete policy for this course is that at least 70% of the course must be already completed and an exceptional circumstance (i.e. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

Academic Integrity:

University policy applies: see link [here](#).

Electronic Gadgets:

Usage of electronic devices (tablets, Surfaces) for taking notes or problem solving is permitted. Any other use of devices is not permitted. Phones must be off or on vibrate. No texting, tweeting, surfing, etc. during class time. We will be doing number crunching for problem solving in class so bring calculators.

Software:

We will be using Matlab and Xfoil to solve homework problems and to do the project work. Matlab is available on the machines in the MNE computer room. It is available from home using the UMD virtual machine. You may also be eligible for access to a student copy through CITS. If you plan on working a bit from home, this might be worth investigating since the virtual machines can be a bit sluggish. For Xfoil you can download an executable to your drive to run on the MNE desktops or to your personal computer. There are execs for Windows/OSX and it is possible to build a linux exec provided you have the right libraries (e.g. X11).

Help Outside of Class:

Please note that I work in New Bedford so I am only on campus to teach this class and for the office hours directly following class. You are welcome to come to New Bedford for help. Also, please do not hesitate to email me if you are struggling with a concept or a homework problem. I will respond through email if the answer is short. Otherwise, I will setup a zoom session or I will make a brief video to try and guide you.

MAR599 / MNE490: Fundamentals of Flight

1	T	1/24	Background
	R	1/26	Standard Atmosphere
2	T	1/31	Governing Equations
	R	2/2	
3	T	2/7	Incompressible Flow
	R	2/9	
4	T	2/14	Compressible Flow
	R	2/16	
5	T	2/21	NO CLASS, MONDAY SCHED
	R	2/23	Problem Solving Session
6	T	2/28	Viscous Flow
	R	3/2	
7	T	3/7	Aerodynamic Intro: Xfoil example
	R	3/9	In-Class Exam
8	T	3/14	SPRING BREAK
	R	3/16	SPRING BREAK
9	T	3/21	2D Aerodynamics: The Airfoil
	R	3/23	
10	T	3/28	3D Aerodynamics: Finite Wings
	R	3/30	
11	T	4/4	Transonic Flow
	R	4/6	
12	T	4/11	Propulsion
	R	4/13	
13	T	4/18	High Speed Flight
	R	4/20	Recorded Lecture
14	T	4/25	Problem Solving
	R	4/27	Design Project Presentations
15	T	5/2	NO CLASS, SENIOR DESIGN PRESENTATIONS
FINAL	T	5/9	Final Exam 8:00-11:00

Tentative Schedule

Course Number: MNE436/MAR599
Course Title: Marine Hydrodynamics & Propulsion
Instructors: Prof. Geoff Cowles
Contacts: School for Marine Science & Technology, SMAST-East 227
836 South Rodney French Boulevard
New Bedford, MA 02744 U.S.A.
(508) 910-6397
gcowles@umassd.edu
Class Time: 9:30 - 10:45, Tuesday/Thursday (Sci & Eng 114)
Office Hours: 10:45-12:15, Tuesday/Thursday (SENG 116C)
Website: UMD blackboard/mycourses
Textbook: Principles of Naval Architecture: Ship Resistance & Flow
Authors: Lars Larsson & Hoyte Raven
ISBN 978-0-939773-76-3
Publisher link: <http://www.sname.org/pubs/books>
Prerequisites: MNE 332 (Undergrad Fluids) or Equivalent

Course Description: This course provides instruction, demonstration and exercises in the fundamentals of marine hydrodynamics. The curriculum will emphasize application of these principles through classroom examples, homework content, and computation-based projects.

Course Objectives: Students will be able to

1. Apply a fundamental understanding of the resistance components
2. Estimate the resistance components of a given ship
3. Match propulsion to the ship
4. Estimate the installed power to achieve design speed
5. Explain the relationship between ship form and purpose
6. Demonstrate their understanding of fundamental geometric tradeoffs from the point of view of hydrodynamics.
7. Employ mathematical models in support of the ship resistance problem.
8. Quantify the role of global shipping in greenhouse gas and smog-forming emissions and explain ongoing remediation efforts from a design perspective.

Grading:

Quizzes:	5%
Homework (lowest dropped):	20%
Midterm Project:	15%
Midterm Exam:	20%
Final Project:	15%
Comprehensive Final Exam:	25%

Standard grade ranges apply

Class Approach:

My approach to this course is to use, to the extent possible, Blackboard / MyCourses as an aid to providing content electronically through reading assignments, instructional

videos, and other online content. My strategy in doing this is to enable you, the student, to gain a basic level of understand of the material **before** you come to class so that **during** class we can discuss the material at a higher level and delve deeper into applications of the concepts (as opposed to introducing the information for the first time). With this model, your “homework” time outside of class will be a mix of reading and viewing online content in MyCourses, completing online quizzes in addition to traditional problem set questions.

The course is organized into nine units, each focused on a central topic. These units will span one or two weeks. Most units consist of two or three regular in-class lectures and one problem solving session. Each unit has an associated homework assignment. The written and computing problems portion of the homework will be due at the beginning of the next unit. The online quiz problems for each homework must be completed in mycourses prior to each lecture.

A typical unit will look like:

Before each Regular Lecture (2-4 lectures per unit)

- Work through the associated learning module in MyCourses, including any reading assignments and online content
- Take the associated learning assessment Quiz in MyCourses. These quizzes constitute 5% of your grade.

During Class:

- I will review the material and answer questions you may have on it and we will work through problems that put into practice the concepts discussed in the unit. These problems do not need to be turned in and do not factor into your grade.

Homework:

Each unit will have a homework that you must turn in (8 total). I will drop the lowest homework grade.

Homework Format:

- Turn in your written work on time at the beginning of class
- Write neatly and box your answers
- If you cannot attend class, have a classmate turn it in or scan/email it to me. In the event this is necessary please do not, if at all possible, take 10 pictures with your phone in alternating portrait/landscape orientation.
- I encourage you to work with others but you must write up the solutions on your own. Explanations must be in your own words.

Incomplete Policy:

Incomplete may be given only in exceptional circumstances at the instructor's discretion. The student must be passing at the time of the request or be sufficiently close to passing. If the work is not completed within one year of the recording of the incomplete grade, the grade will become an F(I). The incomplete policy for this course is that at least 70% of

the course must be already completed and an exceptional circumstance (i.e. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

Academic Integrity:

University policy applies: see link [here](#).

Electronic Gadgets:

Usage of electronic devices for taking notes or problem solving is permitted. Any other use of devices is not permitted. Phones must be on vibrate. No texting, tweeting, surfing, etc. during class time.

Fall 2017: Tentative Schedule of Lectures and Assignments

Date	Unit	Lec	Title	SRF Chapters	Assigned [covers lectures]	Due
9/7	Background	1	Overview and Historical Context	1-4	HW1 [1,2,3]	
9/12		2	Dynamic Similarity			
9/14		3	Resistance Decomposition and Force Coefficients			
9/19	Wave	4	Surface Gravity Waves	5	HW2 [4,5]	HW1
9/21	Resistance	5	Kelvin Wake			
9/26	Viscous	6	Boundary Layers	6	HW3 [6,7]	HW2
9/28	Resistance	7	Frictional Drag			
10/3	Added Resistance from Lift	8	Flow over Hydrofoils	7	HW4 [8,9]	HW3
10/5		9	Flow over Finite Wings			
10/10		10	Hydrofoils and Air-Lift Vehicles		PROJ1	HW4
10/12			In Class Midterm		Covers [1-9]	
10/17	Bare Hull	11	Tow Tank Testing	8	HW5 [11-14]	
10/19	Resistance	12	Froude Decomposition			
10/24	Computation	13	Systematic Series	9,10		
10/26		14	Computational Ship Hydro			
10/31	Propulsion	15	Theory & Characteristics		HW6 [15-18]	HW5
11/2		16	Hull/Propulsion Interaction			
11/7		17	Systematic Series			
		18	Alternative Propulsion			
11/14	Hull Design & Powered Calculations	19	Ship Design	11.1-11.4.3.3	HW7 [19,20]	HW6,PROJ1
11/16		20	Full Powering Computation		PROJ2	
11/21		21	Detailed Hull Design	11.5.9-		HW7
11/23			Thanksgiving			
11/28	Specialty Classes	22	Planing Hydrodynamics	11.4.4	HW8 [22,23]	
11/30		23	Yacht Hydrodynamics			
12/5			Course Review			HW8
12/7			Project Presentations			PROJ2
12/12			Comprehensive Final: 8-11			

**CEN 430-02
CEN 530-02
MAR 610-02
Spring Semester 2017
Introduction to Environmental/Ocean Turbulence
Tuesday/Thursday 12:30-1:45, Room TBA**

Instructor: Daniel MacDonald
Prerequisite(s): Undergraduate Fluid Dynamics
or Permission of Instructor

Description: The course focuses on the fundamental fluid dynamics underpinning turbulence theory. Emphasis is placed on both mathematical and physical understanding. Random variables and their quantification are introduced, as are dimensional scaling/analysis and non-dimensional quantities, including the Reynolds, Richardson and Prandtl numbers. Other emphases include exchange of energy between mean flow and turbulence, diffusion, modern data analysis techniques, recent observations and newly emerging observational tools.

Office Hours: TBA

Reference Texts:

Kundu, P.K., I.M. Cohen, and D. Dowling 2015. *Fluid Mechanics, 6th Edition*. Elsevier.

Tennekes, H., and J.L. Lumley, 1972. *A First Course in Turbulence*. MIT Press, Cambridge, Massachusetts

Thorpe, S.A., 2005. *The Turbulent Ocean*. Cambridge University Press, Cambridge UK.

Thorpe, S.A., 2007. *An Introduction to Ocean Turbulence*. Cambridge University Press, Cambridge UK.

** There are numerous other textbooks and reference materials on turbulence which are quite good.

Evaluation:

1. Homework Assignments	30%
2. Midterm Exam	20%
3. Final Exam	25%
4. Paper Review and Presentation	20%
4. Class Participation	5%

Expectations:

The goal for this course is for the student to build a mathematical and conceptual understanding of turbulence, and to be able to relate that understanding to others. To reach that goal we will rely heavily on mathematics and mathematical solutions that can describe the relevant natural phenomena. The math is critical in building intuition about the physics, but always keep in mind that the math is only a tool. Remember to always ask yourself: “What does this (math, model, etc.) tell me about what’s really going on?”

Graduate vs. Undergraduate: There are different requirements for the undergraduate (CEN 430-02) vs. graduate (CEN 530 and MAR 610) versions of this course. CEN 430-02 students are allowed (and even encouraged) to form homework teams of up to four students. The undergraduate teams can also collaborate on the semester project/presentation. Teams are allowed to turn in one homework assignment for the team, with the entire team receiving the same grade. Team homeworks will be held to a higher standard than solo homeworks with regards to written explanations, neatness of work, and completeness. All students should engage equally in the homework process – those who rely on their teammates to complete the homework might receive an acceptable grade for the homework assignment, but will be at a significant disadvantage during exams.

	CEN 430-01	CEN 530/MAR 610
Homework	Certain problems will be marked as optional for solo HW completion. HW teams must complete all problems.	Must work all problems.
Exam I	In-Class Component Only	In-Class and Take-Home Components
Final Exam	In-Class Component Only	

Class: Students will attend class regularly and ask questions freely.

Homework: The ability to communicate effectively in science and engineering is as important as the ability to do good science and engineering. Therefore, make sure that your homework assignments are clearly, neatly, and concisely written in a professional manner. Show your work clearly whenever necessary. Treat your homework assignments as an opportunity to *teach me* about what you have learned in this course, and how well you know it.

University Policy on Academic Dishonesty: All students should be aware of the university’s policy on academic dishonesty, including plagiarism. This policy appears in both the undergraduate catalogue and the student handbook.

Academic Support: Academic support services are available through appropriate offices on main campus. These include services for learning and physically disabled students, which are available through the Disabled Student Services office.

Instructor Contact Information:

Daniel MacDonald
Violette 107B
Office: 508-910-6334
Email: dmacdonald@umassd.edu

CEN 530-02/MAR 610-02/CEN 430-02: Introduction to Environmental Turbulence
Spring 2017

Time and Place: Tuesday/Thursday 12:30 - 1:45, Room TBA

Note: Schedule subject to change

Week	Date	Lecture	Source:	HW Due Date
1	1/24/17	Introduction/Math Review	Notes	
	1/26/17	Math Review/Tensor Notation	KC-2	
2	1/31/17	Kinematics	KC-3	
	2/2/17	Kinematics	KC-3	PS #1
3	2/7/17	Conservation Laws	KC-4	
	2/9/17	Conservation Laws	KC-4	PS #2
4	2/14/17	Turbulence (Averages, correlations)	KC-13.1-5	
	2/16/17	Turbulence (Averages, correlations)		PS #3
5	2/21/17	No Class: Monday Schedule		
	2/23/17	Turbulence (KE budgets)	KC-13.6-7	
6	2/28/17	Turbulence (Turbulent Production/Cascade)	KC-13.8	PS #4
	3/2/17	Turbulence (Dispersion)	KC-13.15	
7	3/7/17	Review		
	3/9/17	EXAM #1		
8	3/14/17	No Class: Spring Break		
	3/16/17			
9	3/21/17	Turbulence (Free and bounded shear flows)	KC-13.10-12	
	3/23/17	Turbulence (Free and bounded shear flows)		
10	3/28/17	Stratified Turbulence	KC-13.14 + Thorpe	PS #5
	3/30/17	Stratified Turbulence		
11	4/4/17	Spectra	KC-13.9	
	4/6/17	Spectra		PS #6
12	4/11/17	Spectra		
	4/13/17	Measurement Techniques	Thorpe	
13	4/18/17	Measurement Techniques		PS #7
	4/20/17	...	Thorpe	
14	4/25/17	...		
	4/27/17	Student Presentations		PS #8
15	5/2/17	Student Presentations		
	5/8/17	Final Exam		

Course Number: MAR 622-01 Interdisciplinary Case Studies in Fisheries
Course Title: Stock Identification Methods
Instructor: Steven Cadrin, Associate Professor
Contacts: School for Marine Science & Technology, SMAST-East 121
(508)910-6358; scadrin@umassd.edu
Class Location: SMAST-East classroom 101
Class Time: Thursday 2:30-4:00 pm
Office Hours: Thursday afternoon or by appointment

Course Description: This course provides instruction and demonstration of a wide range of methods used to identify population structure of fishery resources, including life history traits, morphology, environmental signals, genetics, and marking techniques. Methodological reviews include historical development, benchmark case studies, critique of current issues, and prescriptions for the most effective protocols for stock identification. Applications in fisheries science will be described to promote an interdisciplinary approach to stock identification.

Primary Course Objectives:

1. Understanding the role of stock identification in fisheries science
2. Familiarity with stock identification methods
3. Ability to synthesize information from various approaches for interdisciplinary conclusions on population structure.

A secondary goal of this course is to bridge educational gaps through critical reading in new fields and synthesis of multidisciplinary information involving:

- Biology (population dynamics, genetics, physiology)
- Physical oceanography (hydrographic barriers, planktonic dispersal)
- Chemical oceanography (otolith microchemistry, isotopic composition)
- Marine policy (conservation biology, resource management)

Evaluation procedures:

1. Weekly assignments (40% of grade) – one brief summary of current management units for a species of interest to the student and four brief reviews of published case studies that apply stock identification methods (life history, morphology, environmental signals, genetics, and dispersal) for the same species. Reviews should be one page including the full citation followed by a concise review of objectives, methodology, results, conclusions and the student's critique. Assignments are due by email before class and a hard copy at class.
2. Class project reviewing stock identification information that is available for the same species of interest (60% of grade).
 - a. List of references (10% of grade; due March 22) a comprehensive list of published information on stock structure, organized by discipline, including the papers reviewed for weekly assignments.
 - b. Class presentation (10% of grade; April 19) and final report (40% of grade; due April 26) that summarize applications of each stock identification approach for the species of interest and synthesize all summaries for an interdisciplinary conclusion.

3. Attendance at all lectures is the best way to understand topics, but is not required for evaluation.
4. University policy on academic dishonesty, including plagiarism, applies.

Principle text: Cadrin, S.X., L.A. Kerr and S. Mariani, editors. 2014. Stock Identification Methods: applications in fishery science, 2nd Edition. Elsevier, New York. (~\$75 from <http://store.elsevier.com/Stock-Identification-Methods/isbn-9780123970039/>)

Course outline and schedule of lectures and assignments (subject to change):

DATE	LECTURE	TOPIC	ASSIGNMENT	CHAPTERS
25-JAN	1	Introduction		1-2
1-FEB	2	Life History Characters	current units	4-5
8-FEB	NO CLASS - SAW65 WG			
15-FEB	3	Morphology	life history	6-9
22-FEB	4	Natural Tags	morphology	10-12
1-MAR	5	Genetics	environmental	13-14
8-MAR	NO CLASS - SAFETY TRAINING		genetics	15
15-MAR	NO CLASS - SPRING BREAK			
22-MAR	6	Dispersal	reference list	15-19
29-MAR	NO CLASS - SAW65 WG			
5-APR	7	Interdisciplinary Analysis	dispersal	20,22
12-APR	8	Complex Structure		3,21
19-APR	Student Presentations			
26-APR	NO CLASS	Final Exam	Term Paper	

The following statement regarding Title IX information has been reviewed by the Faculty Senate in spring 2015:

The purpose of a university is to disseminate information, as well as to explore a universe of ideas, to encourage diverse perspectives and robust expression, and to foster the development of critical and analytical thinking skills. In many classes, including this one, students and faculty examine and analyze challenging and controversial topics. If a topic covered in this class triggers post-traumatic stress or other emotional distress, please discuss the matter with the professor or seek out confidential resources available from the Counseling Center,

<http://www.umassd.edu/counseling/>, 508-999-8648 or - 8650, or the Victim Advocate in the Center for Women, Gender and Sexuality, <http://www.umassd.edu/sexualviolence/>, 508-910-4584. In an emergency contact the Department of Public Safety at 508-999-9191 24 hrs./day.

UMass Dartmouth, following national guidance from the Office of Civil Rights, requires that faculty follow UMass Dartmouth policy as a “mandated reporter” of any disclosure of sexual harassment, abuse, and/or violence shared with the faculty member in person and/or via email. These disclosures include but are not limited to reports of sexual assault, relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus, disclosure by the student to the faculty member requires that the faculty member inform the University’s Title IX Coordinator in the Office of Diversity, Equity and Inclusion at 508-999-8008 to help ensure that the student’s safety and welfare is being addressed, even if the student requests that the disclosure not be shared. For confidential counseling support and assistance, please go to

<http://www.umassd.edu/sexualviolence/>

MAR645: Ocean Circulation and Modeling Fall 2018

Suggested Texts: Atmosphere Ocean Dynamics, by Adrien Gill; Geophysical Fluid Dynamics by Benoit Cushman-Roisin; Selected papers on Modeling.

Instructor: Avijit Gangopadhyay, Office. SMAST E-230, x6330.

Course meets: Two times a week (1.5 hours each time)

Date	Reading	Homework	Topics
Week 1			The Global Ocean Circulation patterns; Wind driven and Thermohaline Circulation, Modeling Introduction
Week 2			Equations of Motion, Coriolis Force, Geostrophy
Week 3			Wind effects, Ekman Balance, Sverdrup Balance
Week 4			Stommel's Solution, Vorticity, Munk's solution
Week 5			2-layer adjustment, Potential vorticity
Week 6			Rossby Waves and Kelvin Waves
Week 7/1	Revision		Barotropic and Baroclinic Instability
Week 7/2		Exam 1	
Week 8			Heat and Salt, Double Diffusion, Stratification
Week 9			Early Numerical Models, Primitive Equations
Week 10			Finite Difference, Constraints, MOM - Algorithm
Week 11			Operational modeling, Basin scale modeling
Week 12			Biogeochemical Modeling
Week 13			Basics of Data Assimilation; Uncertainty Estimate
Week 14			Recent Advances in Modeling and Assimilation
Week 15	All of the Above	Final Exam	

Notes: Homework problems are due on the First Class period following the week assignments are given in. Homework will be graded on the basis of an "honest effort". Late homework will be marked down. The total homework for the semester will count as 1 exam. Class participation will be important in determining the letter grade for grades near letter grade boundaries.

USP-IO Course Listings

Benthos I (Zoobenthos of unconsolidated submerged bottoms)

Methods for studying benthic populations and communities. Sampling planning. Substrate importance. Factors structuring the benthos in coastal, continental shelf, abyssal and hadal systems. Larval recruitment and settlement. Horizontal and vertical distribution of populations. Benthic-pelagic coupling and resurgence processes. Role of benthos in the energy flow of marine trophic webs. Planning and development of marine benthos research projects.

Integrated Management of Coastal and Oceanic Areas

Analysis of integrated management concepts in light of the rules established by the Law of the Sea Convention and by the United Nations Conference on Environment and Development (UNCED). Institutional, legal and intergovernmental considerations. Main processes and methods involved in management: objectives, focal points, available tools and decision making. Problem identification, analysis, formulation, application and evaluation of management programs. Interaction between the main uses of coastal and oceanic areas (navigation, communication, use of living and mineral resources, tourism and recreation, pollution and others). Conflict resolution. Damage assessment. Interdependence between ecosystems and development. Integration of ecological, social, economic and political knowledge to implement integrated management plans. Critical analysis of national and international cases and presentation of solutions.

Aquaculture: Principles, Practices and Reflections

Theoretical classes: Principles of aquaculture - History of aquaculture - Biological and technological basis of aquaculture - Reproduction and selection - Feeding and nutrition - Health and diseases - Selection of aquaculture sites - Cultivation systems and structures - Harvesting and processing - Economics and markets - Aquaculture and the environment - Aquaculture practices - Cultivation techniques for the main species - Integrated cultivation - Reflections on restocking: topics for discussion and presentation of seminars - Sustainable development of aquaculture - Aquaculture in the fisheries context - Global aquaculture: situation and prospects - Brazilian aquaculture: situation and prospects - Evidence for sustainable aquaculture development from oceanographic research.

Secondary Planktonic Production

1) Limiting factors in the pelagic ecosystem: light; nutrients; temperature; interactions with other environmental factors; predation, competition and symbiosis. 2) Structure of pelagic food webs; phytoplankton-zooplankton interactions; the microbial loop; food web simulation models; importance of zooplankton as food for fish and other consumers. 3) Role of zooplankton in the transformation of biogenic material in the oceans; relationships between the distribution of primary productivity, phytoplankton and zooplankton; zooplankton metabolic activity and the carbon and nitrogen cycles. 4) Zooplankton physioecology: feeding activity; egg production; growth efficiency; respiration and excretion; energy balance. 5) Quantitative sampling for cohort determination; artificial cohorts; egg-ratio method; indirect methods. 6) Bacterial secondary production: concept, relevance and research approaches. 7) Experimental methods for studying secondary production. 8) Case studies: planktonic secondary production in different marine environments. 9) Execution of a pilot project on planktonic secondary production.

Advances in Pelagic Marine Ecology

1) Methodological advances and challenges in the study of the pelagic zone. 2) Coastal processes. 3) Oceanic processes. 4) Physical-biological coupling. 5) Benthic-pelagic coupling. 6) Biological interactions in the pelagic ecosystem. 7) Pelagic biogeochemistry. 8) Global changes and the pelagic environment.

Concepts, Practices and Reflections on Contemporary Oceanography

1) Science-society relationship: historical context. 2) Forging and transforming the postwar paradigm. 3) Renewing the science-society pact. 4) Research, development and innovation in the public and private sectors. 5) Purpose of scientific research: how, when and why. 6) Justifying scientific research: the current currency(-ies). 7) Metrics and values for evaluating scientific production. 8) Databases for evaluating scientific production: Lattes, Qualis Capes, JCR, Scopus. 9) Science and a quantitative unit: preparing manuscripts for publication.

Popular press articles and various media

Online databases:

Experimental Benthic Ecology

Preparatory activities (4 3-hour classes): 1) Discussion of the scope of benthic ecology and the history of research in this area; 2) Introduction to the experimental approach in the field and laboratory; and 3) Exercise: formal development of hypotheses and a sampling and/or experimental design based on previous scientific knowledge of the students and/or case studies. Fieldwork (2 full weeks): 1) Field trips (beach, rocky shore, mangrove, estuary or shallow shelf) for direct or indirect observations (using, when necessary, a submersible remote operation vehicle (ROV) and the Véliger II research vessel, in addition to a wide range of other equipment made available by the professors); 2) Identification of questions that can be tested with field observations/measurements or short-term field or laboratory experiments; 3) Literature survey using the search tools provided by USP and the CAPES Portal; 4) Development of hypotheses and a sampling or experimental design consistent with the proposed hypothesis; 5) Execution of the developed plan; 6) Organization of the obtained data; and 7) Initiation of manuscript preparation. Closing activities (4 3-hour classes): 1) Completing the literature survey; 2) Finishing the manuscript (data analysis and writing); and 3) Delivery of the manuscript for evaluation by the professors.

Bibliography:

The literature will be composed of scientific articles published in peer-reviewed journals but will be specific to each topic addressed each time the course is taught. This survey will be part of student learning.

The literature will be composed of scientific articles published in peer-reviewed journals but will be specific to each topic addressed each time the course is taught. This survey will be part of student learning.

The following books will be used as basic references for experimental design and data analysis.

Interactions between Physical and Biological Processes in Marine Ecosystems

1) General concepts of the role of circulation in the functioning of marine ecosystems. 2) Circulation as an indirect factor influencing organic production in the oceans. 3) Relationships between vertical mixing and the "critical point" of primary production. 4) Continental resurgences - classic examples of the western continental margins. 5) Shelf edge resurgences and their relationships with mesoscale vortices. 6) The "Island Effect" on marine productivity in oceanic zones. 7) Vertical flow of particulate organic matter in continental shelves and large ocean basins. 8) Patterns of temporal variation in primary and secondary production in relation to the meteorological and hydrographic regime in temperate regions.

Paleochemistry of the Oceans

1) History and evolution of ocean paleochemistry. 2) Climatic variations on a tectonic scale. 3) Introduction to methods used in paleochemistry. 4) Geochemical tracers in biogenic sediments; 4.1) Foraminifera; 4.2) Stable isotopes ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$); 4.2.1) Interspecific variations and $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ deviations in benthic foraminifera; 4.2.2) Effects of pH and [carbonate ion] on $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values; 4.2.3) Integration of geochemical and paleontological proxies; 4.) Chemostratigraphy; 4.3.1) Stable isotopes ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$); 4.3.2) Strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$); 4.4) Smaller and trace elements; 4.4.1) Paleotemperatures by Mg/Ca; 4.4.2) Trace elements as proxies for nutrients; 4.5) Proxies for pH and [carbonate ion]; 4.5.1) Boron isotopes ($\delta^{11}\text{B}$); 4.5.2) Trace elements; 4.6) Neodymium isotopes (ϵNd). 5) Geochemical tracers in terrigenous sediments; 5.1) Element/Ca ratios.

Paleoceanography

1) Climate system. 2) Chronology. 3) Methods for sampling marine sediments. 4) Surface circulation. 5) Global thermohaline circulation. 6) Physical, chemical and biological interactions between the atmosphere and the ocean. 7) Stable isotopes. 8) Tracers of past oceanographic variations. 9) Oceans and climatic variations. 10) Causes of glacial and interglacial cycles. 11) Iron fertilization of the oceans. 12) The global carbon cycle. 13) Last glacial period in the South Atlantic Ocean.

Morphodynamics of Coastal Environments

The processes and phenomena that determine the morphodynamic behavior of coastal environments is the central theme of this course. Greater emphasis is given to sedimentary coastal environments, such as sandy beaches, barrier-island systems, estuaries, deltas and tidal flats, and the processes related to cohesive and non-cohesive sediments are addressed. The first part of the course addresses water movement dynamics (wave and current-related processes: generation and characteristics) in the coastal zone and their effects on sediment transport and morphological consequences. Subsequently, the morphodynamics in several environments will be discussed in light of the dominant processes, morphology and sedimentary products. The covered time

scales will vary from short (singular events, such as the incidence of a wave) to long (geological, related to sea-level variations). Recent methods for studying coastal morphodynamics will be presented, and case studies will be discussed.

Special Topics in Geological Oceanography

The content will be determined by the guest lecturers and will represent their lines of research and publications. In general, the lecturers will discuss topics of interest in all areas of geological oceanography and other related fields, considering the main lines of the leading national and international research.

Bibliography:

Books and scientific articles will be at the discretion of the invited professor.

Geophysical Methods in Sedimentary Marine Samples

1) Resistivity. 2) Natural gamma-ray or radioactivity measurements. 3) Induced gamma-ray for measuring density. 4) Colorimetry and spectrophotometry: moisture and density (MAD) (density, grain density, water content, porosity and pore ratio). 5) Thermal conductivity. 6) Shear resistance, P waves, X-ray microfluorescence and microradiography. 7) Paleomagnetism - magnetostratigraphy. 8) Paleomagnetism - magnetic properties.

Special Topics in Ocean Margins

Historical overview of convergent margin studies (1900-1980); Geological observation methods: marine and terrestrial; Definition of the main tectonic elements and processes in a convergent margin; Study of geological maps of fossil convergent margins; Marine drilling at convergent margins; Study of the structure of accretionary and erosional margins; Static and dynamic models of forearc basin deformation; Definition of thrust from seismic images; Earthquakes and tsunamis: observations and conceptual models; Recognition of fossil earthquakes in the geological record; Flow of heat, temperature and metamorphism in subduction zones; History of the tectonic plate theory and continental drift; Calculating the spreading rate from magnetic anomalies; Magmatism, tectonics and crustal architecture of ocean ridges, an extreme example of rifting; Using GeoMapApp: global exploration of ocean ridges; Fusion in ridges, rifts and arcs from a process-oriented perspective; Original rocks and fusion products: peridotites, tholeiites and andesites.

Geological Oceanography

Ocean relief as a function of tectonics, climatic variations and hydrodynamics - Main physiographic units - Methods for studying seabeds - Sedimentology concepts: sediments - Marine sedimentation: sources and transport - The continental margin - Coastal regions - Relative variations in sea level and their influence on sedimentary processes - Anthropogenic sedimentation - Seminars.

Ocean Tide Analysis

1) The tides phenomenon: gravitational force of attraction of the sun and moon. 2) Tide-generating force. Mean longitude of the sun, moon, lunar perigee, perihelion and ascending node. Frequency of solar and lunar motions. 3) Fundamental equations of tidal dynamics. 4) Tide-generating potential. Doodson numbers. 5) Fundamental equation for tide analysis and forecasting. Fourier integral. 6) Fourier transform. Tide Spectrum. Fourier anti-transform tide forecasting. Dirac distribution function. Truncation effect. 7) Perinodal corrections. Filtering tidal records. 8) Generation of the nonlinear tidal components produced by the tidal currents in terms of the equilibrium theory, according to Franco (2001). 9) Absolute gravimetric measurements, GPS, meteorological and sea-level measurements in the Cananeia and Ubatuba Research Stations.

Satellite Altimetry Applications in Physical Oceanography

Characteristics of altimetric measurements. Correction of instrumental and satellite positioning errors. Contributions of ionospheric and tropospheric effects in altimetric signals. Data processing techniques: collinear passes and crossing points of ascending and descending satellite passes. Oceanic contributions in altimetric measurements. The altimetric geoid and its comparison with other geoids. Altimetric determination of ocean dynamic features: mesoscale eddies, mean sea level, dynamic surface variability, ocean circulation, surface waves, planetary waves, heat storage and tides. Assimilation of altimetric measurements in prediction systems and numerical hydrodynamic and wave propagation models.

Application of Numerical Models to Coastal and Oceanic Processes

Synthesis of hydrodynamic processes in coastal and oceanic regions. Equations describing the movement and conservation of seawater properties. Description of numerical methods for solving partial differential-equation systems. Explicit, implicit, and iterative finite difference schemes. Basic stability, consistency and convergence concepts. Two-dimensional models. Numerical filtering. Types of gridding and nesting. Computational boundary conditions. Treatment of non-linear terms. Three-dimensional models. Separation of external and internal modes. Changing coordinate systems. Model types: sigma coordinate, hard lid, multi-layer, isopycnal coordinate, quasi-geostrophic, current function and spectral. Finite element method. Simulation and forecasting of circulations induced by tides, wind and density stratification with two- and three-dimensional numerical models. Modeling applications for wave propagation, pollutant dispersion and sediment transport problems.

Kinematics and Dynamics of Estuaries

1) Forcings of estuarine circulation. 2) Estuary classification. 3) Processing and analysis of oceanographic data. 4) Mixing processes: simplified concepts and methods. 5) Continuity equation: uni-, bi- and three-dimensional forms. 6) Motion equations: uni-, bi- and three-dimensional forms. 7) Saline wedge estuary: current and salinity intrusion (unidimensional model). 8) Well mixed estuary: unidimensional model. 9) Circulation in partially mixed estuaries: unidimensional analytical model. 10) Circulation and salinity structure: partially mixed estuary: uni- and bidimensional analytical models.

Hydrodynamics of the Continental Shelf

Introduction: Continental margin. Brazilian continental shelf. Differences and similarities between deep ocean and continental shelf dynamics. Shallow water equations. Parametrization of shear stresses. Geostrophic balance. Ekman balance. Inertial motion. Continental shelf waves: gravity waves, Poincaré waves and Kelvin waves. Confined waves: edge waves, Kelvin waves, continental shelf waves and confined coastal waves. Generation and relevance of confined waves. Propagation and effect of waves in channels and in semi-closed basins. Natural modes of oscillation: seiches. Tides on the continental shelf. Effect of the continental shelf on tides: local and remote generation. Propagation and co-oscillation. Semi-closed basins: resonance. Tidal currents. Residual currents. Rectification. Internal tides. Tidal energy dissipation. Wind-generated currents and processes in the continental shelf. Stationary current generated by uniform wind: wind raising, forced seiches, inertial models and adjustment to equilibrium. Stationary current generated by non-uniform wind: arrested topographic wave. Current generated by non-uniform and non-stationary wind. Coastal resurgence and subsidence. Thermohaline processes in the continental shelf: mechanisms of the formation of the seasonal thermocline. Shallow water and resurgence fronts. Thermohaline circulation. Interactions with boundaries: estuarine plumes and plume fronts. Oceanic water intrusion on the continental shelf. Continental shelf-breaking fronts. Meanders and frontal vortices. Continental shelf-breaking resurgence. Physical pollution processes in the continental shelf: pollutant transport and diffusion and the importance of mass stratification and current variability. Residential and industrial waste pollution: submarine emissaries. Oil pollution. Thermal pollution. Physical oceanography of the Brazilian Continental Shelf: review of the major published studies.

Oceanography by Satellite

Introduction: instrument chronology, orbits, geographic coverage, spatial and temporal resolution and active and passive sensors. Radiation propagation: three-dimensional geometry, absorption, scattering, refraction, blackbody, association between spectral bands and sensors. Visible light and chlorophyll: how visible-spectrum sensors work, CZCS, SeaWiFS, morphological corrections, calibration, cloud detection, applications and intrinsic problems. Infrared and temperature: how infrared sensors work, GOES, AVHRR, MODIS, MCSST calibration, feature detection, TSM climatologies, applications and typical problems. Radiometers, temperature, vapor and wind: how radiometric sensors work, SSM/I, TRMM, comparison with infrared sensors, time series, surface heat flux and problems to consider. Scatterometers and wind: straight-section and wind-vector scatterometers, capillary waves and Bragg scattering, shear stress, Ekman pumping, mass and heat flux in the Ekman layer, directional statistics and interpolation. Altimeters and dynamic height: instrument operation; electromagnetic and geophysical corrections; GEOSAT, ERS, TOPEX/POSEIDON and JASON; sampling problems; detection of currents, waves and thermal anomalies; Radon transform; and digital filters.

Geophysical Fluid Dynamics II

Quasi-geostrophic scale analysis - Quasi-geostrophic potential vorticity conservation equation - Rossby and Sverdrup motions - Rossby waves in stratified ocean - Vertical and horizontal Rossby wave structures - Modal and layer models - Energy transfer equations - Hydrodynamic instabilities - Equatorial waves.

Geophysical Fluid Dynamics I

Continuum hypothesis: transport, Lagrangian and Eulerian descriptions - Working forces: equations and simplifications - Surface and internal gravity waves - Vorticity and circulation: Kelvin and Taylor-Proudman theorems - Geostrophic, gradient, inertial and cyclostrophic motions - Poincaré and Kelvin waves: ocean tides - Shallow water inviscid theory: quasi-geostrophic approach; stationary and wave solutions (planetary and topographic Rossby waves).

Methods for Analyzing Quasi-Synoptic Data in Physical Oceanography

The continuously stratified ocean in the ocean: theoretical and observational aspects; Dynamic method; Analysis of acoustic Doppler current profiler (ADCP) data; Optimal mapping; Dynamic modes: modal decomposition and recomposition; Statistical vertical modes; Current function mapping; Multi-layer models: formalism and application; Philips model; Dynamic calibration of layer models; Mapping potential vorticity; Potential vorticity reversal models: principles, models of anomalies and barotropic and baroclinic interactions.

Large-Scale Ocean Circulation

Forces acting on oceans; Scale analysis; Conservation equations of the amount of motion, volume, vorticity and thermodynamic properties, on a large scale; Ekman dynamics and wind action in oceanic motions; Classical wind-forced circulation models; Thermocline and global thermohaline circulation; Equatorial dynamics and shallow meridional cells of the Atlantic; Role of the oceans in the climate system.

Analysis of Temporal Oceanic Processes

1) Measurement techniques (discrete and continuous). Sampling intervals. 2) Graphical representations of scalar and vector time series. 3) Histograms. Statistical parameters (mean, standard deviation, etc.). 4) Co-variances. Correlations between series (dispersion diagrams, correlation coefficient, etc.). 5) Probability models (normal and uniform distributions, etc.). Confidence intervals. 6) Fourier integral. Spectral analysis. Fourier transform. Anti-transform. Spectrum and cross-spectrum. Spectral windows. 7) Principal component analysis. 8) Aliasing. Series filtering (in the time and frequency domains). 9) Wavelets. Wavelet transforms. 10) Practical exercises with time series of tides, atmospheric pressure, currents, winds, temperature, salinity, oxygen content, nutrient concentrations, sedimentation rate, living organisms, bacteria, plankton, cetaceans, fish, etc.

Special Topics in Oceanography II

Study of global, hemispheric and equatorial ocean circulation; Long-term and seasonal variations in circulation systems; Recent results of general ocean circulation models; Coastal and estuarine oceanic processes related to global changes; Ocean-atmosphere coupled models; Physical-biological process models. Modern methods for analyzing geophysical data; Representation of density stratification in numerical models; Methods for specifying lateral boundary conditions in numerical models; Large-scale nesting in numerical models; Objective analysis of model observations and results; Integration of remote and in-situ data in numerical hydrodynamic models.

Current Topics in Oceanography

Study of global, hemispheric and equatorial ocean circulation; Long-term and seasonal variations in circulation systems; Recent results of general ocean circulation models; Coastal and estuarine oceanic processes related to global changes; Ocean-atmosphere coupled models; Physical-biological and biogeochemical process models. Modern geophysical data analysis methods; Representation of density stratification in numerical models; Methods for specifying lateral contour conditions in numerical models; Nutrient-phytoplankton-zooplankton (NPZ) models; Objective analysis of model observations and results; Initialization fields in numerical experiments.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5710 Integrated Management of Coastal and Oceanic Areas

Prof. Alexander Turra

turra@usp.br +55-11-3091-6594

Office: IOUSP Main Building 112

Office Hours: 2 hours weekly, TBA

Mon and Wed, 9-12h

Trimestral course

12 weeks, 06 credits

(3rd trimester)

½ September, October, November. ½ December

Course Description:

The course was designed to enable students to learn about current issues involving the management of coastal and oceanic areas, which encompasses a wide range of topics ranging from biological, social, economic, and public policy processes. Because it is taught by specialists outside IOUSP, the course brings the possibility of updating in subjects not covered by the curriculum of the area.

Course Objectives:

- To introduce students to the complexity of performing integrated management of and between coastal and oceanic areas in different ecosystems;
- To discuss how to achieve good results for a sustained development of these areas;
- To present the methods used in the operation of management programs
- To create learning situations which allow the formation of human resources in the area.

Materials:

- Books and articles:
 1. Alexander, L.M. 1993. Large Marine Ecosystems - a new focus for marine resources management, Butterworth-Heinemann Ltd. - Marine Policy, 1993: 186-198.
 2. Balmol, W. & Oates, W., 1988. The Theory of Environmental Policy, Cambridge University Press.
 3. Bateman, I. et al., 2002. Economic Valuation With Stated Preference Techniques, Edward Elgar.

4. Vieira, P.F., Berques, F. & Seixas, C., 2005. Gestão integrada e participativa de recursos naturais – conceitos, métodos e experiências. Secco/APED.
5. Bisbal, G.A. 1995. The southeast south american shelf large marine ecosystem: evolution and components. *Marine policy* (Guildford, England) 19 (1) 21-38.
6. Bateman, I. et al., 2002. *Economic Valuation With Stated Preference Techniques*, Edward Elgar. 276p.
7. Birnie, P. 1995. Law of the sea and ocean resources: implications for marine scientific research. *Int. Journal of marine and coastal law* 10 (2): 229-251 (Special Issue).
8. Boesch, D. & Macke, S.A. 1995. Bridging the gap: What natural scientists and policy-makers need to know about each other. In: *improving interactions between coastal science and policy*. *Proceedings of the California Symposium*.:33-48. Washington, D.C. National Academy Press.
9. Borgese, E.M. 1994. Training and education in ocean management for the 21st century: regional and global aspects. *Second International conference on oceanography: Toward sustainable use of oceans and coastal Zones*. November 14-19. Lisbon. Portugal.
10. Borgese, E.M. 1995. *Ocean governance and the United Nations*. Halifax, Nova Scotia. Dalhousie University. Center for foreign Policy studies.
11. Bredariol, S.C. & Magrini, A. 1997. Gestão ambiental e conflitos: os caminhos da negociação. *IAIA Int. Assoc. for Impact Assesment*, vol. 1 n.3, seção brasileira: 24-83.
12. Burke, W.T. 1996. Introduction. Importance of the 1982 UN Convention on the Law of the Sea and its future developments. *Ocean development and international law* (London) 27 (1/2) January-June 1996: 1-4. Special issue.
13. Christensen, V & maclean, J. 2011. *Ecosystem Approaches to Fisheries: a global perspective*. Cambridge Iniversity Press.325p.
14. Chua, T.E. 1993. Essential elements of integrated coastal management. *Ocean & Coastal Management* 21 (1-3): 81-108.
15. Chua, T.E. & Scura, L.F. eds. 1992. *Integrative framework and methods for coastal area management*. *ICLARM Conf. Proc.* 37, 169p.
16. Cincin-Sain, B. 1993. Sustainable developmente and integrated coastal management. *Ocean & Coastal Management* 21 (1-3): 11- 43.
17. Cincin-Sain, B. 1993. (Ed.). *Special Issue: Integrated coastal Management*. *Ocean & Coastal Management* 21 (1-3): 1-377.
18. Cincin-Sain, B. & Knecht, R.W. 1998. *Integrated coastal and ocean management. Concepts and Practices*. Island Press. 517p.
19. Cincin-Sain, B., Knecht, R.W. & Fisk, G. 1995. Growth in capacity for integrated coastal management since UNCED: an international perspective. *Ocean & Coastal Management* 29 (1-3): 93-123.
20. Clarck, J. R., 1995. *Coastal Zone Management Handbook*. CRC Press LLC, Boca Raton, 694 p.
21. Commission Océanographique Intergouvernementale. 1997. *Guide méthodologique d'aide à la gestion intégrée de la zone côtière*. UNESCO.

22. Conrad, J. & Clark, C., 1987. *Natural Resource Economics: Notes and Problems*, Cambridge: Cambridge University Press.
23. Cort, R.P. 1995. A practical guide to environmental impact assessment. *Quarterly Review of Biology* 70 (4). 533p.
24. Cunningham, S. & Bostock, T. 2005. *Successful fisheries management issues, case studies and perspectives*. Eburon Academic Publ. 237
- DHN. 1985. *Convenção das Nações Unidas sobre o Direito do Mar. Versão em língua portuguesa*. Ministério dos Negócios Estrangeiros e do Mar do Governo da República de Portugal. 313p.
25. Field, B.C. 1994. *Environmental Economics*. New York. McGraw-Hill. 406p.
- Gianesella, S.M.F.; Saldanha-Correa, F.M.P. 2010. *Sustentabilidade dos oceanos. Série Sustentabilidade, v.7*. Blucher, São Paulo.199p.
26. Hong, S.Y. 1995. A framework for emerging new marine policy: the Korean experience. *Ocean & Coastal Management* 19: 391-415.
27. Jacobi, P.R., 2000. *Ciência ambiental: os desafios da interdisciplinaridade*. Ed. Annablume/FAPESP, São Paulo, 388 p.
28. Kalikoski, D.; Dias, J.; Thè, A.M. G.; Ruffino, M..L. & Marrul, S. (Org). 2009. *Gestão compartilhada do uso sustentável de recursos pesqueiros: refletir para agir*. IBAMA, Brasília, 184p.
29. Law of the Sea Institute (Honolulu, Hawaii) 1993. *The marine environment and sustainable development: law, policy and science*. Proceedings of the 25th. Couper, A. & Cold. E. (Eds). Annual Conference of the Law of the Sea Institute, Un. Hawaii, Honolulu. 688 p.
30. Little, P., 2003. *Políticas Ambientais no Brasil*. IIEB/Peirópolis.
- Maine, R.A.; Cam, B. & Davis-Case, D. 1996. *Participatory analysis , monitoring and evaluation for fishing communities*. FAO Fisheries Technical Paper, n. 364. Rome, FAO. 142 p.
31. Norse, E.A. & Crowder, L.B., 2005. *Marine conservation biology. The science of maintaining the sea's biodiversity*. Island Press.
32. Kullenberg, G. 1995. Reflections on marine science contributions to sustainable development. *Ocean & Coastal Management* 29 91-3): 1-11.
33. Pires-Filho, I.A. & Cycon, D.E. 1987. Planning and managing Brazil's coastal resources. *Coastal Management* 15 (1): 64-74.
34. Pitcher, T.J.; Hart, P.J.B.& Pauly, D. 2001. *Reinventig Fisheries Management*. Kluwer Academic Pu
35. Pomeroy, R.S. 1995. Community-based and co-management institutions for sustainable coastal fisheries management in Southeast Asia. *Ocean & Coastal Management* 27 (3): 143-162.
36. Roach, J.A. 1996. Marine scientific research and the new law of the sea. *Ocean development and international law*. London. 27 (1/2): 59-72.
37. Sorensen, J.C. 1997. National and international efforts at integrated coastal management: definions, achievements , and lessons. *Coastal Management*, 24 3-41.

38. U.S. Department of Commerce. 1995. Economic valuation of natural resources: a handbook for coastal resource policymakers. NOAA Coastal Ocean Program Decision Analysis Series, no 5. Silver Spring, Md. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Coastal Ocean Program Office.
39. Vallega, A. Towards the sustainable management of the Mediterranean Sea. Marine policy (Guildford, England) 19(1) January 1995:47-64. Includes bibl. References.
40. Vallejo, S.M. 1993. The integration of coastal zone management into national development planning. Ocean & Coastal Management 21: 163-181.
41. Vieira, P.F., Berques, F. & Seixas, C., 2005. Gestão integrada e participativa de recursos naturais – conceitos, métodos e experiências. Secco/APED. Florianópolis. 415p.
42. WCED (World Commission on Environment and Development). 1987. Our Common Future. Oxford, Oxford University Press.
43. Webster, D.G. 2009. Adaptive Governance; The dynamics of Atlantic Fisheries Management. 397p.
44. Willmann, R. & Insull, D. 1993. Integrated coastal fisheries management. Ocean and Coastal Management, Elsevier Sc. Publ. Ltd., England. Printed in Northern Ireland . 21 (1-3): 285-302.
45. Walters, C. J. & Martell, S. J. D. 2004. Fisheries ecology and management. Princeton: Princeton University Press. 399p.

- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework:	15%
Field work:	25%
Midterm:	30%
Seminar:	30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 – Analysis of integrated management concepts in light of the rules established by the Law of the Sea Convention and by the United Nations Conference on Environment and Development (UNCED).

Week 2 – Institutional, legal and intergovernmental considerations.

Week 3 – Main processes and methods involved in management: objectives, focal points, available tools and decision making.

Week 4 – Main processes and methods involved in management: objectives, focal points, available tools and decision making.

Week 5 – Problem identification, analysis, formulation, application and evaluation of management programs.

Week 6 – Interaction between the main uses of coastal and oceanic areas (navigation, communication, use of living and mineral resources, tourism and recreation, pollution and others).

Week 7 – Interaction between the main uses of coastal and oceanic areas (navigation, communication, use of living and mineral resources, tourism and recreation, pollution and others).

Week 8 – Conflict resolution.

Week 9 – Damage assessment.

Week 10 – Interdependence between ecosystems and development.

Week 11 – Integration of ecological, social, economic and political knowledge to implement integrated management plans.

Week 12 – Critical analysis of national and international cases and presentation of solutions.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5715 Secondary Planktonic Production

Prof. Rubens M. Lopes

rubens@usp.br +55-11-3091-6556

Office: IOUSP Main Building 100

Office Hours: 2 hours weekly, TBA

Tue and Thurs, 9-11h30

Trimestral course

12 weeks, 08 credits

(1st trimester)

April, May, June

Course Description:

Although secondary production is a central process in the metabolism of marine pelagic ecosystems, little attention has been given to this theme in Brazil. This course will provide the dissemination of the subject with the graduate students of the University of São Paulo and others interested in the subject. It is hoped that this course will contribute to increase the quantity and quality of scientific research related to secondary planktonic production in Brazil.

Course Objectives:

- To provide students with an understanding of the metabolic processes of marine zooplankton under an ecosystemic approach;
- To train the students with field and laboratory techniques related to studies on secondary planktonic production;
- To stimulate and support the students in the elaboration and execution of research projects for the study of secondary planktonic production.

Materials:

- Books:
 1. Boltovskoy, D. (ed.) 1999. South Atlantic Zooplankton. Backhuys Publ., Leiden, 1700pp., (2 vols.), Harris, R.; Wiebe, P.; Lenz, J.; Huntley, M. & Skjoldal, H.R. (eds.) 2000. ICES Zooplankton Methodology Manual. Academic Press, London, 684 p.
 2. Mann, K. H. and Lazier, J. R. N. 1996. Dynamics of Marine Ecosystems: biological-physical interactions in the oceans. 2nd ed. Blackwell Science, Inc. Inglaterra. pp 394.

3. Morita, R.Y. 1997. Bacteria in oligotrophic environments: starvation-survival lifestyle. Kluwer, Dordrecht, 529 p. Rigler, F. H. & J.
 4. A. Downing 1984. The calculation of secondary production. In: Manual on methods for the assessment of secondary production in fresh waters (Downing & Rigler, eds.), Blackwell, Oxford, p. 19-58 (2nd ed.).
 5. Valiela I. 1995 Marine ecological processes. 2nd ed. Springer Verlag, New York, 686 p.
 6. Williams, R. 1984. An overview of secondary production in pelagic ecosystems. In: Flows of energy and materials in marine ecosystems. Theory and practice (Fasham, ed.), Plenum Press, New York, p. 361-405.
- Various scientific articles to be distributed to the students during the course.
 - Class notes on the USP course website
 - Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Field and Laboratory reports: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
R= Reprovado (Failed)							

Calendar:

Week 1 – Limiting factors in the pelagic ecosystem: light, nutrients, temperature, interactions with other environmental factors: predation, competition and symbiosis

Week 2 – Structure of pelagic food webs; phytoplankton-zooplankton interactions; the microbial loop

Week 3 – Food web simulation models; importance of zooplankton as food for fish and other consumers

Week 4 – Role of zooplankton in the transformation of biogenic material in the oceans; relationships between the distribution of primary productivity, phytoplankton and zooplankton

Week 5 – Zooplankton physioecology: feeding activity, egg production, growth efficiency, respiration and excretion, energy balance

Week 6 – Quantitative sampling for cohort determination; artificial cohorts; egg-ratio method; indirect methods

Week 7 – Bacterial secondary production: concept, relevance and research approaches

Week 8 – Experimental methods for studying secondary production

Week 9 - Case studies: planktonic secondary production in different marine environments

Week 10 – Case studies: planktonic secondary production in different marine environments, Execution of a pilot project on planktonic secondary production

Week 11 - Execution of a pilot project on planktonic secondary production

Week 12 – Execution of a pilot project on planktonic secondary production



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5807-3 Application of Numerical Models to Coastal and Oceanic Processes

Prof. Joseph Harari

joharari@usp.br

+55-11-3091-6576

Office: IOUSP Main Building 193

Office Hours: 2 hours weekly, TBA

Tue and Thur, 9-12h

Trimestral course

12 weeks, 06 credits

(3rd trimester)

½ September, October, November, ½ December

Course Description:

Synthesis of hydrodynamic processes in coastal and oceanic regions. Equations describing the movement and conservation of seawater properties. Description of numerical methods for solving partial differential-equation systems. Explicit, implicit, and iterative finite difference schemes. Basic stability, consistency and convergence concepts. Two-dimensional models. Numerical filtering. Types of gridding and nesting. Computational boundary conditions. Treatment of non-linear terms. Three-dimensional models. Separation of external and internal modes. Changing coordinate systems. Model types: sigma coordinate, hard lid, multi-layer, isopycnal coordinate, quasi-geostrophic, current function and spectral. Finite element method. Simulation and forecasting of circulations induced by tides, wind and density stratification with two- and three-dimensional numerical models. Modeling applications for wave propagation, pollutant dispersion and sediment transport problems.

Course Objectives:

- To become familiar with the techniques of numerical modeling, its applications to the analysis of circulation, waves, transport, and dispersion in coastal and oceanic regions;
- To get to know the power of prediction and the diagnosis of fundamental problems in Oceanography.

Materials:

- Books:
 1. HARARI, J. - 1989 - Apostila da disciplina "Modelos numéricos aplicados a processos costeiros e estuarinos (IOF814)", do Curso de Pós - graduação em Oceanografia Física do Instituto Oceanográfico da USP. Exemplares no acervo da Biblioteca do Instituto Oceanográfico da USP - 217 p.
 2. BLUMBERG, A. F. & MELLOR, G. L., 1987. A description of a three-dimensional coastal ocean circulation model. In: Three-Dimensional Coastal Ocean Models, vol 4, Ed: N. S. Heaps, American Geophysical Union, Washington, D. C., USA
 3. RAMMING, H. G. & KOWALIK, Z. - 1980 - "Numerical modelling of marine hydrodynamics - Applications to dynamic physical processes" - Elsevier Oceanography series 26, Netherlands, 368 pp.
 4. KOWALIK, Z. & MURTY, T. S. - 1993 - "Numerical modeling of ocean dynamics" - World Scientific - Advanced Series on Ocean Engineering, vol. 5, 481 p. Mellor, G. L. 2004: Users guide for a three-dimensional, primitive equation, numerical ocean model (<http://www.aos.princeton.edu/WWWPUBLIC/htdocs.pom>).
 5. MILLER, R. N. 2007. Numerical Modeling of Ocean Circulation. Cambridge Press ((ISBN-13: 9780511267062).
 6. Benoit Cushman-Roisin and Jean-Marie Beckers – 2010. Introduction to Geophysical Fluid Dynamics - Physical and Numerical Aspects. Academic Press.
- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 - Synthesis of hydrodynamic processes in coastal and oceanic regions.

Week 2 - Equations describing the movement and conservation of seawater properties.

Week 3 – Basic stability, consistency and convergence concepts.

Week 4 – Two-dimensional models. Numerical filtering. Types of gridding and nesting.

Week 5 – Computational boundary conditions. Treatment of non-linear terms.

Week 6 – Three-dimensional models.

Week 7 - Separation of external and internal modes. Changing coordinate systems.

Week 8 – Model types: sigma coordinate, hard lid, multi-layer,

Week 9 – Model types: isopycnal coordinate, quasi-geostrophic, current function and spectral.

Week 10 – Finite element method.

Week 11 - Simulation and forecasting of circulations induced by tides, wind and density stratification with two- and three-dimensional numerical models.

Week 12 - Modeling applications for wave propagation, pollutant dispersion and sediment transport problems.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5809-3 Hydrodynamics of the Continental Shelf

Prof. Belmiro Mendes de Castro Filho and Prof. Marcelo Dottori

Trimestral course

bmcastro@usp.br +55-11-3091-6613

12 weeks, 06 credits

mdottori@usp.br +55-11-3091-7131

Office: IOUSP Main Building 189

(3rd trimester)

Office Hours: 2 hours weekly, TBA

½ September, October, November, ½ December

Tue and Thur, 9-12h

Course Description:

Introduction: Continental margin. Brazilian continental shelf. Differences and similarities between deep ocean and continental shelf dynamics. Shallow water equations. Parametrization of shear stresses. Geostrophic balance. Ekman balance. Inertial motion. Continental shelf waves: gravity waves, Poincaré waves and Kelvin waves. Confined waves: edge waves, Kelvin waves, continental shelf waves and confined coastal waves. Generation and relevance of confined waves. Propagation and effect of waves in channels and in semi-closed basins. Natural modes of oscillation: seiches. Tides on the continental shelf. Effect of the continental shelf on tides: local and remote generation. Propagation and co-oscillation. Semi-closed basins: resonance. Tidal currents. Residual currents. Rectification. Internal tides. Tidal energy dissipation. Wind-generated currents and processes in the continental shelf. Stationary current generated by uniform wind: wind raising, forced seiches, inertial models and adjustment to equilibrium. Stationary current generated by non-uniform wind: arrested topographic wave. Current generated by non-uniform and non-stationary wind. Coastal resurgence and subsidence. Thermohaline processes in the continental shelf: mechanisms of the formation of the seasonal thermocline. Shallow water and resurgence fronts. Thermohaline circulation. Interactions with boundaries: estuarine plumes and plume fronts. Oceanic water intrusion on the continental shelf. Continental shelf-breaking fronts. Meanders and frontal vortices. Continental shelf-breaking resurgence. Physical pollution processes in the continental shelf: pollutant transport and diffusion and the importance of mass stratification and current variability. Residential and industrial waste pollution: submarine emissaries. Oil pollution. Thermal pollution. Physical oceanography of the Brazilian Continental Shelf: review of the major published studies.

Course Objectives:

- To study, under theoretical and observational approaches, the main physical processes that occur in the waters of the continental shelf;
- To deduce and apply approximate or semi-analytical solutions to the following continental shelf processes: long waves, currents, tides, heat and mass changes with the atmosphere, and energy and mass changes with estuarine and deep ocean waters;

- To get approximate solutions to the equations that govern the physical processes associated with marine coastal pollution;

Materials:

- Books:
 1. Csanady, G.T., 1982. Circulation in the coastal ocean. Dordrecht D. Reidel Publishing Company.
 2. Miranda, L.B., Castro, B.M., Kjerfve, B., 2012. Princípios de Oceanografia Física de Estuários, segunda edição. Editora da Universidade de São Paulo.
 3. Miranda, L.B., Andutta, F.P., Kjerfve, B., Castro, B.M., 2017. Fundamentals of estuarine physical oceanography. Springer.
 4. Brink, K.H., Robinson, A.R. (ed.), 1998. The global coastal ocean: Processes and Methods. John Wiley & Sons, Inc.
 5. Robinson, A.R., Brink, K.H. (ed.), 1998. The global coastal ocean: regional studies and syntheses. John Wiley & Sons, Inc.
 6. Blumberg, A.L., Bruno, M., 2018. The urban ocean: the interaction of cities with water. Cambridge University Press.
 7. Simpson, J.H., Sharples, J., 2002. Physical and biological oceanography of shelf seas. Cambridge University Press.
- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 - Introduction: the Continental margin. The Brazilian continental shelf. Differences and similarities between deep ocean and continental shelf dynamics. Shallow water equations. Parametrization of shear stresses. Review on Geostrophic and Ekman balances, and inertial motion.

Week 2 - Continental shelf waves: gravity waves, Poincaré waves and Kelvin waves.

Week 3 - Confined waves: edge waves, Kelvin waves, continental shelf waves and confined coastal waves. Generation and relevance of confined waves. Propagation and effect of waves in channels and in semi-closed basins. Natural modes of oscillation: seiches.

Week 4– Effect of the continental shelf on tides: local and remote generation. Propagation and co-oscillation. Semi-closed basins: resonance. Tidal currents. Residual currents. Rectification. Tidal energy dissipation. Wind-generated currents and processes in the continental shelf.

Week 5 – Internal Tides. Internal gravity waves on a continuously stratified ocean. Normal modes of vertical velocity. The barotropic tidal forcing.

Week 6 – Stationary current generated by uniform wind: wind raising, forced seiches, inertial models and adjustment to equilibrium. Stationary current generated by non-uniform wind: arrested topographic wave.

Week 7 – Current generated by non-uniform and non-stationary wind. Coastal upwelling and downwelling.

Week 8 – Thermohaline processes in the continental shelf: mechanisms of the formation of the seasonal thermocline. Shallow water and upwelling fronts. Thermohaline circulation.

Week 9 – Interactions with boundaries: estuarine plumes and plume fronts.

Week 10 – Dynamics of the outer shelf. Oceanic water intrusion on the continental shelf. Continental shelf-breaking fronts. Meanders and frontal vortices. Continental shelf-breaking upwelling.

Week 11 – Physical pollution processes in the continental shelf: pollutant transport and diffusion and the importance of mass stratification and current variability. Residential and industrial waste pollution: submarine emissaries. Oil pollution. Thermal pollution.

Week 12 - Physical oceanography of the Brazilian Continental Shelf: review of the major published studies.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5810-3 Satellite Oceanography

Profs. Paulo S. Polito and Olga T. Sato

polito@usp.br +55-11-3091-6575

Office: IOUSP Main Building 172

Office Hours: 2 hours weekly, TBA

Mon: 13-17h, Fri: 9-12h,

Trimestral course

12 weeks, 08 credits

(3rd trimester)

½ September, October, November, ½ December

Course Description:

Introduction: instrument chronology, orbits, geographic coverage, spatial and temporal resolution and active and passive sensors. Radiation propagation: three-dimensional geometry, absorption, scattering, refraction, blackbody, association between spectral bands and sensors. Visible light and chlorophyll: how visible-spectrum sensors work, CZCS, SeaWiFS, morphological corrections, calibration, cloud detection, applications and intrinsic problems. Infrared and temperature: how infrared sensors work, GOES, AVHRR, MODIS, MCSST calibration, feature detection, TSM climatologies, applications and typical problems. Radiometers, temperature, vapor and wind: how radiometric sensors work, SSM/I, TRMM, comparison with infrared sensors, time series, surface heat flux and problems to consider. Scatterometers and wind: straight-section and wind-vector scatterometers, capillary waves and Bragg scattering, shear stress, Ekman pumping, mass and heat flux in the Ekman layer, directional statistics and interpolation. Altimeters and dynamic height: instrument operation; electromagnetic and geophysical corrections; GEOSAT, ERS, TOPEX/POSEIDON and JASON; sampling problems; detection of currents, waves and thermal anomalies; Radon transform; and digital filters.

Course Objectives:

- To become familiar with the physical principles of remote data collection; - the connection between electromagnetic and geophysical measurements;
- to get to know the application of satellite data in the study of oceanographic processes;
- to learn the statistical analysis of satellite data;

Materials:

- Books:
 1. Methods of Satellite Oceanography, Robert H. Stewart, Univ. Of California Press, 1984.

2. Satellite Oceanography: an Introduction for Oceanographers and Remote-Sensing Scientists, I. S. Robinson, E. Horwood Halsted Press, 1985.

- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
R= Reprovado (Failed)							

Calendar:

Week 1 - Introduction: instrument chronology, orbits, geographic coverage, spatial and temporal resolution and active and passive sensors.

Week 2 - Radiation propagation: three-dimensional geometry, absorption, scattering, refraction, blackbody, association between spectral bands and sensors.

Week 3 – Visible light and chlorophyll: how visible-spectrum sensors work, CZCS, SeaWiFS, morphological corrections, calibration, cloud detection, applications and intrinsic problems.

Weeks 4/5 – Infrared and temperature: how infrared sensors work, GOES, AVHRR, MODIS, MCSST calibration, feature detection, TSM climatologies, applications and typical problems.

Weeks 6/7 – Radiometers, temperature, vapor and wind: how radiometric sensors work, SSM/I, TRMM, comparison with infrared sensors, time series, surface heat flux and problems to consider.

Weeks 8/9 – Scatterometers and wind: straight-section and wind-vector scatterometers, capillary waves and Bragg scattering, shear stress, Ekman pumping, mass and heat flux in the Ekman layer, directional statistics and interpolation.

Weeks 10/11 – Altimeters and dynamic height: instrument operation; electromagnetic and geophysical corrections; GEOSAT, ERS, TOPEX/POSEIDON and JASON; sampling problems; detection of currents, waves and thermal anomalies;

Week 12 – Radon transform; and digital filters.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5811-2 Geophysical Fluid Dynamics I

Prof. Belmiro Castro

bmcastro@usp.br

+55-11-3091-6613

Office: IOUSP Main Building 178

Office Hours: 2 hours weekly, TBA

Mon and Wed, 9-12h

Trimestral course

12 weeks, 06 credits

(1st trimester)

March, April and May

Course Description:

The Continuum hypothesis. Lagrangian and Eulerian descriptions of investigating fluid dynamics. Conservation equations and their simplifications. The concept of scaling. Non-rotational surface and internal gravity waves. Vorticity and circulation: Kelvin and Taylor-Proudman theorems. Geostrophic, gradient, inertial and cyclostrophic motions. Poincaré and Kelvin waves. Ocean tides. The shallow-water inviscid theory.

Course Objectives:

- To become familiar with the fundamentals of fluid dynamics;
- To understand the conservation principles, such as mass/volume, linear and angular momentum
- To be presented to wave dynamics on a homogeneous and on a stratified fluid.
- To get to know the vorticity/circulation theorems
- To learn the effects of rotation on a fluid motion: geostrophy, inertial motions, Kelvin waves and ocean tides
- To understand the shallow-water equations and linear solutions.

Materials:

- Books:
 1. Pedlosky, J. (2013). Geophysical fluid dynamics. Springer Science & Business Media.
 2. Gill, A. E. (2016). Atmosphere—ocean dynamics. Elsevier.

3. Class notes on the USP course website
4. Assorted articles to be distributed in class

Student responsibilities:

5. Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 - The continuum hypothesis. Lagrangean and Eulerian descriptions. Trajectories and streamlines.

Week 2 - The conservation laws: conservation of mass and volume, conservation of linear momentum. Surface and body forces in the ocean

Week 3 – Scales of motions. Scaling analysis. Simplifications to the conservation laws. Nondimensional numbers in Oceanography.

Week 4 – The beta and f planes. The Boussinesq approximation. The Helmholtz decomposition of the velocity vector: stream function and velocity potential

Week 5 – Irrotational surface and internal gravity waves

Week 6 – The effects of rotation. Conservation of vorticity and Ertel's Potential Vorticity theorem. The Kelvin and Taylor-Proudman theorems.

Week 7 – Geostrophic, Inertial and Cyclostrophic motions

Week 8 – Barotropic vs. Baroclinic geostrophic motions: Taylor-Proudman vs. Thermal wind theorems

Week 9 – Poincaré (or Sverdrup) waves and Kelvin waves

Week 10- Ocean Tides. The tidal potential. Resonance.

Week 11 – The shallow-water inviscid theory: dynamics of the homogeneous ocean

Week 12 - Shallow-water oscillatory motions



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5811-2 Geophysical Fluid Dynamics II

Prof. Ilson C. Silveira

ilson.silveira@usp.br +55-11-3091-6552

Office: IOUSP Main Building 185

Office Hours: 2 hours weekly, TBA

Tue and Thur, 9-12h

Trimestral course

12 weeks, 06 credits

(2nd trimester)

June, ½ July, August, ½ September

Course Description:

Quasi-geostrophic scale analysis - Quasi-geostrophic potential vorticity conservation equation - Rossby and Sverdrup motions – Rossby waves in stratified ocean - Vertical and horizontal Rossby wave structures - Modal and layer models - Energy transfer equations - Hydrodynamic instabilities - Equatorial waves.

Course Objectives:

- To become familiar with the Quasi-geostrophy theory;
- To understand the ocean adjustment at subinertial frequency;
- To learn the approximations done to the continuously-varying density structure of the ocean
- To get to know instability of geophysical flows due to velocity shear
- To understand the equatorial dynamics

Materials:

- Books:
 1. Vallis, G. K. (2017). Atmospheric and oceanic fluid dynamics. Cambridge University Press.
 2. McWilliams, J. C. (2006). Fundamentals of geophysical fluid dynamics. Cambridge University Press.
- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 - The Vorticity equation; Meso and Large Scale Analysis; Potential Vorticity

Week 2 - The Quasi-geostrophy theory as by C. Rossby, J. Charney and E. Eady

Week 3 – Conservation of quasi-geostrophic potential vorticity on a homogeneous ocean

Week 4 – Vorticity wave dynamics: planetary, topographic and sheared-flow waves.

Week 5 – The energy equation for a barotropic ocean; Principles of hydrodynamic instability

Week 6 – The Rayleigh-Kuo equation; criteria for barotropic instability: Rayleigh-Kuo's and Fjortoft's

Week 7 – Conservation of quasi-geostrophic potential vorticity on a stratified fluid

Week 8 – Plane baroclinic waves, vertical normal pressure and vertical velocity modes

Week 9 - The energy equation for a barotropic ocean; Baroclinic Instability; the Lorenz diagram

Week 10- The Charney-Stern equation; Criteria for baroclinic instability

Week 11 - Multiple-layer models of the ocean; the Philips model; Instability on a two-layer ocean

Week 12 - Equatorial dynamics; the equatorial beta plane; equatorial waves



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5817-3 Methods for Analyzing Quasi-Synoptic Data in Physical Oceanography

Prof. Ilson C. Silveira

ilson.silveira@usp.br +55-11-3091-6552

Office: IOUSP Main Building 185

Office Hours: 2 hours weekly, TBA

Wed and Fri; 9-12h, 14-17h

Trimestral course

12 weeks, 08 credits

(3rd trimester)

½ September, October, November, ½ December

Course Description:

This course seeks to apply theoretical knowledge of Geophysical Fluid Dynamics I and II with data analysis and theoretical calculations. Basic processing of hydrographic data. Processing of vessel-mounted acoustic Doppler current profiler. Interpolation. Smoothing and filtering. Objective mapping. The Dynamic Method. Vertical sections and horizontal distributions of temperature, salinity, potential density, stratification (N^2) and potential vorticity. Dynamical analysis, based on the quasi-geostrophic framework. Estimates of the Rossby deformation radii. Modal decomposition, recomposition and truncation. Potential vorticity numerical inversion.

Course Objectives:

- To get to know the ocean subinertial physical processes from quasi-synoptic data;
- To learn how to extract dynamic information through dynamic reduction, manipulation and “calibration” of quasi-synoptic observations.

Materials:

- Books:
 1. Emery, W. & Thomson, R.E. 1997. Data Analysis Methods in Physical Oceanography. Pergamon Press, 634pp.
 2. Soloviev, A & Lukas, G. 2006. The Near-Surface Layer of the Ocean. Elsevier, 551 p.

3. Wunsch, C. 2015. Modern Observational Physical Oceanography: Understanding the Global Ocean, Princeton University Press, 512p.

- Class notes on the USP course website
- Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
R= Reprovado (Failed)							

Calendar:

Week 1 - The continuously stratified ocean: theoretical and observational aspects

Week 2 – Basic processing of hydrographic data: de-spiking, bin averaging, moving averages, windowing.

Week 3 – Analysis of acoustic Doppler current profiler (ADCP) data. The University of Hawaii CODAS package.

Week 4 - Interpolation. Optimal methods. Objective analysis and Krigging.

Week 5 - The dynamical method: the classical and the velocity reference versions.

Week 6 – Stream function mapping from hydrographic, altimetry and ADCP data.

Week 7 – Stratification vertical profiles. Estimate of the baroclinic Rossby deformation radii. Dynamical modes: modal decomposition, truncation and recomposition

Week 8 – Empirical Orthogonal Functions (EOFs): scalar and vectorial; for non- and propagating signals. Statistical (EOF) vs. dynamical modes.

Week 9 – Multi-layer models: formalism and application. The two-layer or the Philips model. Reduced gravity models.

Week 10 – The Flierl dynamical calibration of layer models

Week 11 - Mapping Ertel's and quasi-geostrophic potential vorticity

Week 12 - Potential vorticity numerical inversion. Identification of barotropic and baroclinic interactions and instabilities.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5818-2 Large-Scale Ocean Circulation

Prof. Edmo J. D. Campos

edmo@usp.br +55-11-3091-6597/+55-11-3091-6584

Office: IOUSP Main Building 205

Office Hours: 2 hours weekly, TBA

Tue and Thur, 14-17h

Trimestral course

12 weeks, 06 credits

(2nd trimester)

June, ½ July, August, ½ September

Course Description:

This course addresses fundamental topics of Physical Oceanography, such as: The kinematics and dynamics of ocean circulation; the role of seawater movement in the global distribution of physical and biogeochemical properties in ocean basins; the interactions with the atmosphere and the seabed and the large-scale mechanisms through which the ocean determines the climatic conditions and their variations.

Course Objectives:

- To study the ocean currents spatial scale ranging from hundreds (mesoscale) to thousands of kilometers (large scale);
- To study the transport of water and heat by ocean currents;
- To understand the role of the different agents which force the ocean circulation, with special emphasis on wind action and sea density differences;
- To understand the role of the oceans in transporting substances, organisms and heat, and in controlling the climate system.

Materials:

- Books:
 1. George Pickard and William Emmerly: Descriptive Physical Oceanography
 2. Stephen Pond and George Pickard: Introductory Dynamical Oceanography
 3. Joseph Pedlosky: Ocean Circulation Theory

4. John Knauss: Physical Oceanography
 5. John Appel: Principle of Ocean Physics
 6. Open University: Ocean Circulation
- Class notes on the USP course website
 - Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework: 40%

Midterm: 30%

Final Exam: 30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
R= Reprovado (Failed)							

Calendar:

Week 1 – Forces acting in the ocean at large scales.

Week 2 – Large Scale analysis.

Week 3 – Conservation equations of the mass and volume at large scale.

Week 4 – Conservation equation of linear momentum at large scale.

Week 5 – Conservation equations of absolute and potential vorticities at large scale.

Week 6 – Thermodynamics of the sea water and the equation of state

Week 7 – The effect of friction: boundary Layer theory and Ekman dynamics

Week 8 – Classical linear wind-forced circulation models: the Sverdrup and Stommel models

Week 9 – The effect of topography. The modified Stommel model. The Munk model

Week 10 – The nonlinear wind-forced circulation models: the Fofonoff and Moore models

Week 11 – Equatorial dynamics and shallow meridional cells of the Atlantic.

Week 12 – Role of the oceans in the climate system.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5908-1 Paleoceanography

Prof. Felipe A. L. Toledo

ftoledo@usp.br +55-11-3091-6675

Office: IOUSP Main Building 181

Office Hours: 2 hours weekly, TBA

Tues and Thur, 10-12h, 14-17h

Trimestral course

12 weeks, 08 credits

(1st trimester)

March, April, May

Course Description:

This course is proposed to integrate with the other contents developed in graduate courses of the Oceanographic Institute, in order to contribute together with the other disciplines in the training of students of this course. Paleoceanography, since it discourses about the evolution of the oceans (geology, climatology, sedimentology among others), allows to integrate data of diverse areas, and has been shown as a valuable medium for the study of the variations of past climates.

Course Objectives:

- To present the methods through which it is possible to perform a paleoceanographic reconstruction;
- To demonstrate the influence of the oceans on the global climate cycles and the influence of this climatic variations on the oceans.
- To document, through the analysis of marine sediments, the variations in paleocirculation and paleotemperatures of the oceanic currents;

Materials:

- Books:
 1. Andrews, J.T.; Austin, W.E.N.; Bergsten, H. and Jennings, E. (eds.) 1996. Late Quaternary Palaeoceanography of the North Atlantic Margins, London.
 2. Bigg, G.R. (1998) The oceans and the climate. 266p, Cambridge University Press, New York.

3. Clark, P.U.; Webb, R.S.; Keigwin, L.D. (eds.) (1999) Mechanisms of Global Climate Change. American geophysical Union, Washington.
 4. Fischer, G. e Wefer, G. (eds.) (1999) Use of proxies in paleoceanography: Examples from the South Atlantic. Springer-Verlag, Berlin.
 5. Peixoto, J. e Oort, A. (1992) Physics of climate. 520p, New York.
Van Loon, H. (ed.) (1984) Climates of the Oceans. World Survey of climatology, vol. 15.
 6. Seidov, D.; Haupt, B.J.; Maslin, M.A. (eds.) (2001) "The Oceans and Rapid Climate Change: Past, Present and Future. AGU Geophysical Monograph Series Volume 126, 293p.
 7. Wefer, G.; Berger, W.H.; Siedler, G. e Webb, D.J. (eds.) (1996) The South Atlantic. Springer-Verlag, Berlin.
- Class notes on the USP course website
 - Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Homework:	40%
Exam:	30%
Seminar:	30%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1 – Climate system.

Week 2 – Geochronology.

Week 3 – Methods for sampling marine sediments.

Week 4 – Surface circulation; Global thermohaline circulation.

Week 5 – Physical, chemical and biological interactions between the atmosphere and the ocean.

Week 6 – Stable isotopes.

Week 7 – Tracers of past oceanographic variations.

Week 8 – Oceans and climatic variations.

Week 9 – Causes of glacial and interglacial cycles.

Week 10 – Iron fertilization of the oceans.

Week 11 – The global carbon cycle.

Week 12 – Last glacial period in the South Atlantic Ocean.



Instituto Oceanográfico da USP

Graduate Course Syllabus

IOC5914-1 Chemical and Environmental Aspects of Marine Organic Pollution

Prof. Rosalinda C. Montone

rmontone@usp.br

+55-11-3091-8961

Office: IOUSP Main Building 185

Office Hours: 2 hours weekly, TBA

Tue and Thur, 9-12h; 14-17h

Trimestral course

12 weeks, 08 credits

(1st trimester)

½ September, October, November, ½ December

Course Description:

1. Environmental aspects of organic pollutants 2. Organic pollutants in the marine environment: distribution and fate. 3. Sewage pollution and eutrophication 4. Oil Pollution 5. Persistent Organic Pollutants 6. Plastics in marine environment 7. Oceanographic processes related to marine organic pollution 8. Analysis of organic pollutants in environmental samples 9. Discussion of environmental data and seminars

Course Objectives:

- To provide students an overview of chemical processes and interactions involving organic pollutants in the marine environment.
- To approach chemical and environmental aspects of organic pollutants contribute to a better understanding of their processes in biogeochemical cycles in the marine environment.

Materials:

- Books:
 1. Albaigés, J. 1989. Marine Pollution. Hemisphere Publishing Corporation. New York, 365 p.
 2. Baptista Neto, J.A., Kersanach-Wallner, M., Patchineelam, S.M. 2008. Poluição Marinha. Editora Inerciência., Rio de Janeiro, 412 p.

3. GRIMALT, J. O.; FERNANDEZ, P.; BAYONA, J. M. & ALBAIGÉS, J. 1990. Assessment of fecal sterols and ketones as indicators of urban sewage inputs to coastal waters. Environ. Sci. Technol., 24(3): 357-363.
 4. JONES, K. C.; de VOOGT, P. 1999. Persistent organic pollutants (POPs): state of the science. Environ. Pollut., 100: 209-221.
 5. Kennish, M.J. 1997. Practical Handbook of estuarine and marine pollution. Boca Raton, Florida
 6. Haines, P.A., Hendrickson, M.D. 2009 Polycyclic Aromatic Hydrocarbons: Pollution, Health Effects and Chemistry. Nova Science Publisher. Pp361.
 7. NRC, 2001. Oil in the sea III. Inputs, Fates, and Effects. The National Academic Press. 280pp
 8. Reemtsma, T.; Jekel, M 2006.Organic Pollutants in the Water Cycle: Properties, Occurrence, Analysis and Environmental Relevance of Polar Compounds. Wiley. 368 pp.
 9. Popeek, E. 2003. Sampling and Analysis of Environmental Chemical Pollutants. Academic Press. 356 pp
- Guide for laboratory experiments available on the USP course website
 - Assorted articles to be distributed in class

Student responsibilities:

- Students will be responsible for reading the assigned material by the date indicated in the schedule. They will also be responsible for completing homework assignments by the due date. A rate of 10%/day is taken off late homework. The students can be absent up to 15% of total classes taught during the trimester according to USP regiment.

Grading:

Laboratory reports: 50%

Exam: 25%

Seminar: 25%

Grading scale:

A	90.0-100.0	B	75.0-89.9	C	50.0-74.9	R	0-49.9
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R= Reprovado (Failed)

Calendar:

Week 1. Marine Pollution. Protocols and Indices

Week 2. Environmental aspects of organic pollutants

Week 3. Organic pollutants in the marine environment: distribution and fate.

Week 4. Sewage pollution and eutrophication

Week 5. Oil Pollution

Week 6. Persistent Organic Pollutants

Week 7. Plastics in marine environment

Week 8. Chlorofluorocarbons: the ozone layer and its role in dating and investigating deep ocean motions

Week 9. Oceanographic processes related to marine organic pollution

Week 10. Analysis of organic pollutants in environmental samples: hydrocarbons

Week 11. Analysis of organic pollutants in environmental samples: organochlorines

Week 12. Discussion of environmental data and seminars

Appendix V. Faculty CV's

CURRICULUM VITAE

(Feb 2018)

MARK A. ALTABET

Chair and Professor
Dept. of Ocean and Estuarine Sciences
School for Marine Science and Technology
University of Massachusetts Dartmouth
706 S. Rodney French Blvd.
New Bedford, MA 0744-1221
508-999-8622
maltabet@umassd.edu

EDUCATION

B.S.: Biological Sciences, S.U.N.Y. at Stony Brook; graduated Magna Cum Laude (1979).

Ph.D.: Harvard University (June, 1984).

Thesis title: ^{15}N Natural Abundance in Warm-Core Rings of the Gulf Stream: Studies of the Upper-Ocean Nitrogen Cycle.

Post-Doctoral Scholar: Woods Hole Oceanographic Institution (1984/1985)

PROFESSIONAL EXPERIENCE

Post-Doctoral Research Associate, Harvard University (summer, 1984).

Post-Doctoral Investigator, Woods Hole Oceanographic Institution (September, 1985 to February 1986).

Assistant Scientist, Woods Hole Oceanographic Institution (March 1986 to March 1990).

Associate Scientist, Woods Hole Oceanographic Institution (March 1990 to May, 1995).

Visiting Professor, Institute for Earth Sciences, The Hebrew University in Jerusalem (February to July 1993).

Associate Professor, University of Massachusetts, Dartmouth (June 1995 to August 2001)

Adjunct Associate Professor, University of Massachusetts, Amherst (July 1997 to 2012)

Adjunct Professor, Geological Sciences Dept., Brown University (Sept. 2001 to present)

Professor, University of Massachusetts, Dartmouth (Sept. 2001 to present)

AWARDS/FELLOWSHIPS/HONORS

3-year National Science Foundation graduate fellowship.

W.H.O.I. Postdoctoral Scholarship.

Invited Plenary Speaker: International Conference on Paleoceanography, Kiel 1992

Fulbright Scholar for 1993.

Invited Speaker; Goldschmidt Conference, Edinburgh 1994

Camille and Henry Dreyfus Foundation Award in Environmental Chemistry (1999)

Invited Speaker; International Conference on the Geochemistry of the Earth's Surface, Honolulu (2002)

Invited Speaker; Chemical Oceanography Gordon Research Conference on Chemical Oceanography (2003)

Session Chair; Gordon Research Conference on Organic Geochemistry (2003)

Turner Lecturer, U Michigan (2003)

Invited Speaker; Goldschmidt Conference on Geochemistry (2005)

Invited Speaker; Ocean Carbon Biogeochemistry Workshop, WHOI (2006)

Guest Scientist; IFM-GEOMAR (Sept. 2008)

Invited Speaker; Ocean Carbon Biogeochemistry Workshop, WHOI (2008)

Invited Speaker; Agouron Institute Nitrogen Symposium (2009)

Invited Speaker; Canadian Inst. for Advanced Research – Oceans Workshop (2010)

Visiting Scholar; Ocean University of China, Qingdao (2013)

Session Chair; Chemical Oceanography Gordon Research Conference on Chemical Oceanography (2015)

Visiting Scientist; Isotope Hydrology Laboratory, International Atomic Energy Agency, Vienna (2017)

RESEARCH INTERESTS

Nitrogen cycling in aquatic environments including microbial transformations.
Stable isotope biogeochemistry and ecology.
Environmental impacts of anthropogenic nitrogen
Ocean deoxygenation and hypoxia
Oceanic paleochemistry and paleoclimatology.
Atmospheric CO₂ and global warming

EXTERNAL PROFESSIONAL ACTIVITIES

Member of Editorial Board for *Marine Chemistry* (1991 to 2015).
Member of Editorial Board for *Organic Geochemistry* (2000 to 2005)
Steering Committee Member for Denitrification Methods Workshop, Horn Pt. MD, May 2008
Organizing Committee for NASA Astrobiology Inst. Ocean Deoxygenation Workshop, April 2010
Working Group Member for PAGES Nitrogen Cycle in the Ocean, Past and Present (2009 to 2014)
Senior Editor for *L&O Letters* (2016 to present)

GRADUATE STUDENTS AND POST-DOCS ADVISED AS PRIMARY

Students

Daniel Sigman
Matt McIlvin
Chawalit Charoenpong
Li-Tao Fu
Talya Gulman
Haibie Hu
Xinqun Wang
Enrique Montes
Santhiska Pather
Christeen Sheehan
Yishu Song
Lin Zhang
Shuo Chen
Sheel Prajapati

Post-Docs

Matt Higginson
David Timothy
Rajesh Agnihotri
Laura Bristow
Annie Bourbonnais

Bibliography - Mark A. Altabet

Mark Altabet is the author of 116 publications, 106 in peer-reviewed scientific journals, 26 of which have been published in AGU journal. According to Google Scholar, his publications have a citation h-index of 50;

<https://scholar.google.com/citations?user=1Jj7uyYAAAAJ&hl=en>

The following is a selected list.

(* - over 100 citation, ** - over 200 citations, *** - over 300 citations, **** - over 500 citations)

- *Altabet, M. A. and J. J. McCarthy, 1985. Temporal and spatial variations in the natural abundance of ^{15}N in PON from a warm-core ring. *Deep-Sea Res.*, **32**, 755-772.
- ***Altabet, M. A., 1988. Variations in nitrogen isotopic composition between sinking and suspended particles: Implications for nitrogen cycling and particle transformation in the open ocean. *Deep-Sea Res.*, **35**, 535-554.
- Altabet, M. A. and W. B. Curry, 1989. Testing models of past ocean chemistry using foraminiferal $^{15}\text{N}/^{14}\text{N}$. *Glob. Biogeochem. Cycles*, **3**, 107-119.
- **Altabet, M. A., W. G. Deuser, S. Honjo and C. Stienen, 1991. Seasonal and depth-related changes in the source of sinking particles in the North Atlantic. *Nature*, **354**, 136-139.
- *Francois, R., M. A. Altabet and L. H. Burckle, 1992. Glacial to interglacial changes in surface nitrate utilization in the Indian Section of the Southern Ocean as recorded by sediment ^{15}N . *Paleoceanography*, **7**, 589-606.
- *Francois, R., M. A. Altabet, R. Goericke, D. C. McCorkle, C. Brunet and A. Poisson, 1993. Changes in the ^{13}C of surface water particulate organic matter across the subtropical convergence in the S.W. Indian Ocean. *Glob. Biogeochem. Cycles*, **7**, 627-644.
- ****Altabet, M. A., and R. Francois, 1994. Sedimentary nitrogen isotopic ratio as a recorder for surface nutrient utilization. *Global Biogeochemical Cycles* **8**, 103-116.
- ***Altabet, M.A., R. Francois, D.W. Murray, and W.L. Prell, 1995. Climate-related variations in denitrification in the Arabian Sea from sediment $^{15}\text{N}/^{14}\text{N}$ ratio. *Nature*, **373**, 506-509.
- ***Sigman, D. M., M. A. Altabet, R. Michener, D. C. McCorkle, B. Fry and R. M. Holmes. (1997). Natural Abundance-level measurement of the nitrogen isotopic composition of oceanic nitrate: an adaptation of the ammonia diffusion method. *Mar. Chem.* **57**, 227-242.
- ***Francois, R., M. A. Altabet, E.-F. Yu, D. Sigman, M. P. Bacon, M. Frank, G. Barielle and L. Labeyrie. (1997). Contribution of Southern Ocean surface-water stratification to low atmospheric CO_2 during the last glacial period. *Nature.*, **389**, 929-935
- *Naqvi, S.W.A., T Yoshinari, D.A. Jayakumar, M. A. Altabet, P.V. Narvekar, A.H. Devol, J.A. Brandes, and L.A. Codispoti (1998) Budgetary and biogeochemical implications of N_2O isotope signatures in the Arabian Sea. *Nature*, **394**, 462-464.
- *Sigman, D.M., M.A. Altabet, R. Francois, D.C. McCorkle, J-F. Gaillard. (1999) The isotopic composition of diatom-bound nitrogen in Southern Ocean sediments. *Paleoceanography*, **14**, 118-134.
- ***Altabet, M.A., C. Pilskaln, R. Thunell, C. Pride, D. Sigman, F. Chavez and R. Francois, The nitrogen isotope biogeochemistry of sinking particles from the margin of the eastern North Pacific, *Deep-Sea Res.*, **46**, 655-679, 1999.
- *Sigman, D.M., M. A. Altabet, D. C. McCorkle, R. Francois, G. Fisher. The $\delta^{15}\text{N}$ of nitrate in the southern ocean I: Consumption of nitrate in surface waters *Global Biogeochem. Cycles*, **13**, 1149-1166, 1999.
- *Altabet, M.A., D.W. Murray and W.L. Prell, Climate-linked variations in Arabian Sea denitrification over the last 1 m.y.: Implications for the marine N cycle, *Paleoceanogr.*, **14**, 732-743, 1999.
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- Zhang, L., M. A. Altabet, T. Wu, and O. Hadas (2007) Sensitive Measurement of $\text{NH}_4^+ \text{ }^{15}\text{N}/^{14}\text{N}$ ($\delta^{15}\text{N}$) at natural abundance levels in fresh and saltwaters *Anal. Chem.* 79: 5297-5303.
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- Altabet, M.A., E. Ryabenko, L. Stramma, D. Wallace, M. Frank, P. Grasse, and G. Lavik (2012) An Eddy-Stimulated Hotspot for Fixed Nitrogen-Loss from the Peru Oxygen Minimum Zone *Biogeosciences*, 9, 4897–4908, doi:10.5194/bg-9-4897-2012
- Montes, E., M. A. Altabet, F. Muller-Karger, M. I. Scranton, R. Thunell, Cl. Benitez-Nelson, L. Lorenzoni, Y. Astor (2013) Biogenic nitrogen gas production at the oxic-anoxic interface in the Cariaco Basin, Venezuela. *Biogeosciences*, 10, 267–279, doi:10.5194/bg-10-267-2013
- Bryant Mason, A., Y. J. Xu, and M.A. Altabet. (2013) Limited capacity of river corridor wetlands to remove nitrate - A case study on the Atchafalaya River Basin during the 2011 Mississippi River Flooding. *Water Resour. Res.*, 49, doi:10.1029/2012WR012185.
- Pather, S., C. A. Pfister, D. M. Post and M.A. Altabet (2014) Ammonium cycling in the rocky intertidal: Remineralization, removal, and retention. *Limnology and Oceanography* 59, 361–372
doi:10.4319/lo.2014.59.2.0361
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- Charoenpong, C., L.A. Bristow, and M.A. Altabet (2014) A continuous flow isotope ratio mass spectrometry method for high precision determination of dissolved gas ratios and isotopic composition *Limnology and Oceanography Methods* 12, 323-337.
- Bourbonnais, A., M. A. Altabet, C.N. Charoenpong, J.Larkum, H. Hu, H. W. Bange and L. Stramma. (2015) N-loss isotope effects in the Peru oxygen minimum zone studied using a mesoscale eddy as a natural experiment *Global Biogeochemical Cycles* 29, 793–811, doi:10.1002/2014GB005001
- Hu, H., A. Bourbonnais, J. Larkum, H. Bange, and MA Altabet Nitrogen cycling in shallow low oxygen coastal waters off Peru from nitrite and nitrate nitrogen and oxygen isotopes. *Biogeosciences* 13, 1453-1468, 2016, <http://www.biogeosciences.net/13/1453/2016/>, doi:10.5194/bg-13-1453-2016
- Bourbonnais, A., R. T. Letscher, H. W. Bange, V. Échevin, J. Larkum, J. Mohn, N. Yoshida, and M. A. Altabet (2017), N_2O production and consumption from stable isotopic and concentration data in the Peruvian coastal upwelling system, *Global Biogeochem. Cycles*, 31, 678–698, doi:10.1002/2016GB005567

CURRICULUM VITA

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1. Higher Education

Ph.D. in Oceanography, June 1971: Massachusetts Institute of Technology; Cambridge, MA.
M.S. in Engineering (Fluid Mechanics), June 1967: Brown University; Providence, RI.
B.S. in Engineering (aerospace option) with honors, June 1965: Brown University; Providence, RI.

2. Academic Positions

2000-	Professor: School of Marine Science & Technology (SMAST), University of Massachusetts, Dartmouth (UMassD)
1987-00	Professor: Dept. of Earth Sciences, University of New Hampshire
1979-87	Associate Professor: Dept. of Earth Sciences, University of New Hampshire
1974-79	Assistant Professor: Dept. of Earth Sciences, University of New Hampshire

3. Other Positions

2000-	Director, SMAST OCEAN Observation Laboratory
2005-09	Chair, Dept. of Estuarine and Ocean Sciences/ SMAST/UMassD
2000-05	Program Chair, UMassD School of Marine Science and Technology
1983-00	Director, UNH Ocean Process Analysis Laboratory
1998-00	Chair, UNH Marine Program Executive Committee
1997-98	Visiting Scholar: Thayer School for Engineering, Dartmouth College, Hanover, NH
1995-96	Chair, UNH Marine Program Executive Committee
1992-93	Chair, UNH Marine Program Executive Committee
1992-00	Director, Marine Program Center for Ocean Sciences
1988-89	Visiting Scholar: Dept. of Earth and Planetary Sciences, Harvard University
1984-86	Associate Director, UNH Marine Program
1983, 1985	Acting Director, UNH Marine Program
1981-82	Visiting Scholar: Center for Coastal Studies, Scripps Institution of Oceanography
1971-74	Assistant Research Oceanographer: IGPP, University of California, San Diego
1966-71	Research Assistant: Dept. of Meteorology, Massachusetts Institute of Technology
1965-66	Ford Foundation Research Assistant, Dept. of Engineering, Brown Univ., Providence, RI

4. Academic and Professional Honors and Fellowships

A. Publications: Book Chapters

- 1) **Brown, W.S.**, 2014. "Elements of Physical Oceanography", Chapter 1 in *Springer Handbook of Ocean Engineering*, Part A Ocean Engineering Science, Editors M. Dhanak and N. Xiros, ISBN 978-3-319-16649-0; <https://www.springer.com/us/book/9783319166483>
- 2) **Brown, W.S.**, 2014. "Physical Properties of Seawater", Chapter 5 in *Springer Handbook of Ocean Engineering*, Part A Ocean Engineering Science, Editors M. Dhanak and N. Xiros, ISBN 978-3-319-16649-0; <https://www.springer.com/us/book/9783319166483>
- 3) Irish, J.D. and **W.S. Brown**, 1990. "The Environment", Chapter III in *Submersible Vehicle Systems Design*, edited by E.E. Allmendinger, Soc. Naval Architects & Marine Engineers, Jersey City, N.J., pp. 425.

B. Publications: Refereed Journals (most recent 20 of 38)

- 1) **Brown, W.S.**, and G. M. Marques, 2012. Transient tidal eddy motion in the western Gulf of Maine, part 1: Primary structure, *Continental Shelf Research*, <http://dx.doi.org/10.1016/j.csr.2012.08.018>.
- 2) Marques, G., and **W.S. Brown**, 2012. Tidal eddy motions in the western Gulf of Maine, part 2: Secondary flow, *Continental Shelf Research*, doi:10.1016/j.csr.2012.02.008.
- 3) **Brown, W.S.**, 2011. Winter variability in the western Gulf of Maine, part 1: internal tides, *Dynamics of the Atmosphere and Oceans*, 42, 224-249.
- 4) Schofield, O., S. Glenn, J. Orcutt, M. Arrott, M. Meisinger, A. Gangopadhyay, **W. S. Brown**, R. Signell, M. Moline, Y. Chao, S. Chien, D. Thompson, A. Balasuriya, P. Lermusiaux, and M. Oliver, 2011. Automated sensor network to advance ocean science. *EOS.Trans.AGU*, 91(39), 345-46.
- 5) Roarty, H., S. Glenn, J. Kohut, D. Gong, E. Handel, E. Rivera, T. Garner, L. Atkinson, **W. S. Brown**, C. Jakubiak, M. Muglia, S. Haines, and H. Seim, 2010a. Operation and Application of a Regional HF Radar Network in the Mid-Atlantic Bight. *Marine Technology Society Journal*, 44(6), 133-145.
- 6) Schofield, O., J. Kohut, S. Glenn, J. Morell, J. Corredor, J. Orcutt, M. Arrott, I. Krueger, M. Meisinger, C. Peach, F. Vernon, A. Chave, Y. Chao, S. Chien, D. Thompson, **W. S. Brown**, M. Oliver, and W. Boicourt, 2010. A regional Slocum glider network in the Mid-Atlantic coastal waters leverages broad community engagement. *Marine Technology Society Journal*, Vol. 44(6), 185-195.
- 7) **Brown, W. S.**, A. Gangopadhyay, F. L. Bub, Z. Yu and G. Strout, and A. R. Robinson, 2007a. An operational circulation modeling system for the Gulf of Maine/Georges Bank region, Part 1: The basic elements, *IEEE Journal of Oceanic Engineering*, 32(3), 807-822.
- 8) **Brown, W. S.**, A. Gangopadhyay, and Z. Yu, 2007b. An operational circulation modeling system for the Gulf of Maine/Georges Bank region, Part 2: Applications, *IEEE Journal of Oceanic Engineering*, 32(3), 823-838.
- 9) Fan, Y., **W. S. Brown**, and Z. Yu, 2005. Model Simulations of the Gulf of Maine Response to Storm Forcing, *Journal of Geophysical Research*, 110, C04010, doi:10.1029/2004JC002479.
- 10) Erturk, S.N., A. Bilgili, M.R. Swift, **W.S. Brown**, B. Celikkol, J.T.C. Ip, and D.R. Lynch, 2002. Simulation of the Great Bay Estuarine System: Tides with Tidal Flats Wetling and Drying, *Journal of Geophysical Research*, 107 (C5), 101029/2001JC000883.
- 11) Mupparapu, P., and **W.S. Brown**, 2002. Role of Convection in Winter Mixed Layer Formation in the Gulf of Maine, February 1987, *Journal of Geophysical Research*, 107(C12), 3229, doi: 10.1029/1999JC000116.
- 12) da Silveira, I., **W.S. Brown**, and G. R. Flierl, 2000. Dynamics of the North Brazil current retroflexion region from WESTRAX Observations, *Journal of Geophysical Research*, 105, C12, 28559-28583.
- 13) daSilveira, I., G.R. Flierl and **W.S. Brown**, 1999. Dynamics of separating western boundary currents , *Journal of Physical Oceanography*, 29 (2),119-144.
- 14) **Brown, W.S.**, 1998. Wind-forced pressure response of the Gulf of Maine, *Journal of Geophysical Research*, 103 (C13), 30,661-30,678.
- 15) Bub, F.L., and **W.S. Brown**, 1996. Intermediate layer water masses in the western tropical Atlantic Ocean, *Journal of Geophysical Research*, 101 (C5), 11903-11922.
- 16) da Silveira, I.C.A., L.B. de Miranda and **W.S. Brown**. 1994. On the origins of the North Brazil current, *Journal of Geophysical Research*, 99 (C11), 22501-22512.
- 17) Richardson, P.L., G.E. Hufford, R. Limeburner and **W.S. Brown**, 1994. North Brazil current retroflexion eddies, *Journal of Geophysical Research*, 99 (C3), 5081-5093.
- 18) **Brown, W.S.**, and J.D. Irish, 1993. The annual variation of water mass structure in the Gulf of Maine, *Journal of Marine Research*, 51, 53-107.
- 19) **Brown, W.S.**, and J.D. Irish, 1992. The annual evolution of geostrophic flow in the Gulf of Maine, *Journal of Physical Oceanography*, Vol. 22, No. 5, 445-473.
- 20) **Brown, W.S.**, W. Johns, E. Katz, K. Leaman, J. McCreary, R. Molinari, P. Richardson, and C. Rooth, 1992. A Western Tropical Atlantic Experiment (WESTRAX), *Oceanography*, 5, 73-77.

Curricular Materials

A. Graduate Courses

UMassD

MAR 555 - <u>Introductory Physical Oceanography</u>	(Fall 2010-12)
MAR 520 - <u>Thesis Proposal Development Seminar</u>	(Spring 2008-18)
MAR 670 - <u>Adv. Time Series Analysis of Ocean Data</u>	(2008, 2012, 2017)

UNH

ESCI 758 - Introductory Physical Oceanography	(yearly 1976-1994)
ESCI 860 - Ocean Circulation	(occasionally)
ESCI 958 - Introductory Dynamical Oceanography	(bi-yearly 1994-1998)
ESCI 959 - Data Analysis Methods for... Ocean Sciences	(bi-yearly 1989-1999)

B. Graduate Degree Student Advisees (since 1993)

- 1) Richard Arena, PhD. Marine Sciences and Technology, Department of Estuarine and Ocean Sciences, School for Marine Science and Technology, University of Massachusetts Dartmouth, UMass School of Marine Sciences and Technology, expected June 2020.
- 2) Kathryn Tremblay, M.S. Marine Sciences and Technology, Department of Estuarine and Ocean Sciences, School for Marine Science and Technology, University of Massachusetts Dartmouth, UMass School of Marine Sciences and Technology, expected May 2019.
- 3) Gustavo Marques, M.S. Marine Sciences and Technology, Department of Estuarine and Ocean Sciences, School for Marine Science and Technology, University of Massachusetts Dartmouth, UMass School of Marine Sciences and Technology, May 2010.
- 4) Zhitao Yu, M.S. Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, September 2000. Thesis Area: "The Role of Surface Wave/Current Induced-Bottom Stress on Sediment Resuspension on an Estuarine Tidal Flat".
- 5) Yalin Fan, M.S. Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, May 2000. Thesis Area: "The Role of Surface Wave/Current-Induced Bottom Stress on the Response of the Coastal Ocean to Storm Forcing".
- 6) Samuel Miller, M.S. Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, May 1999. Thesis Area: "A Study of Air-Sea Heat Flux in the Formation of Gulf of Maine Winter Water".
- 7) Prashant Mupparapu, MS Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, May 1999. Thesis Title: "Role of Convection in the Winter Gulf of Maine Mixed Layer Formation".
- 8) Hui Feng, M.S. in Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, December 1996. Thesis Title: "Wind-Induced Responses of the Western Gulf of Maine during Spring and Summer".
- 9) Ilson Carlos da Silveira, Ph.D. in Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, May 1996. Dissertation Title: "Meandering and Eddy Formation in Separating Western Boundary Currents".
- 10) John P. Wallinga, M.S. in Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, May 1995. Thesis Title: "On the Internal Semidiurnal Tide in Stellwagen Basin".
- 11) Frank L. Bub, Ph.D., Ph.D. in Earth Sciences/Oceanography Option, Department of Earth Sciences, University of New Hampshire, December 1993. Dissertation Title: "The Structure of Water Mass, Salt, and Temperature Transports within the Intermediate Depths of the Western Tropical Atlantic Ocean".

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EDUCATION

- Ph.D. 2003, University of Rhode Island, Kingstown Rhode Island; Fisheries Science
- M.S. 1995, University of Massachusetts, Dartmouth Massachusetts; Marine Biology
- B.S. 1985, Long Island University, Southampton New York; Marine Science/Biology

PROFESSIONAL EXPERIENCE

- Professor University of Massachusetts, Dartmouth; School for Marine Science & Technology, Fairhaven, MA June 2010 to present. Chair of the Department of Fisheries Oceanography, 2016-present.
- Director, NOAA/UMass Cooperative Marine Education and Research Program School for Marine Science and Technology, New Bedford Massachusetts; September 2005 to June 2010.
- Research Fisheries Biologist Population Dynamics Branch, Northeast Fisheries Science Center, Woods Hole Massachusetts; September 1996 to September 2005.
- Marine Fisheries Biologist Massachusetts Division of Marine Fisheries, Sandwich Massachusetts; January 1988 to September 1996.

AWARDS

- 2017 International Council for the Exploration of the Seas (ICES) Service Award for co-chairing the Strategic Initiative on Stock Assessment Methods
- 2015 ICES Service Award for chairing the ICES Training Program
- 2010 Award of Excellence from the American Fisheries Society's Southern New England Chapter for outstanding contributions to the fields of fisheries research and education.
- 2009 Joint Ocean Commission Initiative, Marc J. Hershman Excellence in Mentoring Inaugural Award

SELECTED PUBLICATIONS

- Brodziak J, SX Cadrin, CM Legault & SA Murawski 2008 Goals and strategies for rebuilding New England groundfish stocks. *Fisheries Research* 94: 355–366.
- Cadrin SX 1995 Discrimination of American lobster stocks off southern New England based on secondary sex character allometry. *Canadian Journal of Fisheries and Aquatic Science* 52: 2712-2723.
- Cadrin SX 2000 Advances in morphometric analysis of fish stock structure. *Reviews in Fish Biology and Fisheries* 10: 91-112.
- Cadrin SX 2000 Evaluating two assessment methods for Gulf of Maine northern shrimp based on simulations. *Journal of Northwest Atlantic Fisheries Science* 27: 119-132.
- Cadrin SX 2010 Interdisciplinary Analysis of Yellowtail Flounder Stock Structure off New England. *Reviews in Fisheries Science* 18: 281–299.
- Cadrin SX, M Bernreuther, AK Daniélsdóttir, E Hjörleifsson, T Johansen, L Kerr, K Kristinsson, S Mariani, K Nedreaas, C Pampoulie, B Planque, J Reinert, F Saborido-Rey, T Sigurdsson & C Stransky 2010 Population Structure of beaked redbfish, *Sebastes mentella*: evidence of divergence associated with different habitats. *ICES Journal of Marine Science* 67: 1617–1630.
- Cadrin SX, JA Boutillier & JS Idoine 2004 A hierarchical approach to determining reference points for Pandalid shrimp. *Canadian Journal of Fisheries and Aquatic Sciences* 61: 1373-1391.
- Cadrin SX, SH Clark, D Schick, D McCarron & MP Armstrong 1999 Application of catch-survey models to the northern shrimp fishery in the Gulf of Maine. *North American Journal of Fisheries Management*. 19: 551-568.

- Cadrin SX & KD Friedland 1999 The utility of image processing techniques for morphometric analysis and stock identification. *Fisheries Research* 43: 129-139.
- Cadrin SX, LA Kerr & S Mariani 2014 *Stock Identification Methods: applications in fisheries science*, 2nd Ed. Elsevier Academic Press. 566p.
- Cadrin SX & M Pastoors 2008 Precautionary harvest policies and the uncertainty paradox. *Fisheries Research* 94: 367-372.
- Cadrin SX & DH Secor 2009 Accounting for spatial population structure in stock assessment: past, present and future. pp. 405-426 in BJ Rothschild & R Beamish, eds. *The Future of Fishery Science in North America*. Springer Verlag.
- Cadrin SX & VM Silva 2005 Morphometric variation of yellowtail flounder. *ICES Journal of Marine Science* 62: 683-694.
- DeCelles GR & SX Cadrin 2011 An interdisciplinary assessment of winter flounder (*Pseudopleuronectes americanus*) stock structure. *J. Northwest Atl. Fishery Science* 43: 103–120.
- Deroba JJ, DS Butterworth, RD Methot Jr, J De Oliveira, C Fernandez, A Nielsen, S Cadrin, M Dickey-Collas, CM Legault, J Ianelli, JL Valero, C Needle, JM O'Malley, Y-J Chang, GG Thompson, C Canales, DP Swain, DCM Miller, NT, Hintzen, M Bertignac, L Ibaibarriaga, A Silva, A Murta, L Kell, CL de Moor, A Parma, C Dichmont, V Restrepo, Y Ye, E Jardim, J Blaylock & M Mood 2015. Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Methods. *ICES JMS* 72: 19-30.
- Goethel D, TJ Quinn II & SX Cadrin 2011 Incorporating spatial structure in stock assessment: movement modeling in marine fish population dynamics. *Reviews in Fisheries Science* 19:119–136.
- Jacobson LD, SX Cadrin & JR Weinberg 2002 Tools for estimating surplus production and F_{MSY} in any stock assessment model. *North American Journal of Fisheries Management* 22: 326-338.
- Kerr LA, SX Cadrin & DH Secor 2010 The role of spatial dynamics in the stability, resilience, and productivity of an estuarine fish population. *Ecological Applications* 20: 497-507.
- Kerr LA, SX Cadrin & DH Secor 2010 Simulation modeling as a tool for examining the consequences of spatial structure and connectivity to local and regional population dynamics. *ICES J. Marine Science* 67: 1631-1639.
- O'Keefe CE, SX Cadrin & K D Stokesbury 2013. Evaluating effectiveness of time/area closures, quotas/caps and fleet communications to reduce fisheries bycatch. *ICES J Mar Sci* 71: 1286-1297.
- Secor DH, LA Kerr & SX Cadrin 2009 Connectivity effects on productivity, stability, and response diversity in an Atlantic herring metapopulation. *ICES Journal of Marine Science* 66: 1726–1732.

RECENT COURSES TAUGHT

- Fishery Management (MAR527)
- Stock Assessment of Fishery Resources (MAR545)
- Field Methods for Fisheries Research (MAR 580)
- Science Communication for Research Scientists (MAR580)
- Advanced Statistical Analysis (MAR596)
- Advanced Population Modeling (MAR599)
- Stock Identification Methods (MAR622)

GRADUATE STUDENT ADVISEES

- Advised 23 graduates (7 PhD and 16 MS)
- Currently advising 10 graduate students (8 PhD and 2 MS)
- Supervised 8 undergraduate interns
- Supervised 7 postdoctoral researchers
- Graduate committee member for 35 graduate students (17 PhD and 18 MS)
- Graduate committee member for 11 graduate students (8 PhD and 3 MS)

Changsheng Chen

Montgomery Charter Chair Professor
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Education:

M.S., Ocean University of Qingdao, Qingdao, P.R. China (Marine Meteorology), 1983
M.S., Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program (Physical Oceanography), 1989
Ph.D., Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program (Physical Oceanography), 1992

Positions:

Montgomery Charter Chair Professor, 2014-present, Professor, 2001-2014: School for Marine Science and Technology, University of Massachusetts-Dartmouth; Adjunct Scientist, 2001-present: Department of Physical Oceanography, Woods Hole Oceanographic Institution (WHOI); Associate Professor with tenure, 1999-2001, Assistant Professor, 1994-1999: Department of Marine Sciences, University of Georgia; Assistant Research Scientist, 1992-1994: Department of Oceanography, Texas A&M University, Postdoctoral Investigator, 1992: Department of Physical Oceanography, Woods Hole Oceanographic Institution; Research Assistant, 1986-1992: Department of Physical Oceanography, Woods Hole Oceanographic Institution; Lecturer, 1983-1986: Department of Marine Meteorology and Oceanography, Ocean University of Qingdao, China.

Products (<http://www.fvcom.smast.umassd.edu/medm-publications/>):

- Chen, C., G. Gao, Y. Zhang, R. C. Beardsley, Z. Lai, J. Qi and H. Lin. 2016. Circulation in the Arctic Ocean: Results from a high-resolution coupled ice-sea nested Global-FVCOM and Arctic-FVCOM system. *Progress in Oceanography*. 141 (2016), 60-80, doi: 10.1016/j.pocean.2015.12.002.
- Zhang, Y., C. Chen, R. C. Beardsley, G. Gao, Z. Lai, B. Curry, C. M. Lee, H. Lin, J. Qi, and Q. Xu, 2016. Studies of the Canadian Arctic Archipelago water transport and its relationship to basin-local forcings: Results from AO-FVCOM. *Journal of Geophysical Research: Oceans*. doi:10.1002/2016JC011634., 121.
- Zhang, Y., C. Chen, R. C. Beardsley, G. Gao, J. Qi and H. Lin, 2016. Seasonal and Interannual Variability of the Arctic Sea Ice: A Comparison between AO-FVCOM and Observations. *Journal of Geophysical Research: Oceans*, in press.
- Sun, Y, C. Chen, R. C. Beardsley, D. Ullman, B. Butman and H. Lin, 2016. Surface circulation in Block Island Sound and adjacent coastal and shelf regions: A FVCOM-CODAR comparison. *Progress in Oceanography*. 143 (2016), 26–45.
- Li, Yun, P. S. Fratantoni, C. Chen, J. A. Hare, Y. Sun, R. C. Beardsley and R. Ji, 2015. Spatio-temporal patterns of stratification on the Northwest Atlantic shelf. *Progress in Oceanography*, 134, 123–137.
- Chen, C.**, Z. Lai, R. C. Beardsley, J. Sasaki, J. Lin, H. Lin, R. Ji and Y. Sun, 2014. The March 11, 2011 Tōhoku M9.0 Earthquake-induced Tsunami and Coastal Inundation along the Japanese Coast: A Model Assessment, *Progress in Oceanography*, 123, 84-104.

- Tian, R., **C. Chen**, J. Qi, R. Ji, R. C. Beardsley and C. Davis, 2014. Model study of nutrient and phytoplankton dynamics in the Gulf of Maine: patterns and drivers for seasonal and interannual variability, *ICES Journal of Marine Science*, doi: 10.1093/icesjms/fsu090.
- Chen, C.** R. C. Beardsley, R. A. Luettich Jr, J. J. Westerink, H. Wang, W. Perrie, Q. Xu, A. S. Dohahue, J. Qi, H. Lin, L. Zhao, P. Kerr, Y. Meng and B. Toulany, 2013. Extra tropical storm inundation testbed: intermodal comparisons in Scituate, Massachusetts, *Journal of Geophysical Research*, 118, doi:10.1002/jgrc.20397.
- Beardsley, R. C., **C. Chen** and Q. Xu, 2013. Coastal flooding in Scituate (MA): a FVCOM study of the Dec. 27, nor'easter, *Journal of Geophysical Research*, 118, doi: 10.1002/2013JC008862.
- Sun, Y., **C. Chen**, R. C. Beardsley, Q. Xu, J. Qi, and H. Lin (2013), Impact of current-wave interaction on storm surge simulation: A case study for Hurricane Bob, *Journal of Geophysical Research* 118, 2685-2701, doi:10.1002/jgrc.20207.

Synergistic Activities:

I am leader of the Marine Ecosystem Dynamics Modeling Research Laboratory, School for Marine Science and Technology, UMASS, with research interests in modeling and observational exploration of ocean circulation, oceanic frontal processes, and biological/physical interaction. Collaborated with R. C. Beardsley, my co-workers and I have developed an innovative unstructured grid, Finite-Volume Community Ocean Model (FVCOM). This model is widely used by ocean communities with applications to academic research and coastal environmental managements. My recent research is focused on global-basin-shelf-estuarine multi-scale modeling, ocean-ice interactions in the Arctic, tsunamis, and coastal inundations.

Graduate Advisor: Robert C. Beardsley (WHOI)

Collaborators (during the Last 48 Months): R. C. Beardsley (WHOI), J. Churchill (WHOI), C. Davis (WHOI), R. Ji (WHOI), C. Li (LSU), D. Limeburner (WHOI), R. Luettich (UNC), W. Perrie (BIO), A. Proshutinsky (WHOI), P. Rizzoli (MIT), B. Rothschild (UMASSD), J. Runge (UNH), D. Townsend (U. of Maine), H. Wang (VIMS), J. J. Westerink (U. of Notre Dame), J. Zhang (UW), J. Wang (NOAA-GLERL)

Graduate Advisors: L. Zheng (S. Florida Univ.), R. Ji (WHOI), S. Hu (SHOU, China), Z. Lai (Sun Yat-Sen Univ., China), Allen Wu (FIO, China), J. Ge (ECNU, China), P. Xue (MIT), G. Gao (SHOU, China), T. Terui (Hokkaido Univ., Japan), Y. Sun (MIT), J. Boucher (NOAA), Y. Ding (OUC, China).

Postdoctoral Investigators Sponsored or Co-Sponsored (within the last 5 years): H. Huang (2006-2009) (LSU), T. Kim (2010-2011) (SNU, Korea), J. Wei (2008-2010) (MIT/Beijing Univ., China), Z. Lai (2010-2011) (Sun Yat-Sen Univ., China), Yun Li (2012-present) (WHOI), Y. Zhang (SHOU, China).

Geoffrey W. Cowles

CURRICULUM VITAE

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CONTACT INFORMATION

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email: gcowles@umassd.edu

HIGHER EDUCATION

Ph.D., Mechanical and Aerospace Engineering, Princeton University, Princeton, New Jersey (1996-2001)
Major: Mechanical & Aerospace Engineering
Date Conferred: June 2001
Thesis: *A Parallel Viscous Multiblock Flow Solver for Free Surface Flows Past Complex Geometries*
Thesis Advisor: Dr. Luigi Martinelli

M.A., Mechanical and Aerospace Engineering, Princeton University, Princeton, New Jersey (1994-1996)
Major: Mechanical & Aerospace Engineering
Date Conferred: June 1996
Advisor: Dr. Luigi Martinelli

B.S. with Honors, Mechanical Engineering, Cornell University, Ithaca, NY (1991-1994)
Major: Mechanical Engineering
Date Conferred: June, 1994
Senior Project: *Aerodynamic Force Calculations for a Rigid Wingsail*

PROFESSIONAL EXPERIENCE

University of Massachusetts Dartmouth, New Bedford, MA

Professor (Assistant, Associate), School for Marine Science and Technology Sep 2007 - present

Initiated research program focused on computational methods in marine sciences. Research topics include marine renewable energy, high performance computing, numerical modeling of coastal and estuarine and systems, and coupled biophysical studies. Developed a wide variety of codes including a block-structured adaptive mesh refinement solver for the shallow water equations, a GPU-accelerated particle tracker, and several modules of the open source ocean model FVCOM. Lab supported through competitive awards from DOE, NSF, ONR, NOAA, and Sea Grant.

Research Scientist, School for Marine Science and Technology Jun 2004 - Sep 2007

Executed multiyear simulation of circulation in the Gulf of Maine using the parallelized Finite Volume Community Ocean Model (FVCOM) code. Constructed a parallel performance model for FVCOM to evaluate the influence of hardware specifications on scalability and throughput to improve component selection. Benchmarked performance and scalability of FVCOM on a range of shared and distributed memory high performance computing systems. Performed validation studies for regional ocean model hindcasts on the New England Shelf. Implemented a sediment model and an interface to the General Ocean Turbulence Model into the FVCOM code. Organized two workshops focused on training scientists to use FVCOM.

Postdoctoral Assistant, School for Marine Science and Technology May 2003 - June 2004

Designed and implemented an efficient parallelization for the FVCOM code using a Single Program Multiple Data Approach and the MPI Message Passing Libraries. Enhanced the usability and portability of the FVCOM code with allocatable memory, migration to Fortran 95/03, and structural reorganization. Solicited and evaluated hardware solutions for the SMAST HPCC (\$500K).

École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Postdoctoral Assistant, Department of Mathematics

Aug 2001 - Sep 2002

Performed free surface simulations using software written during Ph.D. thesis to analyze and rank hull shapes for the Swiss America's Cup Challenge (Alinghi). Examined hydrodynamic effects of localized hull modifications to better understand performance tradeoffs over a range of hull speeds. Performed hydrodynamic simulations and analysis of complex geometries in conjunction with the appendage shape optimization process of the Alinghi design team. Evaluated capabilities of a commercial flow solver to compute ship resistance in the presence of a free surface. Implemented algorithms to maintain accurate computation of ship resistance in the presence of breaking bow waves.

Princeton University, Princeton, NJ

Graduate Student, Mechanical and Aerospace Engineering

Sep 1994 - Jun 2001

Wrote software for the efficient simulation of viscous flow around ships for use on parallel computing platforms using MPI. Ported code to Naval research facilities and trained operators in its utilization. Developed and implemented efficient adjoint-based optimization methods for shape design in turbulent incompressible flows. Provided management and academic support for three undergraduate senior thesis projects and one M.S. thesis in numerical analysis.

EXAMPLE
JOURNAL
PUBLICATIONS
(†ADVISEE)

Haak, C., Cowles, G.W., and Danylchuk, A. (in press). Wave and tide-driven hydrodynamic flows act on multiple scales to shape the distribution of a juvenile fish (*albula vulpes*) in tropical nearshore habitats. *Limnology and Oceanography*

Cowles, G.W., †Hakim, A., and Churchill, J. (2017) A comparison of numerical and analytical predictions of the tidal stream power resource of Massachusetts, USA. *Renewable Energy*, 114A, 215-228.

†Liu, C., Cowles, G. W., Zemeckis, D. R., Cadrin, S. X., and Dean, M. J. (2017) Validation of a hidden Markov model for the geolocation of Atlantic cod. *Canadian Journal of Fisheries and Aquatic Sciences*, 74, 1862-1877.

Ralston, D. K., Cowles, G. W., Geyer, W. R., and Holleman, R. C. (2017) Turbulent and numerical mixing in a salt wedge estuary: dependence on grid resolution, bottom roughness, and turbulence closure. *Journal of Geophysical Research*, 122, 692-712.

Cowles, G.W., A Block-Structured adaptive mesh refinement solver for morphodynamic modeling *Journal of Coastal Research*, 29, 727-735.

Helenbrook, B.T. and G. Cowles (2008). Preconditioning for dual-time-stepping simulations of the shallow water equations including Coriolis and bed friction effects. *Journal of Computational Physics*, 227, 4425-4440.

Cowles, G. (2008). Parallelization of the FVCOM coastal ocean model. *International Journal of High Performance Computing Applications*, 22, 177-193.

Chen, C., R.C. Beardsley, and G. Cowles (2006). An unstructured grid finite-volume coastal ocean model system. *Oceanography*, 19, 78-89.

FUNDING
RECEIVED
AS PI

Mass CEC / MRECo: Phase 1 Feasibility Study for Muskeget Channel. UMD Budget: \$3,876. Aug 1, 2017 - Aug 1, 2018.

NOAA Saltonstall-Kennedy: Using archival tagging data to develop geolocation methodologies for North Atlantic groundfish: application to Atlantic cod, yellowtail flounder, and monkfish. UMD Budget: \$131,491. Sep 1, 2015 to Sep 1, 2018.

NSF: Collaborative Research: A multi-scale approach for optimizing tidal kinetic energy extraction for sustainable power generation. UMD Budget \$ 228,815. Sep 1, 2013-Sep 1, 2017.

ONR. Tidal Flats DRI: An investigation of the dynamical processes influencing sediment transport and morphological change in Skagit Bay using an unstructured grid coastal ocean model. UMD Budget: \$115K. Feb 1, 2008 - Jan 31,2010.

MIT Sea Grant. An assessment of the resource and potential impacts of extraction of tidal kinetic energy off the Massachusetts Coast. Mar, 2009-Mar, 2011. UMD Budget: \$225K

ONR. Tidal Flats DRI: An investigation of the influence of waves on sediment processes in Skagit Bay using an unstructured grid model. UMD Budget: \$115K. Oct 1, 2010- Sep 30, 2012.

TEACHING Graduate Courses taught at UMass Dartmouth

- Ecological Mechanics MAR599 (F2018)
- Quantitative Methods in Marine Science MAR514 (F2008-F2016)
- Fundamentals of Flight MAR599/MNE490 (S2015,S2017)
- Introductory Physical Oceanography MAR555 (F2008-F2018)
- Marine Hydrodynamics & Propulsion MAR599/MNE436 (S2013,S2014,S2016,F2017)
- Marine Ecosystem Modeling MAR524 (S2008,S2009,S2012)

ADVISORS	Advisor	Affiliation	Position
	Luigi Martinelli	Princeton University, Princeton, NJ	Ph.D.
	Alfio Quarteroni	École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland	Postdoc
	Changsheng Chen	UMass Dartmouth, Dartmouth, MA	Postdoc

ADVISEES Current and Former Graduate Students Advised

Student	Program	Degree	Status
Jack Hanson	MNE	M.S.	Current
Marc Carreira	MNE	M.S.	Current
Flynn Casey	IMS	M.S.	Current
Angela Murray	MNE	M.S.	Current
Anthony Ucci	MNE	Ph.D.	Current
Chang Liu	IMS	Ph.D.	Current
Mohammad Hasan	MNE	M.S.	Graduated
Ara Hakim	IMS	M.S.	Graduated
Chang Liu	IMS	M.S.	Graduated
Yeonkil Jung	IMS	M.S.	Graduated

ACADEMIC AND PROFESSIONAL HONORS Entrepreneurship Certificate: CREATE center, EPFL, Lausanne, Switzerland, 2002
Guggenheim Fellowship, Princeton University, 1994-1995
Elected member of IITΣ Mech. Engineering Honor Society, Cornell University, 1993-1994
All-Ivy Academic Athletic Award, Cornell University, 1993 and 1994
Varsity Athlete, Heavyweight Rowing, Cornell University, 1990-1994

CURRICULUM VITAE

Gavin Fay

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HIGHER EDUCATION

Ph.D. University of Washington, 2004-2012, Aquatic and Fishery Sciences, conferred 2012.
M.S. University of Washington, 2001-2004, Aquatic and Fishery Sciences, conferred 2004.
BSc University of Stirling, 1996-2000. Marine Biology with Honors, conferred 2000.

EXPERIENCE

A. Teaching

University of Massachusetts Dartmouth, 2014-present, Assistant Professor, Department of Fisheries Oceanography.

B. Other

University of Massachusetts Dartmouth, 2014, Postdoctoral Research Associate, School for Marine Science & Technology.

Integrated Statistics / NOAA National Marine Fisheries Service, 2011-2014, Postdoctoral Research Associate, Ecosystem Assessment Program.

Commonwealth Scientific and Industrial Organisation, 2008-2011, Research Scientist, Fisheries Modelling, Marine and Atmospheric Research.

University of Washington, 2001-2008, Graduate Research & Teaching Associate, Center for Quantitative Science, School of Aquatic and Fishery Sciences.

Commonwealth Scientific and Industrial Organisation, 2004, Fisheries Modeller, Division of Marine Research.

C. Listing of courses taught at UMass Dartmouth

- Ecosystem-Based Fisheries Management, Spring 2015, Spring 2017, Spring 2019
- Biological Statistics II, Spring 2016, Spring 2017, Spring 2018
- Science Communication for Research Scientists, Fall 2017, Fall 2018
- Bayesian Statistics and Hierarchical Modeling for Ecology, Fall 2016, Fall 2018
- Advanced Population Modeling, Fall 2015, Fall 2017
- Models for Marine Ecosystem Based Management, Spring 2016
- Quantitative Workshops in Fishery and Ecosystem Science, Fall 2016, Spring 2017
- Capture-Recapture and Distance Sampling Methods for Wildlife Biologists, Spring 2017
- Graduate Seminar, Fisheries Oceanography, Spring 2015, Fall 2015, Spring 2018

Graduate Student Advising:

Principal Advisor: Amanda Hart (Ph.D.), Liberty Schilpp (MS, 2018), Ashley Weston (MS, 2018), Robert Wildermuth (Ph.D.), Megan Winton (Ph.D.).

Committee Member: Sam Asci (MS, 2016), Nishchitha Etige (MS), Sofia Gabriel (MS, 2018), Melissa Goulet (MS), Alex Hansell (Ph.D.), Lauren Horton (MS), Joseph Iafrate (Ph.D.),

Chang Liu (Ph.D.), Sean Lucey (Ph.D.), Marjorie Lyssikatos (Ph.D.), Molly Morse (MS, 2018), Christian Petitpas (Ph.D., 2015), Brooke Wright (Ph.D.).

Postdoctoral Fellow Advising:

Jonathan Cummings (2018-), Tammy Silva (2018-), Vanessa Trijoulet (co-advised with Dr. Timothy Miller, NOAA Fisheries, 2016-2018)

SELECTED PUBLICATIONS (*bold italics indicate student author*)

- Olsen, E., I.C. Kaplan, C. Ainsworth, G. Fay, S. Gaichas, R. Gamble, R. Girardin, C. Hansen, T.F. Ihde, H.N. Morzaria-Luna, K.F. Johnson, M. Savina-Rolland, H. Townsend. M. Weijerman, E.A. Fulton, J.S. Link. 2018. Ocean futures as explored using a worldwide suite of ecosystem models. *Frontiers in Marine Science* 5:64. doi: 10.3389/fmars.2018.00064.
- Wildermuth, R.P.***, G. Fay, S. Gaichas. 2018. Structural uncertainty in qualitative models for ecosystem-based management of Georges Bank. *Canadian Journal of Fisheries and Aquatic Sciences* 75: 1635-1643.
- Winton, M.V.***, G. Fay, H.L. Haas, M. Arendt, S. Barco, M.C. James, C. Sasso, R. Smolowitz. 2018. Estimating the distribution and relative density of satellite-tagged loggerhead sea turtles in the western North Atlantic using geostatistical mixed effects models. *Marine Ecology Progress Series* 586: 217-232.
- Samhouiri, J.F., K.S. Andrews, G. Fay, C.J. Harvey, E.L. Hazen, S.M. Hennessey, K. Holsman, M.E. Hunsicker, S.I. Large, K.N. Marshall, A.C. Stier, J.C. Tam, S.G. Zador. 2017. Defining ecosystem thresholds for human activities and environmental pressures in the California Current. *Ecosphere* 8(6):e01860. 10.1002/ecs2.1860.
- Fay, G., J.S. Link, J.A. Hare. 2017. Assessing the effects of ocean acidification in the Northeast US using an end-to-end marine ecosystem model. *Ecological Modelling* 347: 1-10.
- Fay, G., J.S. Link, S.I. Large, and R.J. Gamble. 2015. Management performance of ecological indicators in the Georges Bank finfish fishery. *ICES Journal of Marine Science* 72: 1285-1296.
- Little, L.R., J. Parslow, G. Fay, A.D.M. Smith, R.Q. Grafton, A.E. Punt, and G.N. Tuck. 2014. Environmental derivatives, risk analysis and conservation management. *Conservation Letters* 7: 196-207.
- Fay, G., S.I. Large, J.S. Link, and R.J. Gamble. 2013. Testing systemic fishing responses with ecosystem indicators. *Ecological Modelling* 265: 45-55.
- Large, S.I., G. Fay, K. Friedland, and J.S. Link. 2013. Defining trends and thresholds in responses of ecological indicators to fishing and environmental pressures. *ICES Journal of Marine Science* 70: 755-767.
- Fay, G. and A.E. Punt. 2013. Methods for estimating spatial trends in Steller sea lion pup production using the Kalman filter. *Ecological Applications* 23: 1455-1474.
- Klaer, N.L., S.E. Wayte, and G. Fay. 2012. An evaluation of the performance of a harvest strategy that uses an average-length-based assessment method. *Fisheries Research* 134-136: 42-51.
- Fay, G., A.E. Punt, and A.D.M. Smith. 2011. Impacts of spatial uncertainty on performance of age structure-based harvest strategies for blue eye trevalla (*Hyperoglyphe antarctica*). *Fisheries Research* 110: 391-407.

GRANTS RECEIVED

Mid-Atlantic Fishery Management Council. Evaluation of F-Based Management for the Recreational Summer Flounder Fishery. \$57,400. Apr 2018 – Mar 2019. PI.

NOAA Fisheries Stock Assessment Analytical Methods. Improving the use of data from tag recaptures in Stock Synthesis. \$185,554. Jul 2018 – Jun 2019. PI.

NOAA Office of National Marine Sanctuaries. Productivity and Ecology of Sand Habitats. \$210,000. Apr 2018 – Aug 2020. PI.

International Council for the Exploration of the Sea (ICES). Comparison between IUCN categories of conservation status and fisheries reference points for defining species and stock sustainability. \$29,129. Apr 2018 – Jul 2018. PI.

NOAA Climate Program Office. Development of robust management strategies for northeast groundfish fisheries in a changing climate. \$1,122,745. Sep 2017 - Aug 2020. (lead UMassD PI).

New England Fishery Management Council. Analysis and Infographics Support for Draft Environmental Impact Statement. \$12,568. Jun 2016 - Sep 2017. PI

NOAA Saltonstall Kennedy. Developing strategies to reduce the effects of gray meat disease on the Atlantic sea scallop fishery. \$248,825. Sep 2017 - Aug 2019. (co-PI).

NOAA Fisheries Stock Assessment Analytical Methods. Development and evaluation of a state-space multispecies fisheries assessment model. \$193,303. May 2016 - Apr 2018. (Fay joint PI)

NOAA Fisheries & the Environment (FATE) Program. Incorporating recruitment-environment linkages into stock assessment models for Alaskan groundfish with application to population projections in a changing climate. \$154,031. Sep 2015 – Aug 2017. (Fay joint PI)

Mid-Atlantic Fishery Management Council. Developing and testing stock assessments for black sea bass using Stock Synthesis. \$68,768. Jun 2015 – Aug 2016. (Fay lead PI)

NOAA Northeast Fisheries Science Center. Estimating loggerhead sea turtle density in the US Mid-Atlantic. \$108,199. Sep 2015 – Aug 2017. (Fay sole PI)

NOAA Saltonstall Kennedy (S-K). Combining Fishermen's Knowledge with Oceanographic and Economic Models to Locate, Evaluate, and Predict Gray Meat Outbreaks in Atlantic Sea Scallops. \$299,551. Sep 2015-Aug 2017. (Fay co-PI)

Atlantic States Marine Fisheries Commission. Peer review of red drum stock assessment. \$4,600. Aug 2015 – Apr 2017. (Fay sole PI)

SYNERGISTIC ACTIVITIES

- Ecosystem-based Fisheries Management Plan Development Team, New England Fishery Management Council. Member. 2016 –present.
- ICES Working Group on the Northwest Atlantic Regional Sea (WGNARS). Member. 2011 – present.
- ADMB Foundation. Ordinary Member. 2016 – present.
- External Independent Reviewer: Atlantic States Marine Fisheries Commission, California Department of Fish and Wildlife, ICES, New England Fishery Management Council, NOAA Northeast Fisheries Science Center
- Proposal Reviewer: NOAA Fisheries / Sea Grant Graduate Fellowship in Population and Ecosystem Dynamics, Maryland Sea Grant, Washington Sea Grant.

- Manuscript Reviewer: Canadian Journal of Fisheries and Aquatic Sciences, Conservation Letters, Ecological Applications, Ecological Indicators, Ecology, Ecosystems, Elementa, Fisheries Research, Fishery Bulletin, ICES Journal of Marine Science, Journal of Wildlife Management, PLOS One, Population Ecology.
- Black Sea Bass Stock Assessment Technical Committee. NRCC/NOAA Fisheries. 2015 – 2016.
- Vice-Chair, ICES Workshop on the Marine Strategy Framework Directive, Descriptor 4: Foodwebs. Copenhagen, Denmark. 2015.
- Invited expert: NOAA Fisheries California Current Integrated Ecosystem Assessment workshop, Seattle WA, July 2015.
- Steering Committee, Atlantis Ecosystem Model Summit. Honolulu, USA. 2015.
- Sub-Antarctic Resource Assessment Group (SARAG), Australian Fisheries Management Authority, Australia. Member. 2008–2011.
- Shelf Resource Assessment Group (ShelfRAG), Australian Fisheries Management Authority, Australia. Observer. 2010–2011.
- Slope Resource Assessment Group (SlopeRAG), Australian Fisheries Management Authority, Australia. Observer. 2008–2011.

AVIJIT GANGOPADHYAY

Professor of Oceanography
Department of Estuarine and Ocean Sciences
School for Marine Science and Technology
University of Massachusetts at Dartmouth
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New Bedford MA 02740
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Citizenship: US
Expertise: Multiscale Modeling
Operational Oceanography
Climate and Inter-annual variability
e-mail: avijit@umassd.edu
Fax: (508) 910-6374
www.smast.umassd.edu/modeling/

EDUCATION:

Postdoctoral, 1990-1995. Harvard University, Cambridge, MA.

Ph.D., Ocean Engineering, 1990.
University of Rhode Island, Kingston, RI.
Thesis: “Wind-forcing of the Gulf Stream - A Space-Time Analysis”

M.Tech. Applied Mechanics (Structure-Fluid interactions), 1981.
Indian Institute of Technology, New Delhi, India.
Thesis: “Dynamic Analysis of a Submerged Plate using Finite Element Method”

B.Tech. Naval Architecture, 1979.
Indian Institute of Technology, Kharagpur, India.

EXPERIENCE:

June 2012 – Present:	Professor, SMAST, UMass Dartmouth
September 2007 – May 2012:	Professor and Associate Dean, SMAST, UMass Dartmouth
September 2006 – August 2007:	Interim Dean and Professor, SMAST, UMass Dartmouth;
September 2005 – July 2006:	Interim Associate Dean, SMAST, UMass Dartmouth
September 2003 – August 2004:	Chair, Department of Physics, UMass Dartmouth
November -December, 2004:	Visiting Professor, Univ of Sao Paulo, Brazil (on sabbatical)
August-September, 2004:	Visiting Professor, IISc, Bangalore, India (on sabbatical)
September 1999 – August 2006:	Associate Professor (Tenured), Physics and SMAST, UMassD
June 1997 – August 1999:	Assistant Professor, Physics and CMAST, UMassD
March 1995 – June 1997:	Scientist, Jet Propulsion Lab (NASA/CalTech), Pasadena, CA.
August 1990 – February 1995:	Research Associate, Harvard University.
August 1993 – July 1994:	Consultant, Applied Mathematics, CT.
August 1992 – July 1993:	Consultant, Applied Physics Lab, Johns Hopkins University.
August 1985 – July 1990:	Graduate Research Assistant, GSO, URI.
August 1981 – August 1985:	Engineer, Ocean Engg Div, EIL, New Delhi, India.

Honors: Honorary Research Associate, Harvard University, 1997—2006.
Distinguished Professor, Indian Institute of Technology, Kharagpur, 2007-2012.
MOES SG Chair Professor, Indian Institute of Technology, Kharagpur, 2012-2015.
Honorary Institute Professor, Indian Institute of Technology, Bhubaneswar, 2012-2017.
Adjunct Professor, Institute of Oceanography, Univ of Sao Paulo, Brazil, 2012-2015.
US Fulbright-Nehru Scholar in Teaching and Research (US) 2013-2014.
Distinguished International Visiting Professor, Univ of Sao Paulo, Brazil, 2014.
International Visiting Professor, IIT Kharagpur, 2016-2021.

PUBLICATIONS

- Jana, S., **A. Gangopadhyay**, P. Lermusiaux, A. Chakraborty, A., S. Sil, and P.J. Haley, (2018): High-resolution simulations for the Bay of Bengal: Sensitivity to River Input and Wind Forcing, *Journal of Marine Systems*, 187, 206-222, <https://doi.org/10.1016/j.jmarsys.2018.08.001>.
- Mandal, S., S. Sil, **A. Gangopadhyay**, T. Murty and D. Swain, (2018): On Extracting High Frequency Tidal Variability from HF Radar data in the Northwestern Bay of Bengal, *J. of Operational Oceanography*, 2018-6:1-17, <https://doi.org/10.1080/1755876X.2018.1479571>
- Gawarkiewicz, G., R.E. Todd, W. Zhang, J. Partida, **A. Gangopadhyay**, M.-U.-H. Monim, P. Fratantoni, A. Malek Mercer, and M. Dent. 2018. The changing nature of shelf-break exchange revealed by the OOI Pioneer Array. *Oceanography* 31(1):60–70, <https://doi.org/10.5670/oceanog.2018.110>
- Lermusiaux, P.F.J., P.J. Haley Jr., S. Jana, A. Gupta, C.S. Kulkarni, C. Mirabito, W.H. Ali, D.N. Subramani, A. Dutt, J. Lin, A.Y. Shcherbina, C.M. Lee, and **A. Gangopadhyay**, 2017: Optimal Planning and Sampling Predictions for Autonomous and Lagrangian Platforms and Sensors in the Northern Arabian Sea, *Oceanography*, 30(2):172–185, <https://doi.org/10.5670/oceanog.2017.242>
- Bisagni, J.J., **A. Gangopadhyay**, and A. Sanchez-Franks, 2017: Secular change and inter-annual variability of the Gulf Stream position, 1993–2013, 70°–55°W. *Deep Sea Research. Part I* (2017), <http://dx.doi.org/10.1016/j.dsr.2017.04.001>.
- Gangopadhyay, A.**, A. H. Chaudhuri, and A. H. Taylor, 2016: On the nature of temporal variability along the Gulf Stream path from 75°W to 55°W. *Earth Interactions*. Vol 20 (2016), doi: 10.1175/EI-D-15-0025.1.
- Gangopadhyay, A.**, Jeffrey A. Rezendes, Kevin C. Lydon, Ramprasad Balasubramanian and Iren Valova, 2015: Towards an automated detection of the Gulf Stream North Wall from concurrent satellite images, MTS/IEEE Proceedings. Oceans'15. Washington DC. October, 2015.
- Jana, S., **A. Gangopadhyay** and A. Chakraborty, 2015: Impact of Seasonal River Input on the Bay of Bengal simulation, *Continental Shelf Research*, doi:10.1016/j.csr.2015.05.001.
- Warn-Varnas, A., D.S. Ko, and **A. Gangopadhyay**, 2015. Signatures of Tidal interference patterns in South China Sea, *Journal of Oceanography*, DOI 10.1007/s10872-015-0282-8.
- Soutelino, R.G., **A. Gangopadhyay**, and I. C. A. da Silveira, 2013: The roles of topography and vertical shear on the eddy formation near the site of origin of the Brazil Current Continental Shelf Research, 70 (2013), 46-60. <http://dx.doi.org/10.1016/j.csr.2013.10.001>.
- Gangopadhyay, A.**, N. Bharath Raj, A. Chaudhuri, M.T. Babu and D. Sengupta, 2013: On the nature of meandering of the springtime western boundary current in the Bay of Bengal, *Geophysical Research Letters*, VOL. 40, 1–6, doi:10.1002/grl.50412, 2013.
- Schmidt, A. C. K., **Gangopadhyay, A.**, 2012: An operational Circulation Ocean Prediction System for the Northwest Atlantic: hindcasting during July-September of 2006. *Continental Shelf Research*, <http://dx.doi.org/10.1016/j.csr.2012.08.017>.
- Wang, X., Y. Chao, D. R. Thompson, S. A. Chien, J. Farrara, P. Li, Q. Vu, H. Zhang, J. C. Levin, and **A. Gangopadhyay**, 2012: Multi-model ensemble forecasting and glider path planning in the Mid-Atlantic Bight. *Continental Shelf Research*, <http://dx.doi.org/10.1016/j.csr.2012.07.006>.
- Schmidt, A. C. K., **A. Gangopadhyay**, and P. Brickley, 2012. An Operational Modeling Implementation for the Trinidad-Venezuela Region using Feature Models, MTS/IEEE Proceedings. <http://dx.doi.org/10.1109/OCEANS.2012.6404973>.
- Brown, W, Boicourt, W., C. Flagg, **A. Gangopadhyay**, O. Schofield, S. Glenn and J. Kohut, 2012. Mapping the Mid-Atlantic Cold Pool Evolution and Variability with Ocean Gliders and Numerical Models, MTS/IEEE Proceedings, <http://dx.doi.org/10.1109/OCEANS.2012.6404970>.
- Gangopadhyay, A.**, A. Schmidt, L. Agel, O. Schofield, and J. Clark, 2012: Multiscale Forecasting in the Western North Atlantic: An Application to OSSE in November 2009 and Sensitivity to Glider Data Assimilation, *Continental Shelf Research*. <http://dx.doi.org/10.1016/j.csr.2012.09.013>.
- Davidovich, V. and **A. Gangopadhyay**, 2012, An algorithm for the automatic recognition of oceanic features in frontal maps, *Oceanology*, May 2012, Volume 52, Issue 3, pp 436–446. Original Russian article published in *Okeanologiya*, 2012, Vol. 52, No. 3, pp. 462–472.
- Chaudhuri, A.H., **A. Gangopadhyay** and J.J. Bisagni, 2011: Response of the Western North Atlantic basin to Characteristic high and low phases of the North Atlantic Oscillation, *Ocean Modelling* Volume 39, Issues 3-4, 2011, Pages 220-232.

- Schmidt, A.C.K., Brickley, P., **Gangopadhyay, A.**, Cadwallader, M., Sharma, N., Nobre, C., Coholan, P., Feeney, J., 2011. A Feature Oriented Regional Modeling System for the North Brazil Current Rings Migration after Retroflexion. Proceedings of the Offshore Technology Conference, May 2011, Houston, Texas, USA.
- Chaudhuri, A. H., **A. Gangopadhyay**, J. J. Bisagni, 2011: Contrasting Response of the Eastern and Western North Atlantic Circulation to an Episodic Climate Event. *J. Phys. Oceanogr.*, 41, 1630–1638. doi: <http://dx.doi.org/10.1175/2011JPO4512.1>
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- Chaudhuri, A.H., **A. Gangopadhyay** and J.J. Bisagni, 2009: Inter-annual Variability of Gulf Stream Warm Core Rings in response to the North Atlantic Oscillation, *Continental Shelf Research*. v. 29, issue. 7, p. 856-869.
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- Hasegawa, D., M. Lewis and **A. Gangopadhyay**, 2009: How islands cause Phytoplankton to bloom in their wakes. *Geophysical Research Letters*, VOL. 36, L20605, doi:10.1029/2009GL039743, 2009.
- Mitra, A., **A. Gangopadhyay**, K. Banerjee, A. Dube and A. Schmidt, 2009: Observed changes in water mass properties in the Indian Sundarbans (northwestern Bay of Bengal) during 1980-2007. *Current Science*, Vol. 97, Number 10, Nov 25, 2009.
- Banerjee, K., N. Mukhopadhyay, R. Ghosh, A. Mitra and **A. Gangopadhyay** (2008). Endocrine disrupting chemicals in the marine and estuarine environment. *Indian Science Cruiser*. Vol. 22(2), 18-23.
- Calado, L, **A. Gangopadhyay** and I.C. daSilveira, 2008: Feature-Oriented Regional Modeling and Simulations (FORMS) For the Western South Atlantic, Southeastern Brazil Region. *Ocean Modeling* (25), 48-64.
- Chaudhuri, A.H., J.J. Bisagni and **A. Gangopadhyay**, 2008: Shelf water Entrainment by Gulf Stream Warm Core Rings between 75W and 50W during 1978-1999. *Cont. Shelf Research*. doi:10.1016/j.csr.2008.10.001.
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- Bhaskaran, P.K., R.R. Kumar, S.K. Dube, A.D. Rao, T.S. Murty, **A. Gangopadhyay**, and A. Chaudhuri, 2008, Tsunami Early Warning System – an Indian Ocean Perspective, *Journal of Earthquake and Tsunami*, Vol 2 (3), 197-226.
- Warn-Varnas, A., **A. Gangopadhyay**, and J. Hawkins, 2007: Water Masses in the Monterey Bay during summer of 2000. *Continental Shelf Research*, doi:10.1016/j.csr.2007.01.004.
- Shaji, C. and **A. Gangopadhyay**, 2007: Synoptic modeling of the West India Coastal Current System using an upwelling feature model, *Journal of Atmospheric and Oceanic Technology*, 24(5), 877-893.
- Brown, W. S., **A. Gangopadhyay**, F. L. Bub, Z. Yu and G. Strout, and A. R. Robinson, 2007. “An Operational Circulation Modeling System for the Gulf of Maine/Georges Bank Region, Part 1: The Basic Elements”, *IEEE J. Oceanic Engineering*, 32 (4), 807-822.

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PROFESSIONAL INTERESTS AND AREAS OF EXPERTISE:

- ***Understand fish behavior and physiology relevant to capture and conservation:*** Fish swimming, muscle physiology and energetic; fish reaction to light, sound, and chemical stimuli; fish reaction to fishing gears; movement of fish in natural environment; effect of environment factors on fish.
- ***Evaluate and reduce bycatch and discards:*** Evaluation of bycatch and discards in world fisheries, including endangered, threatened and protected species; design and test of bycatch reduction devices; evaluation and reduction of mortalities of animals encountered with fishing gears but not caught, and mortalities of discards.
- ***Monitor and mitigate ecosystem impact of fishing and marine renewable resource extraction:*** Effect of fishing on the seabed, marine mammals, turtles and seabirds; and mitigation measures to reduce these impacts; reduce and prevent fishing gear loss and ghost fishing; energy conservation in fishing; effect of tidal and wave energy generation on fish and marine animals.
- ***Support fisheries and ecosystem monitoring and management:*** Design, test, measure and monitor scientific survey fishing gears; Size and species selectivity of commercial fishing gears; ecosystem survey methodology, sampling and analysis.
- ***Enhance stakeholder interactions and empower fishing industry:*** Organize technical workshops and deliver training courses on fish behavior near fishing gears, fishing gear design and operation, responsible fisheries, and fisheries conservation.

WORKING EXPERIENCES:

2015.09 – present, Professor (2010.01-2015.08, Associate professor)

2011.01 – 2017.08, SMAST Graduate Program Director

University of Massachusetts Dartmouth, School for Marine Science and Technology, New Bedford, MA

Department of Fisheries Oceanography

- Obtained \$6 million competitive grants/contracts in more than 20 projects over 8 years
- Trained nine graduate students, including 3 PhD and 3 MSc students already graduated
- Edited a book “Behavior of Marine Fishes: Capture Processes and Conservation Challenges”
- Authored (co-authored) more than 40 peer-reviewed papers

A sample of research projects:

- Tested a haddock trawl to reduce cod bycatch
- Tested trawls to reduce yellowtail flounder bycatch on Georges Bank
- Designed and tested shrimp trawl grids to reduce small fish and small shrimps in Gulf of Maine
- Designed and tested a squid trawl to reduce butterfish bycatch in southern New England
- Acted as a principal investigator for GEARNET – a bottom up project aimed at fishing gear development and outreach for New England groundfish industry
- Acted as a principal investigator for REDNET – a project aimed at re-developing the redfish fishery for Gulf of Maine

- Acted as a principal investigator for SQUIDNET – a project aimed at collaborative research to reduce bycatch in southern New England squid trawl fishery

2017.9 – 2017.12, Visiting fishing technologist, Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy

- Assisted the work towards the FAO Voluntary Guidelines for the Marking of Fishing Gear
- Developed strategies for preventing marine debris specifically abandoned, lost or otherwise discarded fishing gear (ALDFG)
- Assisted and participated in the Expert Workshop on the Means and Methods for Reducing Mortality of Marine Mammals in Fisheries and Aquaculture Operations
- Assisted in matters on trawling best practice; edited “Report of the Workshop on Use of Best Available Science in Developing and Promoting Best Practices for Trawl Fishing Operations in Africa.
- Advised on bycatch and discard projects currently being carried out by FAO, including reviewing the Third World Discard Report
- Worked to finalized FAO Fishing Gear Classification Manuel
- Worked on matters related to climate change and fisheries, including authoring a chapter on greenhouse mitigation measures in fisheries and aquaculture for FAO Technical Report

2011.11 – 2017.12 (part-time)

Editor – Fisheries Research, Elsevier

- Acted as a journal editor on fishing gear technology, fish behavior, underwater observations, creational fisheries, onboard handling, and fishing gear impact
- Handled about 60 manuscripts each year
- Acted as a managing guest editor for three special journal issues

2001.4 – 2010.1.

University of New Hampshire, Durham, NH, USA

Research Associate Professor, Institute for the Study of Earth, Oceans and Space

Extension Specialist – Commercial fisheries, New Hampshire Sea Grant

- Obtained \$2.9 million competitive grants/contracts for research and outreach
- Taught two courses for graduate students
- Organized six industry flume tank workshops on efficiency and conservation

A sample of research and outreach projects:

- Designed grid devices to reduce cod discards in flounder trawls in Gulf of Maine
- Designed and tested haddock trawl to reduce cod bycatch
- Designed and tested a seabed-friendly shrimp trawl
- Design and tested shrimp trawls to reduce small fish and small shrimps
- Conducted codend selectivity studies to support fisheries management

1989.6 -2001.4.

Memorial University of Newfoundland, St. John's, NL, Canada

Senior Researcher - Fish Behavior and Fishing Gear, Fisheries and Marine Institute

- Conducted research on fishing gear selectivity, post-selection mortality

- Evaluated fishing gear loss and ghost fishing
- Designed and tested gears to reduce seabed impact and marine mammal entrapment
- Tested commercial and survey fishing gears in the flume tank
- Conducted exploratory fishing and fisheries development in remote areas and deep waters

A sample of applied research projects:

- Designed and tested of seabed-friendly shrimp trawls for Newfoundland offshore fisheries
- Evaluated mortality of snow crabs discarded from Newfoundland crab pot fishery
- Designed and tested of a new salmon trap for live capture of target species in British Columbia
- Conducted an evaluation of ghostfishing prevention in the Atlantic Canada

1989.4-1989.5

Tokyo University of Fisheries. Tokyo, Japan. Visiting scholar.

- Conducted research on swimming performance of jack mackerel
- Participated field studies on fish behavior near a Japanese setnet in Tokyo Bay

1987.8 -1989.3

Ocean University of China, Qingdao, China. Lecturer – Fisheries.

- Graduate and undergraduate teaching: fishing gear and fish behavior
- Research on fish behavior in relation to fishing gears.

EDUCATION:

1987. PhD – University of Aberdeen, Aberdeen, Scotland, UK. Fish Physiology and Ecology: Fish Behavior near Fishing Gears

1982. B.Eng. – Zhejiang Ocean University (Formerly Zhejiang Fisheries College), Zhejiang, China. Marine Fishery: Fishing Gear Technology

ACADEMIC, PROFESSIONAL AND MANAGEMENT ACTIVITIES

Adjunct Positions:

- Adjunct professor, Dept. of Biological Sciences, University of New Hampshire
- Adjunct research scientist, Fisheries and Marine Institute, Memorial Univ. of Newfoundland, Canada
- Guest Professor, Zhejiang Ocean University, China
- Guest Professor, Shanghai Ocean University, China

Member of editorial committee:

- Fisheries Research – editor, guest editor, managing guest editor and editorial board member
- Journal of Ocean Technology – editorial board member

Others:

- US Federal Committee membership: 4 committees
- Professional Membership: 6 societies/groups
- International Expert/Technical Consultation: 6 times
- Organizer/convener of Conferences, Symposia and Workshops: 22 times
- Review for Academic Journals: 39 journals

- Grant Proposal and Report Reviews: 16 agencies
- External thesis reviews and defense panels: 5 universities

PEER-REVIEWED PUBLICATIONS:

- He, P., & Suuronen, P. (2018). Technologies for the marking of fishing gear to identify gear components entangled on marine animals and to reduce abandoned, lost or otherwise discarded fishing gear. *Marine pollution bulletin*, 129(1), 253-261.
- He, P., Davy, D., Sciortino, J., Beveradage, M., & Gudmundsson, A. (2018). Countering climate change: measures and tools to reduce energy use and greenhouse gas emission in fisheries and aquaculture. In: Barange, M., et al. (Eds.). *Impacts of Climate Change on fisheries and aquaculture: Synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries Technical Paper 627.
- Yang, X., Zhang, P., Li, W., Hu, C., Zhang, X., & He, P. (2018). Evaluation of four seagrass species as early warning indicators for nitrogen overloading: Implications for eutrophic evaluation and ecosystem management. *Science of The Total Environment*, 635, 1132-1143.
- Li, J., Li, W., Zhang, X., & He, P. (2017). Physiological and behavioral responses of different modes of locomotion in the whiteleg shrimp *Litopenaeus vannamei* (Boone, 1931) (Caridea: Penaeidae). *Journal of Crustacean Biology*, 38(1), 79-90.
- Bayse, S. M., M.V. Pol, M. Walsh, A. Walsh, T. Bendiksen, and He, P. (2017). Design and test of a grid to reduce bycatch in the longfin inshore squid (*Doryteuthis pealeii*) trawl fishery. *Journal of Applied Ichthyology*. DOI: 10.1111/jai.13381.
- An, Y. I., P. He, T. Arimoto, and Jang, U.J. (2017). Catch performance and fuel consumption of LED fishing lamps in the Korea hairtail angling fishery. *Fisheries Science*, 1-10.
- Bayse, S.M., and P. He. (2017). Technical conservation measures in New England small-mesh trawl fisheries: Current status and future prospects. *Ocean and Coastal Management* 135: 93-102.
- Pol, M. V., B. Herrmann, C. Rillahan, and P. He. (2016). Impact of codend mesh sizes on selectivity and retention of Acadian redfish *Sebastes fasciatus* in the Gulf of Maine trawl fishery. *Fisheries Research*. 184:54-63. doi: 10.1016/j.fishres.2016.06.013.
- He, P., M. Pol, and P. Suuronen. (2016). Selective fishing and balanced harvest: Means, methods and implications. *Fisheries Research*. 184: 1.
- Bayse, S.M., M.V. Pol, and P. He. (2016). Fish and squid behavior at the mouth of a drop-chain trawl: factors contributing to capture or escape. *ICES Journal of Marine Science*, 73: 1545-1556.
- Breen, M., N. Graham, M. Pol, P. He, D.G. Reid, and P. Suuronen. (2016). Selective fishing and balanced harvesting. *Fisheries Research*. 184: 2-8. doi: 10.1016/j.fishres.2016.03.014.
- Reid, D.G., N. Graham, P. Suuronen, P. He, and M. Pol. (2016). Implementing balanced harvesting: practical challenges and other implications. *ICES Journal of Marine Science*, 73: 1690-1696.
- He, P. (2015). Systematic research to reduce unintentional fishing-related mortality: example of the Gulf of Maine northern shrimp trawl fishery. In: G.H. Kruse, et al. (eds.), *Fisheries Bycatch: Global Issues and Creative Solutions*. Alaska Sea Grant, University of Alaska Fairbanks. doi: 10.4027/fbgics.2015.07.
- Kaiser, M.J., R. Hilborn, S. Jennings, ..., P. He, ... and C. Boyd. (2015). Prioritization of knowledge-needs to achieve best practices for bottom trawling in relation to seabed habitats. *Fish and Fisheries*.
- Bayse, S., C. Rillahan, N. Jones, and P. He. (2015). Evaluating a large-mesh belly window to reduce bycatch in silver hake (*Merluccius bilinearis*) trawls. *Fisheries Research* 174:1-9.
- Pol, M. V., B. Herrmann, C. Rillahan, and P. He. (2015). Selectivity and retention of pollock *Pollachius virens* in a Gulf of Maine trawl fishery. *Fisheries Research*. doi: 10.1016/j.fishres.2015.07.029

- O'Connell, C. P., S.Y. Hyun, S.H. Gruber, and P. He. (2015). Effects of barium-ferrite permanent magnets on great hammerhead shark *Sphyrna mokarran* behavior and implications for future conservation technologies. *Endangered Species Research*. 26: 243-256.
- He, P., C. Rillahan and V. Balzano. (2015). Reduced Herding of Flounders by Floating Bridles: Application in Gulf of Maine Northern Shrimp Trawls to Reduce Bycatch. *ICES Journal of Marine Sciences*. 72: 1514-1524. doi: 10.1093/icesjms/fsu235.
- O'Connell, C. P., S.Y. Hyun, C.B. Rillahan, and P. He. (2014). Bull shark (*Carcharhinus leucas*) exclusion properties of the sharksafe barrier and behavioral validation using the ARIS technology. *Global Ecology and Conservation*. 2: 300-314.
- O'Connell, C. P., S. Andreotti, M. Rutzen, M. Meÿer, C.A. Matthee and P. He. (2014). Effects of the Sharksafe barrier on white shark (*Carcharodon carcharias*) behavior and its implications for future conservation technologies. *Journal of Experimental Biology and Ecology*. 460: 37-46
- O'Connell, C.P., T.L. Guttridge, S.H. Gruber, J. Brooks, J.S. Finger and P. He. (2014). Behavioral modification of visually deprived lemon sharks (*Negaprion brevirostris*) towards magnetic fields. *Journal of Experimental Biology and Ecology*. 453: 131-137.
- Bayse, S.M., P. He, M.V. Pol and D.M. Chosid. (2014). Quantitative analysis of the behavior of longfin inshore squid (*Doryteuthis pealeii*) in reaction to a species separation grid of an otter trawl. *Fisheries Research*. 152: 55-61.
- O'Connell, C.P., E.M. Stroud and P. He. (2014). The emerging field of electrosensory and semiochemical shark repellents: mechanisms of detection, overview of past studies, and future directions. *Ocean and Coastal Management*. 97: 2-11.
- O'Connell, C.P., S-Y Hyun, S.H. Gruber, T.J. Connell, G. Johnson, K. Grudecki and P. He. (2013). The use of permanent magnets to reduce elasmobranch encounter with a simulated beach net. 1. The bull shark (*Carcharhinus leucas*). *Ocean and Coastal Management*. 97: 12-19.
- O'Connell, C.P., S. Andreotti, M. Rutzen, M. Meyer and P. He. (2012). The use of permanent magnets to reduce elasmobranch encounter with a simulated beach net. 2. The great white shark (*Carcharodon carcharias*). *Ocean and Coastal Management*. 97: 20-28.
- O'Connell, C.P., P. He, J. Joyce, E.M. Stroud and P.H. Rice. (2014). Effects of the SMART™ (Selective Magnetic and Repellent-Treated) hook on spiny dogfish catch in a longline experiment in the Gulf of Maine. *Ocean and Coastal Management*. 97: 38-43.
- O'Connell, C.P. and P. He. (2014). A Large-scale field analysis examining the effect of magnetic baits and barriers on teleost and elasmobranch behavior. *Ocean and Coastal Management*. 96: 130-137.
- He, P. and V. Balzano. (2013) A new shrimp trawl combination grid system that reduces small shrimp and finfish bycatch. *Fisheries Research*. 140: 20-27.
- He, P. and V. Balzano. (2012). Improving size selectivity of shrimp trawls in the Gulf of Maine with a modified dual-grid size-sorting system. *North American Journal of Fisheries Management*. 32: 1113-1122.
- He, P and V. Balzano. (2012). The effect of grid spacing on size selectivity of shrimps in a pink shrimp trawl with a dual-grid size-sorting system. *Fisheries Research*. 121-122: 81-87.
- He, P., C. Glass, J. Annala, S. Cadrin, K. La Valley and M. Pol. Editors. (2012). Biology, Harvesting, Management and Conservation of Hakes. Special issue. *Fisheries Research*. 114: 1-75.
- He, P and V. Balzano. (2011). Rope Grid: A new grid design to further reduce finfish bycatch in the Gulf of Maine pink shrimp fishery. *Fisheries Research*. 111: 100-107.
- He, P. (2010). Editor. *Behavior of Marine Fishes: Capture Processes and Conservation Challenges*. Ames, IA: Willey-Blackwell. 375 p.

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EDUCATION:

B.A., 1974, Rutgers College of Arts & Sciences, Rutgers University
---- 1974-1975, Special Student, Rutgers College of Arts & Sciences
---- 1980, Guest Lecturer, Institute of Ecology & Genetics, Univ. Aarhus, Denmark
M.A., 1980, Boston University Marine Program
Ph.D., 1984, Boston University Marine Program
---- 1984-85, Postdoctoral Investigator, Woods Hole Oceanographic Institution

PROFESSIONAL EXPERIENCE:**Current:**

Professor, School of Marine Science and Technology, U.Mass. Dartmouth, 2001-
Manager of Coastal Systems Program (for restoration of coastal bays & wetlands), 1997-
Technical Director, Massachusetts Estuaries Project, 2002-
Faculty, University of Massachusetts Intercampus Graduate School of Marine Sciences, 2000-
¹USEPA/USCG-ETV Technical Participant for Development of Test Protocol to Verify Ballast Water
Technologies, 2003-

Previous:

Visiting Investigator, Woods Hole Oceanographic Institution, 1986-1987
Visiting Assistant Research Prof. Ctr. Coastal Environ. Studies, Rutgers Univ., 1987-1988.
Graduate Faculty Associate Member, Rutgers Univ. Ecology Prgm., 1988-1997
Assistant Scientist, Woods Hole Oceanographic Institution, 1987-1991
Associate Scientist, Woods Hole Oceanographic Institution, 1991-1997
Hydrologist, U.S.G.S. Water Resources Division on IPA, 1987-98
Guest Investigator, Woods Hole Oceanographic Institution, 1997-2000.
Adjunct Professor, Boston University Department of Earth Sciences, 1989- 2003
Adjunct Professor, Boston University Marine Program, 1995-2003
Senior Fellow, Center of Marine Science and Technology, U.Mass. Dartmouth, 1997-2001.
Adjunct Professor, Dept. Wildlife & Conservation, U.Mass. Amherst

REPRESENTATIVE PUBLICATIONS:**JOURNAL ARTICLES: (* with Graduate Students of B.L. Howes)**

- 1974 Ward, D.V. and B.L. Howes. The effects of Abate, an organophosphorus insecticide, on marsh fiddler crab populations. *Bulletin of Environmental Contamination & Toxicology* 12:694-697.
- 1976 Ward, D.V., B.L. Howes and D.F. Ludwig. Interactive effects of predation pressure and insecticide (Temefos) toxicity on populations of the marsh fiddler crab *Uca pugnax*. *Marine Biology* 35:119-126.
- 1978 Shisler, J.K., T.L. Schulze and B.L. Howes. The effect of the marsh elder (*Iva frutescens*) on the standing crop biomass of *Spartina patens* and associated wildlife. *Biol. Conserv.* 14:159-166.
- 1980 Lee, C., R.W. Howarth and B.L. Howes. Sterols in decomposing *Spartina alterniflora* and the use of ergosterol in estimating the contribution of fungi to detrital nitrogen. *Limnology Oceanography* 25:290-303.
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- 1981 Howes, B.L., R. Howarth, J.M. Teal and I. Valiela. Oxidation-Reduction potentials in a salt marsh: spatial patterns and interactions with primary production. *Limnology Oceanography* 26:350-360.
- 1982 Valiela, I., B.L. Howes, R.W. Howarth, A.E. Giblin, K. Foreman, J.M. Teal and J.E. Hobbie. Regulation of primary production and decomposition in a salt marsh ecosystem. B. Gopal, R. Turner, R. Wetzel and D. Whigham (eds.), *Wetlands: Ecology and Management*, Proceedings International Wetland Conference. New Delhi, pp. 261-290.
- 1984 Dacey, J.W.H., and B.L. Howes. Water uptake by roots controls water table movement and sediment oxidation in short *Spartina* marsh. *Science* 224:487-489.
- 1984 Wakeham, S.G., B.L. Howes and J.W.H. Dacey. Dimethylsulfide in a stratified coastal pond. *Nature* 310:770-772.
- 1984 Howes, B.L., J.W.H. Dacey and G.M. King. Carbon flow through oxygen and sulfate reduction pathways in salt marsh sediments. *Limnology Oceanography* 29:1037-1051.
- 1984 Dacey, J.W.H., S.G. Wakeham and B.L. Howes. Henry's law constants for dimethylsulfide in freshwater and seawater. *Geophysical Research Letters* 11:991-994.
- 1985 Howes, B.L., J.W.H. Dacey and S.G. Wakeham. Effects of sampling technique on measurements of porewater constituents in salt marsh sediments. *Limnology Oceanography* 30:221-227.
- 1985 Howes, B.L., J.W.H. Dacey and J.M. Teal. Annual carbon mineralization and belowground production of *Spartina alterniflora* in a New England salt marsh. *Ecology* 66:595-605.
- 1985 King, G.M., B.L. Howes and J.W.H. Dacey. Short term endproducts of sulfate reduction in a salt marsh: formation of acid volatile sulfides, elemental sulfur and pyrite. *Geochimica Cosmochimica Acta*. 49:1561-1566.
- 1986 Howes, B.L., J.W.H. Dacey and D.D. Goehring. Factors controlling the growth form of *Spartina alterniflora*: feedback between above-ground production, sediment oxidation, nitrogen and salinity. *Journal of Ecology* 74:881-898.
- 1987 Wakeham, S.G., B.L. Howes, J.W.H. Dacey, R.P. Schwarzenbach and J. Zeyer. Biogeochemistry of dimethylsulfide in a seasonally stratified coastal salt pond. *Geochimica Cosmochimica Acta* 51:1675-1684.
- 1987 Lohrenz, S.E., C.D. Taylor and B.L. Howes. Primary production of protein. II. Algal protein metabolism and its relationship to the composition of particulate organic matter in a well mixed euphotic system. *Marine Ecology Progress Series* 40:175-183.
- 1990 Valiela, I., J. Costa, K. Foreman, J. Teal, B. Howes and D. Aubrey. Groundwater-borne inputs from watersheds to coastal waters. *Biogeochemistry* 10: 177-198.
- 1990 Howes, B.L. and R.L. Smith. Sulfur cycling in a permanently ice covered amictic Antarctic Lake, Lake Fryxell. *Antarctic Journal*. 25: 230-233.
- 1990 Smith, R.L. and B.L. Howes. Bacterial biomass and heterotrophic activity in the water column of an amictic Antarctic Lake. *Antarctic Journal*. 25:233-235.
- 1991 Smith, R.L., B.L. Howes and J.H. Duff. Denitrification in nitrate-contaminated groundwater: occurrence in steep vertical geochemical gradients. *Geochimica Cosmochimica Acta* 55:1815-1825.

- 1991* Weiskel, P.K. and B.L. Howes. Dissolved nitrogen flux through a small coastal watershed. *Water Resources Research* 27: 2929-2939.
- 1991 Smith, R.L., B.L. Howes and S.P. Garabedian. In situ measurement of methane oxidation in groundwater using natural gradient tracer tests. *Applied Environ. Microbiology* 57:1997-2004.
- 1992 Costa, J.E., B.L. Howes, I. Valiela and A.E. Giblin. Monitoring nitrogen and indicators of nitrogen loading to support management action in Buzzards Bay. In: McKenzie et al. (eds) *Ecological Indicators*, Chapt. 6, pp. 497-529.
- 1992* Weiskel, P.K. and B.L. Howes. Differential transport of nitrogen and phosphorus from septic systems through a coastal watershed. *Environmental Science and Technology* 26: 352-360.
- 1992 Conway, N., B. Howes, C. Cavanaugh, R. Turner, and J. McDowell Capuzzo. Characterization and site description of *Solemya borealis*, a newly discovered animal-bacteria symbioses. *Marine Biology* 112: 601-613.
- 1992* Arenovski, A.L. and B.L. Howes. Lacunal allocation and gas transport capacity in the salt marsh grass *Spartina alterniflora*. *Oecologia* 90: 316-322.
- 1992 Howes, B.L., D.R. Schlezinger, D.D. Goehringer and S. Brown-Leger. Carbon cycling in a redox stratified Antarctic Lake, Lake Fryxell. *Antarctic Journal* 27: 263-265.
- 1992 Orson, R.A. and B.L. Howes. Salt marsh development at Waquoit Bay, Massachusetts: Influence of geomorphology on long-term plant community structure. *Estuarine & Coastal Shelf Science* 35: 453-471.
- 1993 Smith, R.L., L.G. Miller and B.L. Howes. The geochemistry of methane in Lake Fryxell, an amictic permanently ice-covered Antarctic lake. *Biogeochemistry* 21: 95-115.
- 1993 Teal, J.M., B.L. Howes, S.B. Peterson, J.E. Petersen and A. Armstrong. Nutrient processing in an artificial wetland engineered for high loading: a septage treatment example. Pp. 421-428 In: *Wetlands of the World: Biogeochemistry, Ecological Engineering, Modeling and Management*. (W.J. Mitsch and R.E. Turner, eds.). Elsevier, New York.
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- 1998 DeSimone, L.A. and B.L. Howes. Nitrogen transport and transformations in a shallow aquifer receiving wastewater discharge: a mass-balance approach. *Water Resources Research* 34:271-285.
- 2000 Teal, J.M. and B. Howes. Salt marsh values: retrospection from the end of the century. Chapter 6, In: *Concepts and Controversies in Tidal Marsh Ecology*, M.P. Weinstein & D.A. Kreeger (Eds), 864p.
- 2000* Schlezinger, D.R. and B.L. Howes. Organic phosphorus and elemental ratios as indicators of

prehistoric human occupation. *Journal of Archaeological Science*, 27:479-492.

- 2000 McKnight, D.M., B.L. Howes, C.D. Taylor, D.D. Goehring. Phytoplankton dynamics in a stably stratified Antarctic lake during winter darkness. *Journal of Phycology* 36:852-861.
- 2000 Bazylinski, D.A., D.R. Schlezinger, B.L. Howes and R.B. Frankel. Occurrence and distribution of diverse populations of magnetic protists in a chemically-stratified coastal salt pond. *Chemical Geology*. 169:319-328.
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- 2013 Buzzelli, C., Z. Chen, T. Coley, P. Doering, R. Samimy, D. Schlezinger, B. Howes. Dry Season Sediment-Water Exchanges of Nutrients and Oxygen in Two Florida Estuaries: Patterns, Comparisons, and Internal Loading. *Florida Scientist*, 76(1):54-71.
- *2013 Medeiros, D. L., D.S. White, B.L. Howes. Replacement of *Phragmites australis* by *Spartina alterniflora*: The Role of Competition and Salinity. *Wetlands, Journal of the Society of Wetland Scientists*, DOI 10.1007/s13157-013-0400-6
- *2013 Benson J.L., D.R. Schlezinger, B.L. Howes. Relationship between nitrogen, light, and *Zoster* marine habitat quality and survival in southeastern Massachusetts estuaries. *Journal of Environmental Management*. 2013 Dec 15; 131-129-37. doi: 10.1016/j.jenvman.2013.09.033. Epub 2013 Oct 23.
- 2013 Schlezinger, D.R., C.D. Taylor and B.L. Howes. Assessment of Zooplankton Injury and Mortality Associated with Underwater Turbines for Tidal Energy Production. *Marine Technology Society Journal*, 47 (4):142-150.
- *2014 Sawabini, A., M. Sundermeyer, B. Howes, D. Schlezinger. Regional Forcing by Light on Dissolved Oxygen in Shallow Temperate Estuaries. *Estuaries and Coasts*, doi.10.1007/s12237-014-9879-1, 2014.
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- 2015 Howes, B.L., Samimy, R.I. The Massachusetts Estuaries Project: University Engagement of Municipalities and Citizens, State and Federal Regulatory Agencies, and Non-Governmental Organizations to Rehabilitate and Sustain the Environmental Resources of Coastal Massachusetts. In: *UMASS Dartmouth, The Engaged Scholarship Collection*, Vol. 1/2015 pp. 146, ISBN 978-1-329-18188-5.
- 2017 Shaw, KC, B L Howes, DR Schlezinger b Macroalgal composition and accumulation in New England estuaries. *Journal of Environmental Management* 206 (2018) 246-254.
- In Press. E.M. Eichner, D.S. White, and B.L. Howes. The Ecology of the Weymouth Back River, to be published by the Town of Weymouth and the Back River Watershed Association. 183 p.
- Submitted: P.J. Mancuso and B.L. Howes Submitted 2018. Nonquitt Salt Marsh: Response of *Phragmites*, *Spartina*, and other Keystone Species to Renewed Tidal Exchange and Strategies to Accelerate Recovery. *Ecological Engineering* [P. Mancuso is a former Graduate Student]

MONOGRAPHS (Refereed):

- 1996 Howes, B.L. and D.D. Goehringer. The Ecology of Buzzards Bay: An Estuarine Profile. National Biological Service Biological Report 31, pp. 141.

COURSES TAUGHT;

Doctoral Dissertation Research and MS Research Fall and Spring Semesters M. Labrie, P. Mancuso, A Unruh

Fall 2016: MAR 600-02, MAR-10, MAR 701-03,

Spring 2017: MAR 600-04, MAR 600-07 and MAR 701-03.

Spring 2018 MAR 620, Estuarine Dynamics

CURRICULUM VITAE (SUMMARY)

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Dean and Professor

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EDUCATION:

Ph.D., Biological Oceanography, 1985, Massachusetts Institute of Technology-Woods Hole Oceanographic Institution
B.A., Biology and Chemistry, 1978, University of Oregon, Eugene

EXPERIENCE:

Dean, 2011 – present, School for Marine Science and Technology, University of Massachusetts Dartmouth
Professor Emeritus, 2011-present, Department of Marine Science, University of Southern Mississippi
Chair, 2004-2011, Department of Marine Science, University of Southern Mississippi
Professor, 1999-2011, The University of Southern Mississippi
Guest Investigator, 2001- 2002, Woods Hole Oceanographic Institution
Associate Professor, 1994-1999, The University of Southern Mississippi
Assistant Professor, 1988-1994, The University of Southern Mississippi
Associate Research Scientist, 1987-1988, The University of Southern Mississippi
Postdoctoral Fellow, 1985-1987, National Research Council Fellowship at the Naval Ocean Research and Development Activity
Postdoctoral Fellow, 1985, Woods Hole Oceanographic Institution
Graduate Fellow, 1979-1985, Massachusetts Institute of Technology-Woods Hole Oceanographic Institution

SCIENTIFIC PUBLICATIONS AND PRESENTATIONS

- Authored or co-authored more than 102 articles in peer-reviewed scientific journals and seven book chapters
- Authored or co-authored more than 250 scientific presentations including more than 70 co-authored by students to professional national and international audiences

SELECTED PUBLICATIONS

2018 Lohrenz, S. E., W. J. Cai, S. Chakraborty, W. J. Huang, X. Guo, R. He, Z. Xue, K. Fennel, S. Howden, and H. Tian (2018), Satellite estimation of coastal $p\text{CO}_2$ and air-sea flux of carbon dioxide in the northern Gulf of Mexico, Remote Sensing of Environment, doi:<https://doi.org/10.1016/j.rse.2017.12.039>.

- 2017 Chakraborty, S., S. E. Lohrenz, and K. Gundersen, K., Photophysiological and light absorption properties of phytoplankton communities in the river-dominated margin of the northern Gulf of Mexico. *Journal of Geophysical Research: Oceans*, doi:10.1002/2016JC012092
- 2016 Xue, Z., R. He, K. Fennel, W. J. Cai, S. Lohrenz, W. J. Huang, H. Tian, W. Ren, and Z. Zang (2016), Modeling pCO₂ variability in the Gulf of Mexico, *Biogeosciences*, 13(15), 4359-4377, doi:10.5194/bg-13-4359-2016.
- 2016 Ren, W., H. Tian, W. J. Cai, S. E. Lohrenz, C. S. Hopkinson, W. J. Huang, J. Yang, B. Tao, S. Pan, and R. He (2016), Century-long increasing trend and variability of dissolved organic carbon export from the Mississippi River basin driven by natural and anthropogenic forcing, *Global Biogeochemical Cycles*, 30(9), 1288-1299.
- 2016 D'Sa, E. J., E. B. Overton, S. E. Lohrenz, K. Maiti, R. E. Turner, and A. Freeman, Changing Dynamics of Dissolved Organic Matter Fluorescence in the Northern Gulf of Mexico Following the Deepwater Horizon Oil Spill, *Environmental Science & Technology*, doi:10.1021/acs.est.5b04924.
- 2015 Huang, W.-J., W.-J. Cai, Y. Wang, S. E. Lohrenz, and M. C. Murrell, The carbon dioxide system on the Mississippi River-dominated continental shelf in the northern Gulf of Mexico: 1. Distribution and air-sea CO₂ flux, *Journal of Geophysical Research: Oceans*, 120(3), 1429-1445, doi:10.1002/2014JC010498.
- 2015 Ren, W., H. Tian, B. Tao, J. Yang, S. Pan, W. J. Cai, S. E. Lohrenz, R. He, and C. S. Hopkinson, Large increase in dissolved inorganic carbon flux from the Mississippi River to Gulf of Mexico due to climatic and anthropogenic changes over the 21st century, *Journal of Geophysical Research: Biogeosciences*, 120(4), 724-736.
- 2015 Salisbury, J., D. Vandemark, B. Jönsson, W. Balch, S. Chakraborty, S. Lohrenz, B. Chapron, B. Hales, A. Mannino, and J. Mathis, How Can Present and Future Satellite Missions Support Scientific Studies that Address Ocean Acidification?, *Oceanography*, 25(2), 108-121.
- 2015 Tian, H., W. Ren, J. Yang, B. Tao, W.-J. Cai, S. E. Lohrenz, C. S. Hopkinson, M. Liu, Q. Yang, C. Lu, B. Zhang, K. Banger, S. Pan, R. He, and Z. Xue, Climate extremes dominating seasonal and interannual variations in carbon export from the Mississippi River Basin, *Global Biogeochemical Cycles*, doi:10.1002/2014GB005068.
- 2015 Xue, J., W.-J. Cai, X. Hu, W.-J. Huang, S. E. Lohrenz, and K. Gundersen, Temporal variation and stoichiometric ratios of organic matter remineralization in bottom waters of the northern Gulf of Mexico during late spring and summer, *Journal of Geophysical Research: Oceans*, 120(12), 8304-8326, doi:10.1002/2015JC011453.
- 2015 Huang, W.J., Cai, W.J., Wang, Y., Hu, X., Chen, B., Lohrenz, S.E., Chakraborty, S., He, R., Brandes, J., Hopkinson, C.S., The response of inorganic carbon distributions and dynamics to upwelling-favorable winds on the northern gulf of Mexico during summer. *Continental Shelf Research*, doi:10.1016/j.csr.2015.08.020.
- 2015 Tian, H., Ren, W., Yang, J., Tao, B., Cai, W.-J., Lohrenz, S.E., Hopkinson, C.S., Liu, M., Yang, Q., Lu, C., Zhang, B., Banger, K., Pan, S., He, R., Xue, Z., Climate extremes dominating seasonal and interannual variations in carbon export from the Mississippi River Basin. *Global Biogeochemical Cycles*, doi:10.1002/2014GB005068.
- 2015 Chakraborty, S., Lohrenz, S.E., Phytoplankton community structure in the river-influenced continental margin of the northern Gulf of Mexico. *Marine Ecology Progress Series* 521:31-47.

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- 2013 Lohrenz, S. E., Cai, W.-J., Chakraborty, S., Gundersen, K., Murrell, M. C., Nutrient and Carbon Dynamics in a Large River-dominated Coastal Ecosystem: The Mississippi-Atchafalaya river River System, Ch. 18, In: *Biogeochemical Dynamics at Major River-Coastal Interfaces: Linkages with Global Change*, Bianchi, T. S., Allison, M., Cai, W.-J., eds., Cambridge University Press, in press.
- 2013 Cai, Y., Guo, L., Wang, X., Lohrenz, S. E., Mozjis, A., Effects of tropical cyclones on river chemistry: A case study of the lower Pearl River during Hurricanes Gustav and Ike. *Estuarine, Coastal and Shelf Science*, accepted.
- 2013 Huang, W.-J., Cai, W.-J., Castelao, R.M., Wang, Y., Lohrenz, S. E., Impacts of a wind-driven cross-shelf large river plume on biological production and CO₂ uptake in the Gulf of Mexico during spring. *Limnology and Oceanography*, in press.
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- 2013 Liu, M., Tian, H., Yang, Q., Yang, J., Song, X., Lohrenz, S. E., Cai, W.-J., Long-term trends in evapotranspiration and runoff over the drainage basins of the gulf of Mexico during 1901-2008. *Water Resources Research* 49:1-25.
- 2012 Guo, X., W.-J. Cai, W.-J. Huang, Y. Wang, F. Chen, M. C. Murrell, S. E. Lohrenz, L.-Q. Jiang, M. Dai, J. Hartmann, Q. Lin, and R. Culp, Carbon dynamics and community production in the Mississippi River plume, *Limnology and Oceanography*, 57(1): 1-17.
- 2011 Cai, W.-J., X. Hu, W.-J. Huang, M. C. Murrell, J. C. Lehrter, S. E. Lohrenz, W.-C. Chou, W. Zhai, Y. Wang, X. Guo, K. Gundersen, J. T. Hollibaugh, M. Dai, and G.-C. Gong, Acidification of subsurface coastal waters enhanced by eutrophication, *Nature Geosciences*, 4(11): 766-770.
- 2010 Diercks, A.-R., R. C. Highsmith, V. L. Asper, D. Joung, Z. Zhou, L. Guo, A. M. Shiller, S. B. Joye, A. P. Teske, N. Guinasso, T. L. Wade, and S. E. Lohrenz (2010), Characterization of subsurface polycyclic aromatic hydrocarbons at the Deepwater Horizon site, *Geophysical Research Letters*, 37(20), L20602, doi: 10.1029/2010gl045046.
- Lohrenz, S. E., Lohrenz, S. E., W.-J. Cai, F. Chen, X. Chen, and M. Tuel (2010), Seasonal variability in air-sea fluxes of CO₂ in a river-influenced coastal margin, *Journal of Geophysical Research-Oceans*, 115(C10), C10034.
- 2010 Cai, W. J., S. E. Lohrenz, "The Mississippi River Plume and Adjacent Margin in the Gulf of Mexico," In: *Carbon and nutrient fluxes in continental margins: a global synthesis* (K. K. Liu, L. Atkinson, R. Quiñones and L. Talaue-McManus, Eds.), Springer-Verlag, NY.

- 2010 Diercks, A.-R., R. C. Highsmith, V. L. Asper, D. Joung, Z. Zhou, L. Guo, A. M. Shiller, S. B. Joye, A. P. Teske, N. Guinasso, T. L. Wade, and S. E. Lohrenz, Characterization of subsurface polycyclic aromatic hydrocarbons at the Deepwater Horizon site, *Geophysical Research Letters*, 37(20), L20602, doi: 10.1029/2010gl045046.
- 2008 Lohrenz, Steven E., W. J. Cai, M. Dagg, D. Redalje, and J. Acker, A Retrospective Analysis of Nutrients and Phytoplankton Productivity in the Mississippi River Plume, *Continental Shelf Research*, doi:10.1016/j.csr.2007.06.019.
- 2006 Lohrenz, S. E. and P. G. Verity, Regional Oceanography: Southeastern United States and Gulf of Mexico (2,W), In: *The Sea*, Vol. 13, The Global Coastal Ocean: Interdisciplinary Regional Studies And Syntheses (A. R. Robinson and K. H. Brink, Eds.), John Wiley & Sons, New York.
- 2002 Lohrenz, S. E., Redalje, D. G., Verity, P. G., Flagg, C. N. and Matulewski, K. M. Primary production on the continental shelf off Cape Hatteras, North Carolina. *Deep Sea Research Part II: Topical Studies in Oceanography*, 49, 4479-4509.

TEACHING

- Developed and taught six graduate courses
- Major advisor for six Ph.D. graduates and eight M.S. graduates
- Committee member for five additional Ph.D. graduates and 22 M.S. graduates

PROPOSALS FUNDED BY EXTERNAL AGENCY

- Principal investigator or co-investigator on grants and contracts to USM totaling over \$17M and \$2.8M to UMass Dartmouth.

RESEARCH CRUISES

- Participation in more than 60 research cruises since 1987

ARTICLE AND GRANT PROPOSAL REVIEW

- Reviewed over 250 manuscripts in national and international scientific journals
- Reviewed over 300 grant proposals and served on various review panels

CURRICULUM VITAE

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EDUCATION

LL.M.	University of San Diego School of Law Primary Field: Environmental Law
J.D.	Thomas Jefferson School of Law Primary Field: Law
M.Sc.	University of Massachusetts, Boston Primary Field: Environmental Science
B.Sc.	University of Massachusetts, Dartmouth Primary Field: Environmental Studies

ACADEMIC APPOINTMENTS

University of Massachusetts, Dartmouth (www.umassd.edu)

Chair, Department of Public Policy (2014 – Present)
Associate Professor, Department of Public Policy (2013 – Present)
Assistant Professor, Department of Public Policy (2009 – 2013)

AREAS OF SPECIALIZATION

Environmental policy, environmental law, administrative law, climate change, coastal management, public goods, decision-making

ACADEMIC ACTIVITIES

BOOKS

McGuire, C. (2014). *Environmental Law from the Policy Perspective: Understanding How Legal Frameworks Influence Environmental Problem Solving*. New York: Routledge Press.
<http://dx.doi.org/10.1201/b16676>

McGuire, C. (2013). *Adapting to Sea Level Rise in the Coastal Zone: Law and Policy Considerations*. New York: Routledge Press.
<http://dx.doi.org/10.1201/b14055>

McGuire, C. (2012). *Environmental Decision-making in Context: A Toolbox*. New York: Routledge Press. *Part of the ASPA Series in Public Administration and Public Policy*
<http://dx.doi.org/10.1201/b11908>

SELECTED ARTICLES & CHAPTERS (*peer-reviewed)

*McGuire, C. (Forthcoming). "Market Approaches to Environmental Governance," In *Handbook of Environmental Governance*, edited by Alka Sapat. New York: Routledge Press.

*McGuire, C. (Forthcoming). "An Exploration of Coastal Property Rights in the United States Under Conditions of Sea Level Rise," In *Exploring Property Rights in Contemporary Governance*, edited by Staci Zavattaro, Gregory Peterson, & Ann Davis. Albany: SUNY Press.

*McGuire, C., & Kayumova, S. (2018). Increased Exposure to Environmental Hazards: An Opportunity for Science, Technology, Engineering, and Math Education. *Environmental Justice*.
<https://doi.org/10.1089/env.2018.0012>

*McGuire, C. (2018). Examining Legal and Regulatory Barriers to Climate Change Adaptation in the Coastal Zone of the United States. *Cogent Environmental Science*, 4(1), 1491096.
<https://doi.org/10.1080/23311843.2018.1491096>

*Kayumova, S., McGuire, C., & Cardello, S. (2018). From Empowerment to Response-ability: Rethinking Socio-Spatial, Environmental Justice, and Nature-Culture Binaries in the Context of STEM Education. *Cultural Studies of Science Education*, 1-25.
<http://dx.doi.org/10.1007/s11422-018-9861-5>

*McGuire, C. (2018). Colliding Worlds: The Objective Nature of Climate Science and the (Somewhat) Subjective Nature of Climate Policy. *Sustainability*, 11(1), 36-40.
<http://dx.doi.org/10.1089/sus.2017.0018>

*McGuire, C. (2018). "Considering the Role of Government Policy in Communicating Climate Change: Lessons from the U.S. Public Flood Insurance Program," In *Handbook of Climate Change Communication, Vol. 3* (pp. 349-360), edited by Walter Filho et al. New York: Springer Press.
http://dx.doi.org/10.1007/978-3-319-70479-1_22

*McGuire, C. (2017). Uncommunicating Climate Change in the Trump Era: Influencing Public Policy by Attempting to Control the Message. *Environmental Justice*, 10(6), 209-212.
<http://dx.doi.org/10.1089/env.2017.0029>

McGuire, C., & Lynch, D. (2017). Competing Narratives of Climate Change. *Environmental Practice*, 19(4), 218-221.
<http://dx.doi.org/10.1080/14660466.2017.1364096>

McGuire, C. (2017). Armoring Against Coastal Climate Change Adaptation in the US: A Massachusetts Perspective. *Coastal Management*, 45(4), 271-276.
<http://dx.doi.org/10.1080/08920753.2017.1327342>

*McGuire, C., & Lynch, D. (2017). The Need for Environmental Justice Never Ends Because Externalities Persist. *Environmental Justice*, 10(3), 68-71.
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McGuire, C. (2017). Risky Business: Publicly Insuring Against Rising Tides. *Environmental Practice*, 19(2), 87-91.
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McGuire, C. (2015). U.S. Coastal Flood Insurance, Risk Perception, and Sea Level Rise: A Perspective. *Coastal Management*, 43(5), 459-464.
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McGuire, C. (2015). Valuing Ecosystem Services in Coastal Management Policy: Looking Beyond the Here and Now. *Natural Resources & Environment*, 30(2), 42-45.

*McGuire, C. (2015). The Role of Risk Perception in Building Sustainable Policy Instruments: A Case Study of Public Coastal Flood Insurance in the United States. *Interdisciplinary Environmental Review*, 16(2-4), 232-252.
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*McGuire, C. (2015). "Climate Change and the Coastal Zone Management Act: The Role of Federalism in Adaptation Strategies." In *Climate Change Impacts on Ocean and Coastal Law: U.S. and International Perspectives* (pp. 419-438), edited by Randall Abate. Cambridge: Oxford University Press.
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*McGuire, C. (2014). Climate Induced Sea Level Rise and Sustainable Coastal Management: The Influence of Existing Policy Frameworks on Risk Perception. *Sustainability*, 7(6), 299-303.
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McGuire, C. (2014). Losing the Message: Some Policy Implications of Anthropocentric Indirect Arguments for Environmental Protection. *Ethics, Policy & Environment*, 17(3), 261-263.
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McGuire, C., & Lynch, D. (2013). Thinking Ahead: The Impacts of Sea Level Rise on Coastal Landscape Protections. *Natural Resources & Environment*, 27(4), 28-35.
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*McGuire, C., & Hill, J. (2012). Climate Adaptation and the Fifth Amendment of the United States Constitution: A Takings Analysis of Adaptation Strategies in Coastal Development with Application to Connecticut's Coastal Management Regime. *Sea Grant Law & Policy Journal*, 5(1), 140-168.
<http://nsglc.olemiss.edu/sglpj/vol5No1/vol5no1.pdf>

McGuire, C. (2012). Coastal Planning, Federal Consistency, and Climate Change: A Recent Divergence of Federal and State Interests. *Natural Resources & Environment*, 27(1), 41-46.
<http://www.jstor.org/stable/24426188>

*McGuire, C. (2012). Public Policy Frameworks in Environmental Settings: An Argument for New Policy Frameworks to Support New Policy Directions. *Environmental Management and Sustainable Development*, 11(1), 1-9.
<http://dx.doi.org/10.5296/emsd.v1i1.1537>

McGuire, C., & Harris, B. (2012). Systems Thinking Applied to U.S. Federal Fisheries Management: Law and Policy Considerations. *Natural Resources & Environment*, 26(3), 3-6.
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*McGuire, C. (2011). A Framework for Analyzing Information Flows in Public Policy Decision-making: A Move Towards Building Sustainable Policy Instruments. *Journal of Politics and Law*, 4(2), 25-35.

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*McGuire, C., & Perivier, H. (2011). The Nonexistence of Sustainability in International Maritime Shipping: Issues for Consideration. *Journal of Sustainable Development*, 4(1), 72-78.

<http://dx.doi.org/10.5539/jsd.v4n1p72>

*McGuire, C., & Harris, B. (2010). Some *Back-ended* Legal and Political Issues in United States Fisheries Management. *Journal of Politics and Law*, 3(2), 52-62.

<http://dx.doi.org/10.5539/jpl.v3n2p52>

*McGuire, C. (2010). A Case of Carbon Sequestration Potential of Land Use Policies Favoring Re-growth and Long-term Protection of Temperate Forests. *Journal of Sustainable Development*, 3(1), 11-16.

<http://dx.doi.org/10.5539/jsd.v3n1p11>

SELECTED CONFERENCE PRESENTATIONS (*conference proceedings)

McGuire, C. (April 2018). *Unbundling the Duality of Land Use in Hazardous Coastal Areas*. Presentation at the 4th Annual UMass Interdisciplinary Legal Studies Colloquium, Boston, MA.

*McGuire, C. (April 2018). *Armoring Against Rising Tides: Impacts of Coastal Fortification in the US Towards Coastal Policy Options*. Paper presented at the 10th International Conference on Climate Change: Impacts and Responses, Berkeley, CA.

*McGuire, C. (August 2017). *Examining Legal and Regulatory Barriers to Climate Change Adaptation in the Coastal Zone of the United States*. Paper presented at the International Climate Change Information Programme (ICCIIP) North American Symposium on Climate Change and Coastal Zone Management, Montreal, Canada.

*Kayumova, S., & McGuire, C. (April 2017). *Understanding 'Glocalization' in the Context of Gateway Cities: Story of a 'Matter' of Justice*. Paper presented at the 90th Annual International Conference of the National Association for Research in Science Teaching (NARST), San Antonio, TX (virtual presenter).

*McGuire, C. (October 2016). *Exploring the Impact of Government Subsidies on Coastal Development: A Case Study of the United States Public Flood Insurance Program*. Paper presented at the Estuarine and Coastal Sciences Association (ESCA) 56 - Coastal Systems in Transition: From a 'Natural' to an 'Anthropogenically-modified' State, Bremen, Germany.

McGuire, C. (December 2015). *Resilient Communities: Policy Impacts of Climate Change*. Invited Presenter: Global Awareness Education and Action (GAEA): A Summit on Climate Resiliency, Dartmouth, MA.

*Goodman, M., & McGuire, C. (November 2015). *Risky Business: Publicly Insuring Against Rising Tides*. Paper presented at the Association for Public Policy Analysis & Management's 37th Annual Fall Research Conference: The Golden Age of Evidence-Based Policy, Miami, Florida (non-presenting participant).

Wright, J., & McGuire, C. (April 2015). *When Policy Outcomes Frustrate Policy Goals: Recent Evidence of Public Flood Insurance Premium Distortions in Massachusetts*. Panel presentation at the UMass Legal Studies Interdisciplinary Colloquium, UMass Club, Boston, MA (non-presenting participant).

*McGuire, C. (October 2014). *The Impact of Climate Induced Sea Level Rise on Coastal Management: How Existing Policy Frameworks Influence Risk Perception*. Panel presentation

COURSES TAUGHT

Administrative Law (JD and MPP)
Alternative Dispute Resolution (JD)
American Environmental Policy (Undergraduate)
Coastal Zone Management (MPP and Undergraduate)
Environmental Law (JD, MPP and Undergraduate)
Environmental Policy (MPP and Undergraduate)
Introduction to Public Policy (Undergraduate)
Land Use (JD)
Ocean Policy & Law (MPP and Undergraduate)

CURRICULUM VITAE

Pia H. Moisander
College of Arts and Sciences, Department of Biology
University of Massachusetts Dartmouth
Associate Professor

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HIGHER EDUCATION

Ph.D. May 2002
University of North Carolina at Chapel Hill, Department of Marine Sciences

M.S. April 1994
University of Helsinki, Finland, Dept. of Limnology and Environmental Sciences

EXPERIENCE

Sep 16-present	Associate Professor	Department of Biology University of Massachusetts Dartmouth
Sep 10-Aug 16	Assistant Professor	Department of Biology University of Massachusetts Dartmouth
Sep 10-present	IMS Professor	Institute of Marine Sciences University of Massachusetts
Jan 06-Aug 10	Assistant Researcher	Institute of Marine Sciences University of California Santa Cruz
May 05-Dec 05	Postdoctoral Scholar	Ocean Sciences Department University of California Santa Cruz
May 04-May 05	Research Associate National Research Council, National Academy of Sciences	NASA Ames Research Center and University of California Santa Cruz, Ocean Sciences Department
May 02-May 04	Postdoctoral Researcher	UNC-CH, Institute of Marine Sciences and Finnish Institute of Marine Research (FIMR)

PEER-REVIEWED JOURNAL ARTICLES

(49) **Moisander PH**, *Shoemaker KM, Daley M, McCliment E, Larkum J, Altabet MA. 2018. Copepod-associated Gammaproteobacteria respire nitrate in the open ocean surface layers. *Frontiers in Microbiology* 9:2390 doi: 10.3389/fmicb.2018.02390

- (48) Benavides M, *Shoemaker KM, **Moisander PH**, Dittmar T, Duhamel S, Van Wambeke F, Grosso O, Bonnet S. 2018. Aphotic N₂ fixation along an oligotrophic to ultraoligotrophic transect in the Western Tropical South Pacific Ocean. *Biogeosciences* DOI: 10.5194/bg-2017-542 (DOI for preprint; final version accepted)
- (47) **Moisander PH**, Benavides M, Berman-Frank I, Bonnet S, White A, Riemann L. 2017. Chasing after non-cyanobacterial nitrogen fixation in marine pelagic environments. *Frontiers in Microbiology* 8:1736 DOI: 10.3389/fmicb.2017.01736
- (46) Berthelot H, Benavides M, **Moisander PH**, Grosso O, Bonnet S. 2017. High nitrogen fixation rates in the particulate and dissolved pools in the Western Tropical Pacific. *Geophysical Research Letters* 44: 8414-8423
- (45) *Shoemaker KM, **Moisander PH**. 2017. Seasonal variation in the copepod gut microbiome in the subtropical North Atlantic Ocean. *Environmental Microbiology* 19: 3087-3097 DOI: 10.1111/1462-2920.13780
- (44) *Daley MC, Urban-Rich J, **Moisander PH**. 2016. Bacterial associations with the hydromedusa *Nemopsis bachei* and scyphomedusa *Aurelia aurita* from the North Atlantic Ocean. *Marine Biology Research* DOI 10.1080/17451000.2016.1228974
- (43) Benavides M, **Moisander PH**, Daley MC, Bode A, Aristegui J. 2016. Longitudinal variability of diazotrophs in the subtropical North Atlantic Ocean. *Journal of Plankton Research* 38:662-672
- (42) Benavides M, **Moisander PH**, Berthelot H, Dittmar T, Grosso O, Bonnet S. 2015. Mesopelagic heterotrophic N₂ fixation related to organic matter composition in the Solomon and Bismarck Seas (Southwest Pacific). *PLoS ONE* 10(12): e0143775.
- (41) **Moisander PH**, **Sexton AD, Daley MC. 2015. Stable associations masked by temporal variability in the marine copepod microbiome. *PLoS ONE* 10(9): e0138967
- (40) Severin I, Bentzon-Tilia M, **Moisander PH**, Riemann L. 2015. Nitrogenase expression in estuarine bacterioplankton influenced by organic carbon and availability of oxygen. *FEMS Microbiology Letters* 326(14): fnv105
- (39) *Shoemaker KM, **Moisander PH**. 2015. Microbial diversity in association of copepods in the North Atlantic subtropical gyre. *FEMS Microbiology Ecology* 91(7): fiv064
- (38) *Scavotto R, Dziallas C, Bentzon-Tilia M, Riemann L, **Moisander PH**. 2015. Microbial community composition in association of copepods in the North Atlantic coastal waters. *Environmental Microbiology* 17(10): 3754-3765
- (37) Dabundo R, Lehmann MF, Treibergs L, Tobias CR, Altabet MA, **Moisander PH**, Granger J. 2014. Contamination of commercial ¹⁵N₂ gas stocks with ¹⁵N-labeled nitrate and ammonium and consequences for N₂ fixation measurements. *PLoS ONE* 9(10): e110335.
- (36) **Moisander PH**, Serros T, Paerl RW, Beinart RA, Zehr JP. 2014. Gammaproteobacterial diazotrophs and *nifH* expression in surface waters of the South Pacific Ocean. *The ISME Journal* 8: 1962-1973
- (35) Luo Y-W, Doney SC, Anderson LA, Benavides M, Bode A, Bonnet S, Bostrom K, Bottjer D, Capone DG, Carpenter EJ, Chen YL, Church MJ, Dore JE, Falcon LI, Fernandez A, Foster RA, Furuya K, Kitajima S, Langlois RJ, LaRoche J, Letelier RM, Maranon E, McGillicuddy DJ, **Moisander PH**, Moore MC, Mourino-Carballido B, Mulholland MR, Needoba JA, Orcutt KM, Poulton AJ, Raimbault P, Rees AP, Riemann L, Shiozaki T, Subramaniam A, Tyrrell T, Turk-Kubo, KA, Varela M, Villareal TA, Webb EA, White AE, Wu J, Zehr JP. 2012. Database of diazotrophs in global ocean: Abundances, biomass and nitrogen fixation rates. *Earth System Science Data* 4:47-73
- (34) Mulholland MR, Filippino KC, Bernhardt PW, Blanco J, Mondragon E, Turk K, **Moisander PH**, Zehr JP. 2012. Rates of dinitrogen fixation and the abundance of diazotrophs in North Atlantic coastal waters between Cape Hatteras and Georges Bank. *Limnol Oceanogr* 57:1067-1083
- (33) **Moisander PH**, Cheshire LA, Braddy J, Calandrino L, Hoffman M, Piehler MF, Paerl HW.

2012. Facultative diazotrophy increases competitive strength of *Cylindrospermopsis raciborskii* under fluctuating nitrogen availability. *FEMS Microbiol Ecol* 79:800-811
- (32) **Moisander PH**, Zhang RF, Boyle EA, Hewson I, Montoya JP, Zehr JP. 2012. Analogous nutrient limitations in unicellular diazotrophs and *Prochlorococcus* in the South Pacific Ocean. *The ISME Journal* 6:733-744. (first online in 2011)
- (31) Bombar D, **Moisander PH**, Dippner JW, Foster RA, Voss M, Karfield B, Zehr JP. 2011. Distribution of diazotrophic micro-organisms and *nifH* gene expression in the Mekong River plume during intermonsoon. *Mar Ecol Prog Ser* 424:39-U55.
- (30) **Moisander PH**, Beinart RA, Hewson I, White A, Johnson K, Carlson C, Montoya JM, Zehr JP. 2010. Unicellular cyanobacterial distributions broaden the oceanic N₂ fixation domain. *Science* 327:1512-1514.
- (29) **Moisander PH**, Lehman PW, Ochiai M, Corum S. 2009. Diversity of *Microcystis aeruginosa* in the Klamath River and San Francisco Bay delta, California. *Aquat Micr Ecol* 57:19-31.
- (28) **Moisander PH**, Ochiai M, Lincoff A. 2009. Nutrient limitation of *Microcystis aeruginosa* in northern California Klamath River reservoirs. *Harmful Algae* 8:889-897.
- (27) Hewson I, Poretsky R, Beinart RA, White A, Shi T, Bench SR, **Moisander PH**, Paerl RW, Tripp HJ, Montoya JP, Moran MA and JP Zehr. 2009. *In situ* transcriptomic analysis of the globally important keystone N₂-fixing taxon *Crocospaera watsonii* in the Southwest Pacific Ocean. *The ISME Journal* 3:618-631.
- (26) Zehr JP, Hewson I, **Moisander PH**. 2009. Molecular biology techniques and applications for ocean sensing. *Ocean Science* 5:101-113.
- (25) **Moisander PH**, Paerl HW, Zehr JP. 2008. Effects of inorganic nitrogen on taxa-specific cyanobacterial growth and *nifH* expression in a subtropical estuary. *Limnol Oceanogr* 53:2519-2432.
- (24) Piehler MF, Dyble J, **Moisander PH**, Chapman AD, Hendrickson J, and Paerl HW. 2009. Interactions between nitrogen dynamics and the phytoplankton community in Lake George, Florida, USA. *Lake and Reservoir Management* 25:1-14.
- (23) **Moisander PH**, Beinart RA, Voss M, Zehr JP. 2008. Diversity and abundance of diazotrophs in the South China Sea during intermonsoon. *The ISME Journal* 2:954-967.
- (22) **Moisander PH**, Paerl HW, Dyble J, Sivonen K. 2007. Phosphorus limitation and diel control in nitrogen-fixing cyanobacteria in the Baltic Sea. *Mar Ecol Prog Ser* 345:41-50.
- (21) Hewson I, **Moisander PH**, Morrison AE, Zehr JP. 2007. Diazotrophic bacterioplankton in a coral reef lagoon: Phylogeny, diel expression, and response to phosphate enrichment. *The ISME Journal* 1:78-91.
- (20) **Moisander PH**, Morrison AE, Ward BB, Jenkins BD, Zehr JP. 2007. Spatial-temporal variability in diazotroph assemblages in Chesapeake Bay using an oligonucleotide *nifH* microarray. *Environ Microbiol* 9:1823-1835.
- (19) Hewson I, **Moisander PH**, Achilles, KA, Carlson, CA, Jenkins BD, Mondragon, EA, Morrison AE, Zehr JP. 2007. Characteristics of diazotrophs in epi-to abyssopelagic waters of the Sargasso Sea. *Aquat Micr Ecol* 46:15-30.
- (18) Sivonen K, Halinen K, Sihvonen L, Koskeniemi K, Sinkko H, Rantasärkkä K, **Moisander PH** and Lyra C. 2007. Microbiological diversity and function in the Baltic Sea with emphasis on cyanobacteria. *Ambio* 36 (2-3):180-185.
- (17) **Moisander PH**, Shiue L, Steward G, Jenkins BD, Bebout BM, Zehr JP. 2006. Application of a *nifH* oligonucleotide microarray for profiling diversity of N₂-fixing microorganisms in marine microbial mats. *Environ Microbiol* 8:1721-1735.
- (16) **Moisander PH**, Piehler MF, Paerl HW. 2005. Diversity and activity of epiphytic nitrogen-fixers on standing dead stems of the salt marsh grass *Spartina alterniflora*. *Aquat Micr Ecol* 39: 271-279.

- (15) Paerl, HW, Piehler MF, Valdes L, Dyble J, **Moisander PH**, Pinckney JL, Steppe TF. 2005. Determining anthropogenic and climatically-induced change in aquatic ecosystems using Microbial indicators: An integrative approach. *Verh Internat Verein Limnol* 29:89-113.
- (14) **Moisander PH**, Steppe TF, Hall NS, Kuparinen J, Paerl HW. 2003. Variability in nitrogen and phosphorus limitation for Baltic Sea phytoplankton during nitrogen-fixing cyanobacterial blooms. *Mar Ecol Prog Ser* 262:81-95.
- (13) Paerl HW, Valdes LM, Pinckney JL, Piehler MF, Dyble J **Moisander PH**. 2003. Microalgae as indicators of estuarine and coastal ecological change. *Bioscience* 53:953-964.
- (12) Paerl HW, Dyble J, **Moisander PH**, Noble RT, Piehler MF, Pinckney JL, Twomey LJ, Valdes LM. 2003. Microbial indicators of aquatic ecosystem change: Current applications to eutrophication studies. *FEMS Microbiol Ecol.* 1561:1-14.
- (11) **Moisander PH**, Hench JL, Kononen K, Paerl HW. 2002. Small-scale shear effects on heterocystous cyanobacteria. *Limnol Oceanogr* 47:109-119.
- (10) **Moisander PH**, McClinton E, Paerl HW. 2002. Salinity effects on growth, photosynthetic parameters, and nitrogenase activity in estuarine planktonic cyanobacteria. *Micr Ecol* 43:432-442.
- (9) Hietanen S, **Moisander PH**, Kuparinen J, Tuominen L. 2002. No sign of denitrification in a Baltic Sea cyanobacterial bloom. *Mar Ecol Prog Ser* 242:73-82.
- (8) Piehler MF, Dyble J, **Moisander PH**, Pinckney JL, Paerl HW. 2002. Effects of modified nutrient concentrations and ratios on the structure and function of the native phytoplankton community in the Neuse River Estuary, North Carolina, USA. *Aquat Ecol* 36:371-385.
- (7) MacGregor BJ, Van Mooy B, Baker BJ, Mellon M, **Moisander PH**, Paerl HW, Zehr J, Hollander D, Stahl DA. 2001. Microbiological, molecular biological, and stable isotopic evidence for nitrogen fixation in the open waters of Lake Michigan. *Environ Microbiol* 3:205-219.
- (6) Paerl HW, Fulton R, **Moisander PH**, Dyble J. 2001. Harmful freshwater algal blooms, with an emphasis on cyanobacteria. *The Scientific World* 1:76-113.
- (5) **Moisander PH**, Paerl HW. 2000. Growth, primary productivity, and nitrogen fixation potential of *Nodularia* spp. (Cyanophyceae) in water from a subtropical estuary in the United States. *J Phycol* 36:645-658.
- (4) Kononen K, Huttunen M, Kanoshina I, Laanemets J, **Moisander P**, Pavelson J. 1999. Horizontal, vertical, and temporal variability of a dinoflagellate-cyanobacterium community in a changing hydrodynamical regime: A case study at the entrance to the Gulf of Finland. *Mar Ecol Prog Ser* 186:43-57.
- (3) **Moisander P**, Kononen K, Rantajärvi E, Huttunen, M. 1997. Phytoplankton community in relation to salinity fronts at the entrance to the Gulf of Finland, Baltic Sea. *Ophelia* 46:187-203.
- (2) Lehtimäki J, **Moisander P**, Sivonen K, Kononen K. 1997. Growth, nitrogen fixation, and nodularin production by two Baltic Sea cyanobacteria. *Appl Environ Microbiol* 63:1647-1656.
- (1) **Moisander P**, Lehtimäki J, Sivonen K, Kononen K. 1996. Comparison of $^{15}\text{N}_2$ and acetylene reduction methods for the measurement of nitrogen fixation by Baltic Sea cyanobacteria. *Phycologia* 35(6 Suppl):140-146.

Book chapters

- (4) Zehr JP, Church MJ, **Moisander PH**. 2006. Diversity, distribution, and biogeochemical Significance of nitrogen-fixing microorganisms in anoxic and suboxic ocean environments. pp. 337-371. In: Neritin LN (ed) *Past and present water column anoxia*. NATO Science Series IV. Vol 64. Springer.
- (3) Paerl HW, Dyble J, Pinckney JL, Valdes LM, Millie DF, **Moisander PH**, Morris JT, Bendis B,

- Piehl MF. 2004. Using microalgal indicators to assess human and climatically induced ecological changes in estuaries. pp. 145-174. In: Bortone SA (ed) *Estuarine Indicators*. CRC Press, Boca Raton, FL, USA.
- (2) **Moisander P.** 2003. Cyanobacterial blooms in the Baltic Sea: a sum of multiple factors (In Finnish), pp 75-78. In: Walls, M. & Rönkä, M. (eds). *Veden varassa - Suomen Vesiluonnon monimuotoisuus (Biodiversity of Finnish Aquatic Ecosystems)*. Edita. Helsinki, Finland. ISBN 951-37-3849-3.
- (1) **Moisander P.** 2002. Toxic algae cross international borders (In Finnish). In: H. Lumme (ed.), *Lue ja Opi Suomeksi 2 (Read and Learn in Finnish 2)*. Tietosanoma Oy. Gummerus Kirjapaino Oy, Jyväskylä, Finland. Pp. 122-123. ISBN 951-885-206-5.

Graduate students advised:

In progress

Katyanne Shoemaker, Ph.D. candidate in Marine Sci at UMassD	Jan 2014-present
Ryan Nuttall, Ph.D. candidate in Marine Science at UMassD	Sep 2017-present
Abhishek Naik, Ph.D. candidate in Marine Sci at UMassD	Sep 2017-present

Graduated

Ryan Nuttall, M.S., Marine Biology at UMassD	Sep 2015-Sep 2017
Sarah Holmes, M.S., Marine Biology at UMassD	Sep 2012-Jan 2015
Rosemary Scavotto, M.S., Marine Biology at UMassD	Sep 2012-Sep 2014
Katyanne Shoemaker, M.S., Marine Biology at UMassD	Sep 2011-Dec 2013

• Associate Editor:

Journal of Plankton Research, 1/2015-present
Frontiers in Aquatic Microbiology, 5/2018-present

• Manuscripts or proposals reviewed:

Reviewed 12-17 manuscripts + proposals per year

• International workgroup co-leader

Co-lead an Ocean Carbon and Biogeochemistry workgroup (<https://www.us-ocb.org/n-fixation-working-group/>): ***Developing best practices on oceanic ¹⁵N₂ fixation rates and relationship to communities.***

Cynthia Hughes Pilskaln

Present Position

Full Professor, Oceanography
University of Massachusetts Dartmouth
School for Marine Science and Technology (SMAST)
New Bedford, MA 02744 USA

Personal

Born: August 8, 1956, Cleveland, Ohio

Education

Ph.D.: Geological Sciences, Harvard University, 1985
M.A.: Geological Sciences, Harvard University, 1980
B.Sc.: Geology, University of Vermont, 1978

Honors, Fellowships, and Awards

- *Univ. of Massachusetts Dartmouth, Chancellor's Colloquium Honorary Speaker, 2010.
- *Recipient of Laura Randall Schweppe Endowed Fellowship/Lecture Series in Marine Science, Univ. of TX Austin Marine Science Inst., 2006
- *State of California: Woman of the Year and Maritime Woman Explorer Award, 1993
- *The Oceanography Society: Innovative Use of New Technology Award, 1989
- *Harvard University: Graduate Teaching Fellowship, 1979-1980

Advisory Board Memberships

- Scientific Advisory Committee, Westport River Watershed Alliance (WRWA), Westport, MA, 2008-2011
- Land for Maine's Future Board, State of Maine, Governor Appointee, 1998-2000
- Bermuda Biol. Station for Research, Corporation Member and Scientific Advisory Board, 1995-2002

Professional Society Memberships (current as of 2017)

American Geophysical Union
The Oceanography Society
American Association for the Advancement of Science

Research Interests

Expertise: Marine biogeochemistry and sedimentology/sediment transport; global marine carbon cycle dynamics. Research interests: Time-series geochemical particle fluxes in the ocean and large lake systems with emphasis on the quantitative relationship of such fluxes to climate forcing over short and long (geologic) time scales, and to the formation of recent sediment record; organic carbon cycling and POC aggregation and degradation processes in the water column and at the sediment/water interface; role of particle aggregation in carbon and silica remineralization and export fluxes; development and use of particle imaging instrumentation and submersible vehicle-based technology for the in-situ study of marine particles.

Research Cruise/Submersible Vehicle Experience

1985 to present: Chief Scientist or Co-Chief Scientist of over 60 oceanographic and large lake cruises. Submersible diving experience in DSRV ALVIN, SEA CLIFF and JOHNSON SEA LINK, and DSRV AVALON (all dives 4-8 hours to depths ranging from 700 – 1500 m). Chief Scientist on approximately 50 ROV deployment cruises. Field experience with the following ROV's: ISE Hysub, BENTHOS Mini-ROVER MK II, BENTHOS OpenFrame ROV, Hydrobotics Engineering Hydrobot 1000, and DOE Phantom, MBARI Western Flyer.

International Research Experience

1985-present: PI of research programs in Black Sea (Turkey), Rift Valley Lakes of East Africa, Lake Baikal (Siberia), and Antarctic/Southern Indian Ocean Sector—funded by NSF, National Geographic Soc., USGS, and International Oil Co. Consortium; Co PI on pending Brazilian-funded project on southern Brazil margin.

Positions

2017: Jan-May sabbatical leave: Visiting Scholar USC, UCSC and UCSB; Visiting Scientist MBARI.
2006-present: **Full Professor with tenure**, University of Massachusetts School for Marine Science and Technology.
2012-present: **Adjunct Professor**, University of Sao Paulo, Oceanography Inst., Sao Paulo, Brazil.
2001-2006: **Senior Research Scientist**, Bigelow Laboratory for Ocean Sciences.
2000: **Visiting Academic Scientist**, Antarctic Cooperative Research Centre, Univ. of Tasmania (on research leave from Univ. of Maine).
1993-2001: **Associate Professor of Oceanography; awarded tenure 1999**, University of Maine, Department of Oceanography/School of Marine Sciences.
1988-1993: **Assistant Scientist**, Monterey Bay Aquarium Research Institute.
1986-1988: **Research Associate/Adjunct Assistant Professor**, Duke University Marine Laboratory and Duke University Geology Department.
1985: Visiting Investigator, Woods Hole Oceanographic Institution
1984-1986: University of North Carolina at Chapel Hill: Post-Doctoral Associate.
1980: Harvard University: Research Assistant.
1980-1981: United States Geological Survey, Submarine Geology: Field Assistant.
1981-1984: Woods Hole Oceanographic Institution, Research Assistant (Physical Oceanography, Marine Geology and Geophysics, and Ocean Engineering Depts.).

Professional Panel and Committee Service for National Agencies/Professional Meetings Chaired

Invited Discussion Leader and Presenter, Effects of Climate Change on the Biologically-Driven Ocean Carbon Pumps, PICES/IOC/ICES Workshop, Santos, Brazil, 2015.
Invited Speaker/Panel Member, Ocean Acidification and Southern New England Conference, New Bedford, MA, 2014; sponsored by The Woods Hole Research Center, UMD and Buzzard's Bay Coalition.
Representative for UMass Dartmouth/SMASST, Regional Association for Research on the Gulf of Maine, 2014-present.
Coastal Carbon Synthesis/North American Carbon Program (NACP) Committee Member, 2012-present.
Session Chair, Coastal Carbon Workshop, Jan. 19-20, 2012, VIMS (sponsored by OCB)

Office).

Co-convenor and Session Chair, OOI-GBF (Ocean Observatories Initiative-Global Biogeochemical Fluxes) Program and Scoping Workshop, 2010-2011, May 2010, Woods Hole, MA.

Member of Scientific Steering Comm. for OOI-GBF (Ocean Observatories Initiative-Global Biogeochemical Fluxes) Program and Scoping Workshop, 2010-2011.

Invited Session Co-Chair and Invited Speaker, Ocean Carbon and Biogeochemistry Annual Summer Workshop, Scripps Inst., La Jolla, CA, 2010.

Chairperson and Oral Presenter, ASLO/AGU/TOS Ocean Sciences Meeting, Special Session “Gulf of Maine Biogeochemical and Ecosystem Dynamics” (1 oral and 1 poster session), 2008.

Invited Member, Regional Assoc. for Research on the Gulf of Maine (RARGOM) Scientific Steering Comm. for 2009 Gulf of Maine Science Symposium (New Brunswick), 2008-present.

Invited Participant/white paper contributor, Regional Assoc. for Research on the Gulf of Maine (RARGOM) Theme Session on the Role of Shipboard Sampling in Observing Systems; Univ. of NH, Durham, NH, 2008.

Invited Session Moderator, NOAA Ocean Acidification Meeting, Scripps Inst., La Jolla, CA, 2007.

Invited Member, NSF Proposal Review Panel, Division of Ocean Sciences, Chemical Oceanography Program, May 2005.

Invited Member, NSF Scientific Shipboard Equipment Proposal Review Panel, March 2004.

Invited Discussion Leader, Gordon Conference on Chemical Oceanography: Carbon Cycling, Aug. 2003.

Invited Member, NSF Scientific Shipboard Equipment Proposal Review Panel, March 2003.

Invited Participant, JGOFS Southern Ocean Synthesis Group Workshop and Report, Feb. 2002.

Invited Member, Proposal Review Panel, NOAA National Undersea Research Center for the North Atlantic and Great Lakes Program: Oct. 1997.

Invited Member, NSF Proposal Review Panels, Division of Ocean Sciences, Chemical and Biological Oceanography Programs, Nov. 1996.

Invited Member, NSF Proposal Review Panels, Division of Ocean Sciences, Chemical and Biological Oceanography Programs, April 1996.

Participant, NOAA Gulf of Maine Ecosystem Dynamics Workshop and Working Reports, Sept. 1996.

Representative, University of Maine, CORE Annual Meeting, March 1996.

Participant, CORE Science Educators’ Retreat and Report: Advising the Next Generation: Career Opportunities in the Ocean Sciences, Oct. 1995.

Invited Participant, DOE Ocean Margin Program Planning Workshop and Reports, Sept/Oct 1992, 1993, 1994.

Invited Member, Pre-Proposal Review Panel Maine/NH Sea Grant College Program, Feb. 1994.

Invited Member, Scientific Advisory Panel, NOAA Undersea Research Program/New Directions for Undersea Research in the North Atlantic Region and Report, May 1993.

Co-Chair, Special Session “Geochemical processes in large lakes” (2 oral and 1 poster session), American Geophysical Union Fall Meeting, San Francisco, Dec. 1992.

Invited Participant, NSF U.S. JGOFS Third Pacific Planning Meeting and Report: Dec. 1988.

Invited Participant, NSF U.S. JGOFS Sediment Trap Technology and Sampling Workshop and Report: Nov. 1988.

Session Chair and Invited Speaker, Ocean Carbon and Biogeochemistry Workshop, 2010.

Participant and paper contributor, Ocean Carbon and Biogeochemistry (OCB) Workshops, 2005, 2006, 2007, 2008.

Member, North American Carbon Program (NACP) Coastal Synthesis Group, 2008-2010.

Teaching Experience

University of Massachusetts Dartmouth, School of Marine Science and Technology:

- Instructor, Spring 2018; Course: Dept. of Estuarine and Ocean Sciences/SMAST Graduate Seminar in Marine Science and Technology (MAR 700/grad. level/1 credit).
- Instructor, Spring 2018; Course: Special topics: Biogeochemical particle dynamics (MAR 599/grad. level/2 credits).
- Instructor, Fall 2017; Course: Special topics: Pelagic carbonate plankton (MAR 599/grad. level/2 credits).
- Instructor, Fall 2017; Course: Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- *On sabbatical Jan.-May 2017.
- Instructor, Fall 2016; Course: Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Spring-Summer 2016; Course: Coastal Brazil Marine Studies (MAR 450/undergrad level/3 credits)—POSTPONED TO 2017.
- Instructor and Coordinator, Spring 2009-present: MAR 499 SMAST Summer Research Internships for Undergraduates.
- Instructor, Fall 2015; Course: Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Spring 2015; Course: Special topics/Independent Study: Marine-source Biofuels—Reading and Discussion (MAR 595/grad. level/2 credits).
- Instructor, Fall 2014; Course: Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Spring 2014; Course: Special topics/Independent Study: Marine Phytoplankton Ecology (MAR 595/grad. level/2 credits).
- Instructor, Fall 2013; Course: Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Fall 2012 & Spring 2013; Course: Dept. of Estuarine and Ocean Sciences/SMAST Graduate Seminar (MAR 700).
- Instructor, Spring 2011; Course: Special Topics/Climate Change: Causes and Consequences: (MAR 585/grad. level/2 credits).
- Instructor, Fall 2010; Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Fall 2009; Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).
- Instructor, Spring 2009; Course: Special Topics/Climate Change and Carbon Sequestration: (MAR 599/grad. level/2 credits).
- Instructor, Fall 2008; Intro. to Marine Geology/Geological Oceanography (MAR 515/grad. level/3 credits).

Instructor, Fall 2007 & Spring 2008; Course: Dept. of Estuarine and Ocean Sciences/SMAST Graduate Seminar in Marine Science and Technology (MAR 700/grad. level/team-taught/1 credit).

Sea Education Association (SEA), Woods Hole, MA, Climate Change Semester for

Undergraduates:

Invited distinguished lecturer, 2008, 2010, 2011, 2012, 2013: Biogeochemical particle fluxes and sedimentation in the ocean.

University of Maine:

Instructor, Spring 1998, 1999, 2001; Course: Topical Oceanography (adv. undergrad. level).

Instructor, Fall 1997; Course: Introduction to Oceanographic Field Methods (500-level/grad.).

Instructor, Fall 1996; Course: Particle Dynamics in Aquatic Systems (500-level/grad.).

Instructor, Spring 1995; Course: Particle Dynamics in Aquatic Systems (adv. undergrad/grad. level).

Instructor, Fall 1995; Course: Special Topics in Oceanographic Remote Imaging Techniques and Quantitative Analysis (grad. level).

Duke University:

Guest Lecturer, 1986-1987; Course: Marine Geology (grad. level).

University of North Carolina at Chapel Hill:

Instructor, 1984-1986; Course: Oceanography 101 (adv. undergrad./grad. level).

Instructor, 1986; Course: Carbonate Sedimentation Seminar (grad. level).

Guest Lecturer, 1985-1986; Course: Marine Geology (adv. undergrad/grad. level).

General Public Outreach, Education & PR Films, and K-12 Science Education Programs

2016/June: Invited discussion at SMAST with US Sen. Edward Markey and MA State Congressman Bill Keating on climate change impacts on the ocean.

2016/March: Invited scientific panel member, MA State Congressman Keating & Representative Madden Sponsored: Ocean Acidification Panel and Roundtable Discussion (scientists, policy makers and stakeholders), Woods Hole Research Center, Woods Hole, MA.

2015: Invited all-school speaker and 6th grade group mentor for Our Sisters' School (grades 5-8), New Bedford, MA.

2010: Featured Professor/Oceanographer: "Faces of UMass Dartmouth" PR video: www.umassd.edu/faces/cynthiapilskaln/. Shown at New Bedford Oceanarium.

2007: Sandwich, MA Middle School invited speaker, "Three Seasons South: An Antarctic Research Odyssey". 1990: Monterey Bay Aquarium and Sea Studies, Monterey, CA: Film "Exploring the Deep Canyon" – featured scientist in public education film on research in Monterey Bay shown in the Aquarium 1990-1995.

2007: Invited Speaker for New Bedford Women's Luncheon Group, Wamsutta Club on polar oceans and climate change.

2006: Interview with New Bedford Standard Times newspaper on climate change and impact on the ocean, published Nov. 2006.

2004: Maine and Vermont PBS Television 'Quest Series': Featured scientist in "The Gulf of Maine and Climate Change" educational/documentary film.

2003-2004: Speaker for Bigelow Laboratory's Café Scientifique Public Lecture Series, Dec. 2003, Aug. 2004.

2001-2004: Seahorse Cinema, independent documentary film company: Featured scientist in film "Three Seasons South" for public television, focused on Antarctic oceanographic expeditions.

1997-2002: "Project Oceanography" (televised, national/international middle school marine science education program broadcast and produced by the Univ. of South Florida School of Marine Science): Scientist host for three shows on marine snow, Antarctic oceanography and particle fluxes, and deep-sea sediments and sedimentation processes. 1991: Franklin Inst. Science Museum, Philadelphia, PA: "Greenhouse Earth Exhibition" – provided video and text on oceanic carbon cycle for traveling museum exhibition.

1998-present: Children's Museum of Portland: One of featured scientists in exhibit entitled "Maine Scientists Across the Globe".

1997-1998: Design of and participation in marine science component of summer science camp programs for teenagers: Camp Norumbega (Dresden, ME) and Camp Kieve (Walpole, ME).

1996-1998: University of Maine Science Day for Young Women: faculty participant and laboratory host.

1992: McGraw Hill Publishing Co. and Terra Assoc., New York, NY: "Researching the Ocean Depths" – featured scientist in educational science film on oceanography for middle school science curricula.

Graduate Students

Serve/d as chair of thesis committee for following students:

Victoria Gray, M.S. Candidate, Marine Sciences, DEOS, S Mast/UMD
 Nathalie Staiger, M.S. Candidate, Marine Sciences, DEOS, S Mast/UMD
 James Littrell, M.A., 2016, Marine Sciences, DEOS, S Mast/UMD
 Elissa Ward, M.A. 2016, Marine Sciences, DEOS, S Mast/UMD
 Kazuhiro Hayashi, Ph.D., 2013, Marine Sciences, DEOS, S Mast/UMD
 Janet Reichmuth, M.S. Candidate, 1997-2000, Oceanography, University of Maine
 Christine Darkangelo, M.S., Oceanography, 1998, University of Maine

Serve/d on thesis committees for following students:

Michele Markowitz, M.S., 2015-present, Marine Sciences, UC Santa Cruz
 Tyler O'Brien, M.S., 2014-present, Marine Sciences, UMass Boston
 Marco Pedulli, Ph.D., 2013, Marine Sciences, DEOS, S Mast/UMD
 Jennifer E. Szlosek, Ph.D., 2012, Marine Sciences, SUNY-Stony Brook
 Zhankun Wang, Ph.D., 2009, DEOS, S Mast/UMass Dartmouth
 Carolina Nobre, M.S., 2009, Marine Sciences, DEOS, S Mast/UMD
 Lin Zhang, M.S., 2007, DEOS, S Mast/UMass Dartmouth
 Pamela Sparks-McConkey, M.S., Oceanography, 2000, University of Maine
 Sarah Gerken, Oceanography, Ph.D., Oceanography, 2000, University of Maine
 Anneliese Eckhardt, M.S., Oceanography, 2000, University of Maine
 Ian Voparil, M.S., Oceanography, 1999, University of Maine
 Maureen Keller, Ph.D., Oceanography, 1998, University of Maine
 Zhen Chen, Ph.D., Oceanography, 1997, University of Maine
 Ming Wong, M.S., Oceanography, 1996, University of Maine
 Annette Larsen, M.S., Oceanography, 1995, University of Maine
 Deborah Steinberg, Ph.D., Biology, 1993, University of California, Santa Cruz
 Leslie R. Sautter, Ph.D., Geology, 1989, University of South Carolina

Undergraduate research interns advised/mentored

UMD/S Mast and India Inst. of Technology, Bhubaneswar: 2012- 1summer intern (A. Sarkar).

SMAST Summer Research Internship for Undergraduates: 2009- 1 summer undergraduate intern (C. Knight, Mt. Holyoke College); 2012- 1 summer undergraduate intern (H. Allen, Williams College).

Bigelow Laboratory/University of New England Internship Program: 2002-2006: Five individual semester-long undergrad. internships for credit (M. Lettau, S. Polans, C. Falkner/2 semesters, S. McQuilken).

University of Maine School of Marine Sciences: 2 undergrad. internships: 1996-2000.

Research Funding History: 2001-2016

NOAA Coastal Ocean Climate Adaptation (COCA) Program: Improving the environment while protecting our coasts: A holistic accounting of ecosystem services of “Green Infrastructure and Natural and Nature-Based Features (NNBF)” in an urbanized coastal environment (w/E. Douglas, UMB, lead and multiple Co-PIs: 2016-2018: \$279K/\$17K for UMD.

NSF/REU (N. O’Connor, UMD, lead): Research Experience for Undergraduates in Marine Biology: 2015-16.

Univ. of MA President’s Science and Technology Initiatives Fund (w/R. Hannigan, UMB, lead and multiple Co-PIs from UMD, UMB and UMA plus industry and non-profit partners): 2015-2016: \$160K/~\$75K for UMD): Sustainable Seafood Collaboratory.

Woods Hole Oceanographic Inst. Ocean Climate Change Inst.(with L. Keigwin, WHOI): 2010-2011: \$29,000: High resolution climate signals in NW Atlantic margin sediments.

NOAA/ECOHAB: 2009-2014: \$150,000 (Pilskaln PI): *Alexandrium* spp. cyst dynamics in the Gulf of Maine: delivery, deposition, and resuspension: Phase II-Benthic Boundary Layer Modeling.

NOAA/ECOHAB: 2006-2013: \$831,883 (Pilskaln PI): GOMTOX: Dynamics of *Alexandrium fundyense* distributions in the Gulf of Maine - an observational and modeling study of nearshore and offshore shellfish toxicity, vertical toxin flux, and bloom dynamics in a complex shelf sea.

Univ. of MA School of Marine Science (SMS) Intercampus Seed Grant: 2008-2009: \$10,000: Characterization of the microbial community in the particle-rich, marine benthic nepheloid layer (BNL)—for SMS graduate student support.

NSF ITR Program: 2005-2009: \$284,827 (Pilskaln Co-PI): ITR Collaborative Research: Interactive Software Systems for Expert-Assisted Image Analysis and Classification of Aquatic Particles.

NSF/OPP/Antarctic Program: 1998-2004: \$513,926 (Pilskaln PI): POC Production and Export in the Southern Indian Ocean: A US-China Collaborative Program.

NSF/Bio. Oce.: 2001-2005: \$493,509 (Pilskaln PI): Collaborative Research: *Rhizosolenia* mats as a source of nitrogen flux into the surface waters of the Pacific Ocean

ONR/Environmental Optics: 2000-2005: \$303,315 (Bigelow budget, Pilskaln Co-PI): Chalk-Ex: Transport of Optically Active Particles from the Surface Mixed Layer.

NOAA/ECOHAB: 2004-2007: \$417,601 (Pilskaln PI): *Alexandrium* spp. cyst dynamics in the Gulf of Maine: delivery, deposition, and resuspension

*****1988-2016: Receipt of competitive research funding from Federal Agencies, private foundations and industry totaling ~4.6 million dollars.***

Peer-Reviewed Publications

Pilskaln, C.H., A.C. Neumann and J.M. Bane. 1986. The flux and deposition of periplatform carbonate in Northwest Providence Channel, Bahamas. *Third Annual Symposium on the Geology of the Bahamas, Proceedings*, 123-138.

- Pilskaln, C.H. and S. Honjo. 1987. The fecal pellet fraction of biogeochemical particle fluxes to the deep sea. *Global Biogeochemical Cycles*, 1, 31-48.
- Pilskaln, C.H., A.C. Neumann and J.M. Bane. 1988. Periplatform carbonate flux in the Northern Bahamas. *Deep-Sea Research*, 36, 1391-1406.
- Schwing, F.B., J.G. Norton and C.H. Pilskaln. 1990. Earthquake and the bay: Response of Monterey Bay to the Loma Prieta earthquake, 1990. *EOS, Transactions American Geophysical Union*, 71, 250-262.
- Pilskaln, C.H. 1991. Biogenic aggregate sedimentation in the Black Sea basin. *In: Black Sea Oceanography*, E. Izdar and J.W. Murray (eds.), Kluwer Academic Publ., Dordrecht, Netherlands, 200-214.
- Pilskaln, C.H. and T.C. Johnson. 1991. Seasonal signals in Lake Malawi sediments, East Africa. *Limnology and Oceanography*, 36, 544-557.
- Pilskaln, C.H., M.W. Silver, D.L. Davis, K.M. Murphy, S.A. Lowder, B.R. Gritton and L.M. Lewis. 1991. A quantitative study of marine aggregates using specialized ROV instrumentation. *Oceans '91, IEEE Proceedings*, 2, 1175-1182.
- Beir, J.A., S. Wakeham, C.H. Pilskaln and S. Honjo. 1991. An unusual organic chemical composition for interfacial sediment in the Black Sea. *Nature*, 351, 642-644.
- Silver, M.W., C.H. Pilskaln, and D. K. Steinberg. 1991. The biologist's view of sediment trap collections: Problems of marine snow and living organisms. *In: Sediment Trap Studies in the Nordic Countries Symposium Proceedings*. P. Wassmann, A. Heiskanen & O. Lindahl (eds.), Helsinki, Finland, 76-93.
- Buck, K.R., L. Uttal-Cooke, C.H. Pilskaln, D.L. Roelke, M.C. Villac, G.A. Fryxell, L. Cifuentes, and F.P. Chavez. 1992. Autoecology of *Pseudonitzschia australis* Frenguelli, a suspected domoic acid producer, from Monterey, California. *Marine Ecology Progress Series*, 84, 293-302.
- Davis, D.L. and C.H. Pilskaln. 1993. Measurements with underwater video: Camera field width calibration and structured lighting. *Journal of the Marine Technology Society*, 26, no. 4, 13-19.
- Silver, M.W., S.L. Coale, D.K. Steinberg and C.H. Pilskaln. 1994. Marine Snow. *In: Linking Species and Ecosystems*, C.G. Jones and J.H. Laughton (eds.), Chapman and Hall, NY, pp. 45-51.
- Thunell, R.C., W.S. Moore, J. Dymond, C.H. Pilskaln. 1994. Elemental and isotopic fluxes in the Southern California Bight: A time-series sediment trap study in San Pedro Basin. *Journal of Geophysical Research*, 99, 875-889.
- Thunell, R.C., C.H. Pilskaln, E. Tappa and L.R. Sautter. 1994. Temporal variability in sediment fluxes in the San Pedro Basin, Southern California Bight. *Continental Shelf Research*, 14, 333-352.
- Steinberg, D.K., M.W. Silver, C.H. Pilskaln, S.L. Coale and J.B. Paduan. 1994. Mid-water zooplankton communities on pelagic detritus (giant larvacean houses) in Monterey Bay, California. *Limnology and Oceanography*, 39, 1606-1620.
- Edlund, M.B., E.F. Stoermer and C.H. Pilskaln. 1995. Siliceous microfossil succession in the recent history of two basins in Lake Baikal, Siberia. *Journal of Paleolimnology*, 14, 165-184.
- Stoermer, E.F., M.B. Edlund, C.H. Pilskaln and C.L. Schelske. 1995. Siliceous microfossil distribution in the surficial sediments of Lake Baikal. *Journal of Paleolimnology*, 14, 69-82.
- Berelson, W.M., J. McManus, K. Coale, K.S. Johnson, T. Kilgore, D. Burdige and C.H. Pilskaln. 1996. Biogenic matter diagenesis on the sea floor: A comparison between two continental margin transects. *Journal of Marine Research*, 54, 731-762.
- Francois, R., C.H. Pilskaln and M.A. Altabet. 1996. Seasonal variations in the nitrogen isotope composition of sediment trap materials in Lake Malawi, East Africa. *In: International*

- Decade for the East African Lakes: Limnology, Climatology and Paleoclimatology, Symposium Volume*, T. C. Johnson and E. Odada (eds.), Gordon and Breach Publ., 241-250.
- Steinberg, D.K., M.W. Silver, and C.H. Pilskaln. 1997. Role of mesopelagic zooplankton in the community metabolism of giant larvacean house detritus in Monterey Bay, California. *Marine Ecology Progress Series*, 147, 167-179.
- Pilskaln, C.H., J.B. Paduan, F.P. Chavez, R.Y. Anderson and W.M. Berelson. 1996. Carbon export and regeneration in the coastal upwelling system of Monterey Bay, central California. *Journal of Marine Research*, 54, 1149-1178.
- Silver, M.W., S.L. Coale, C.H. Pilskaln and D.K. Steinberg. 1998. Giant aggregates: importance as community centers and agents of material flux in the mesopelagic zone. *Limnology and Oceanography*, 43, 498-507.
- Steinberg, D.K., C.H. Pilskaln and M.W. Silver. 1998. Contribution of zooplankton associated with detritus to sediment trap "swimmer" carbon in Monterey Bay, California. *Marine Ecology Progress Series*, 164, 157-166.
- Altabet, M.A., C.H. Pilskaln, R.C. Thunell, C. Pride, D. Sigman, F.P. Chavez and R. Francois. 1998. The nitrogen biogeochemistry of sinking particles from the margin of the eastern North Pacific. *Deep-Sea Research I*, 46, 655-679.
- Pilskaln, C.H., J.H. Churchill and L.M. Mayer. 1998. Resuspension of sediment by bottom trawling in the Gulf of Maine and potential geochemical consequences. *Journal of Conservation Biology*, 12, 1223-1230.
- Pilskaln, C.H., C. Lehmann, J.B. Paduan and M.W. Silver. 1998. Spatial and temporal dynamics in marine aggregate abundance, sinking rate and flux: Monterey Bay, central California. *Deep-Sea Research II*, 45, 1803-1837.
- Silver, M.W., S.L. Coale, C.H. Pilskaln and F.P. Chavez. 1998. Exploratory observations of marine aggregates sub-euphotic depths. *Deep-Sea Research II*, 45, 1839-1862.
- Villareal, T.A., C. H. Pilskaln, M.A. Brzezinski, F. Lipschultz and G.B. Gardner. 1999. Upward oceanic nitrate transport by migrating diatom mats. *Nature*, 397, 423-425.
- Shipe, R.F., M.A. Brzezinski, C.H. Pilskaln and T.A. Villareal. 1999. Rhizosolenia mats: an overlooked source of silica production in the open sea. *Limnology and Oceanography*, 44, 1282-1292.
- Prahl, F. G., and C.H. Pilskaln and M.A. Sparrow. 2001. Seasonal record for alkenones in sedimentary particles from the Gulf of Maine. *Deep-Sea Research*, 48, 515-528.
- Pilskaln, C.H. and J. Pike. 2001. Formation of sedimentary laminae in the Black Sea and the role of the benthic flocculent layer. *Paleoceanography*, 16, 1-19.
- Xu, J.P., M. Noble, S.L. Eittrich, L.K. Rosenfeld, F.B. Schwing and C.H. Pilskaln. 2002. Distribution and transport of suspended particulate matter in Monterey canyon, California. *Marine Geology*, 181, 215-234.
- Pilskaln, C.H., V.L. Asper and S.J. Manganini. 2003. US-China collaborative research program on particulate organic matter export in the Southern Indian Ocean, East Antarctica. *Antarctic Journal of the United States*, 34, (final issue on-line).
- Pilskaln, C. H., S.J. Manganini, V.L. Asper, T.W. Trull, W. Howard, L. Armand and R. Massom. 2004. Biogeochemical particle fluxes in the Indian Sector of the Southern Ocean: 1998-2001. *Deep-Sea Research I*, 51, 307-322.
- Pilskaln, C.H. 2004. Seasonal and interannual particle export in an African Rift Valley Lake: A five-year record from Lake Malawi, southern East Africa. *Limnology and Oceanography*, 49, 964-977.
- Pilskaln, C. H. 2005. Autobiographical Sketches of Women in Oceanography. *Oceanography Magazine*, 18 (1), p. 188.

- Newell, C.R., C.H. Pilskaln, S.M. Robinson and B.A. MacDonald. 2005. The contribution of marine snow to the particle food supply of the benthic suspension feeder, *Mytilus edulis*. *Journal of Experimental Marine Biology and Ecology*, 321 (2), 109-124.
- Pilskaln, C.H., T. A. Villareal, M. Dennett, C. Darkangelo-Wood and G. Meadows. 2005. High concentrations of marine snow and diatom algal mats in the North Pacific Subtropical Gyre: implications for carbon and nitrogen cycles in the oligotrophic ocean. *Deep-Sea Research Part I*, 52, 2325-2332.
- Benfield, M. C., P. Grosjean, P. Culverhouse, X. Irigoien, M. E. Sieracki, A. Lopez-Urrutia, H. G. Dam, Q. Hu, C. S. Davis, A. Hansen, C. H. Pilskaln, E. Riseman, H. Schultz, P. E. Utgoff and G. Gorsky. 2007. RAPID: Research on Automated Plankton Identification. *Oceanography Magazine*, 20 (2), 172-187.
- Friedland, K. D., J. A. Hare, G. B. Wood, L. A. Col, L. J. Buckley, D. G. Mountain, J. Kane, J. Brodziak, R. G. Lough, and C. H. Pilskaln. 2008. Does the fall phytoplankton bloom control recruitment of Georges Bank haddock, *Melanogrammus aeglefinus*, through parental condition? *Canadian Journal of Fisheries and Aquatic Sciences*, 65 (6), 1076-1086.
- Sieracki, M. E., M. Benfield, A. Hanson, C. Davis, C.H. Pilskaln, D. Checkley, H.M. Sosik et al. 2010. Optical plankton imaging and analysis systems for ocean observation. *Proceedings of Ocean Obs.*, 9, 21-25.
- Silapachote, P., F. Stolle, A. R. Hanson and C. H. Pilskaln. 2010: Classification of challenging marine imagery. *Proceedings of the Fifth International Conference on Computer Vision Theory and Applications (VISAPP)*, 2, 401-406. Piyanuch Silapachote, Frank Stolle, Allen R. Hanson, Cynthia H. Pilskaln
- Li, W., R. Anderson, D. Gifford, L. Incze, J. Martin, C. Pilskaln, J. Rooney-Varga, M. Sieracki, W. Wilson and N. Wolff. 2011. Planktonic microbes in the Gulf of Maine area. *PLoS ONE*, 6 (6), e20981 doi:10.1371/journal.pone.0020981.
- Friedland, K., C. Stock, K. Drinkwater, J. Link, R. Leaf, B. Shank, J. Rose, C. Pilskaln and M. Fogarty. 2012. Pathways between primary production and fisheries yields of large marine ecosystems. *PLoS ONE*, 7(1): e28945. doi:10.1371/journal.pone.0028945.
- Anderson, D.M., Keafer, B.A., Kleindinst, J.L., McGillicuddy, Jr., D.J., Martin, J.L., Norton, K., Pilskaln, C.H., Smith, J.L., Sherwood, C.R., Butman, B. 2014. *Alexandrium fundyense* cysts in the Gulf of Maine: Long-term time series of abundance and distribution, and linkages to past and future blooms, *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2013.10>.
- Hwang, J., D.B. Montluçon, C.H. Pilskaln and T.I. Eglinton. 2013. Molecular and isotopic insights into POM sources and dynamics in Jordan Basin, Gulf of Maine. *Continental Shelf Research*, 68, 15-22.
- McGillicuddy, Jr., D.J., M.L. Brosnahan, D.A. Couture, R. He, B.A. Keafer, J.P. Manning, J.L. Martin, C.H. Pilskaln, D.W. Townsend and D.M. Anderson. 2014. A red tide of *Alexandrium fundyense* in the Gulf of Maine. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2013.05.011>.
- Pilskaln, C.H., D.M. Anderson, D.J. McGillicuddy, B.A. Keafer, K. Hayashi and K. Norton. 2014. Spatial and temporal variability of *Alexandrium* cyst fluxes in the Gulf of Maine: Relationship to seasonal particle export and resuspension. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2012.11.001>.
- Pilskaln, C. H., K. Hayashi, B.A. Keafer, D.M. Anderson and D.J. McGillicuddy. 2014. Benthic nepheloid layers in the Gulf of Maine and *Alexandrium* cyst inventories. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2013.05.021>.
- Pedulli, M., J.J. Bisagni, H.W. Ducklow, R. Beardsley and C.H. Pilskaln. 2014. Estimates of potential new production (PNP) for the waters off the Western Antarctic Peninsula (WAP) region. *Continental Shelf Research*, 84, 54-69.

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- Keigwin, L.D. and C.H. Pilskaln. 2014. Sedimentation and recent paleoclimate in Jordan Basin, Gulf of Maine. *Continental Shelf Research*, 96, 45-55.
- Stamieszkin, K., A.J. Pershing, N.R. Record, C.H. Pilskaln, H.G. Dam and L.R. Feinberg. 2015. Copepod community size structure as a factor in modeled fecal pellet carbon flux variability. *Limnology and Oceanography*, doi: 10.1002/lno.1015.
- Wang, Z.A., G.L. Lawson, C.H. Pilskaln and A.E. Maas. 2017. Seasonal controls of aragonite saturation states in the Gulf of Maine. *Journal of Geophysical Research: Oceans*, 122, doi:10.1002/2016JC012373.
- Najjar, R., E. W. Boyer, D. Burdige, D. Butman, W.-J. Cai, E. A. Canuel, R. Chen, M. A. M. Friedrichs, R. Feagin, P. Griffith, M. Herrmann, A. Hinson, W. M. Kemp, K. Kroeger, A. Mannino, S. L. McCallister, W. McGillis, M. R. Mulholland, C. Pilskaln, J. Salisbury, S. Signorini, H. Tian, M. A. Tzortziou, P. Vlahos, Z. A. Wang, R. C. Zimmerman. 2018. Coastal zone carbon budget of Eastern North America. *Global Biogeochemical Cycles*, 32 (3), 389-416, <https://doi.org/10.1002/2017GB005790>
- Rigual-Hernández, A.S., C.H. Pilskaln, A. Cortina, F. Abrantes and L.K. Armand. 2018. Diatom species fluxes in the seasonally ice-covered Antarctic Zone: new data from offshore Prydz Bay and comparison to other regions from the eastern Antarctic and western Pacific sectors of the Southern Ocean. 2018. *Deep-Sea Research II*, in press.

Manuscripts submitted for publication/in review

- Pedulli, M., J. J. Bisagni, H. Ducklow, C.H. Pilskaln and R. Beardsley. 2018. Trends and spatial/temporal patterns of macronutrients, euphotic depth, mixed-layer depth and chlorophyll-a for the Western Antarctic Peninsula (WAP) region. *Continental Shelf Research*, in revision.

Manuscripts in preparation (with co-authors) for publication

- Pilskaln, C.H. and K. Hayashi. Decadal variability in carbon delivery on the Northwest Atlantic shelf and the role of benthic nepheloid layers. In prep. for *Continental Shelf Research*.
- Pilskaln, C.H., A. Leventer and E. Ward. Seasonal export of diatom species and biogenic opal in the Gulf of Maine. In prep. for *Limnology and Oceanography*.

Technical Reports/Community White Papers

- Pilskaln, C.H. 1988. Composition of Black Sea surface sediments. In: Temporal and Spatial Variability in Sedimentation in the Black Sea: Cruise Report R/V *Knorr* 134-8, Black Sea Leg I, S. Honjo and B. Hay (eds.), WHOI Technical Report #88-35; p. 141-143.
- Arthur, M.A., J.E. Broda, W.E. Dean, A.S. Derman, A.R. Gagnon, B.J. Hay, Y.T. Knouk, S. Honjo, E.D. Neff, C.H. Pilskaln and M. Briskin. 1988. Black Sea Sediments. In: Temporal and Spatial Variability in Sedimentation in the Black Sea: Cruise Rept R/V *Knorr* 134-8, Black Sea Leg I, S. Honjo and B. Hay (eds.), WHOI Technical Report #88-35, p. 109-129.
- Pilskaln, C.H. 1990. Geochemical composition and particulate components of Black Sea Basin fluff layer and surface sediments. MBARI Technical Report #90-4, 15 p.
- Pilskaln, C.H. and J.B. Paduan. 1992. Laboratory techniques for the handling and geochemical analysis of water column particulate and surface sediment samples. MBARI Technical Report #92-9, 22 p.

Kevin D. E. Stokesbury, Ph.D.

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University of Massachusetts Dartmouth

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EDUCATION

Ph.D. Université Laval, Quebec City, Quebec, 1994; (Area of specialization: Marine Ecology).

M.Sc. Acadia University, Wolfville, Nova Scotia, 1987; (Area of specialization: Marine Ecology).

B.Sc. (specialization), Acadia University, Wolfville, Nova Scotia, 1984; (Area of specialization: Marine Biology).

PROFESSIONAL EXPERIENCE:

Professor, Department of Fisheries Oceanography, SMAST, 9/1/16 to present

Professor, Chair of the Department of Fisheries Oceanography, SMAST, 9/1/10 to present

Associate Professor, Chair of the Department of Fisheries Oceanography, SMAST, 9/1/05 to 8/31/2010

Assistant Professor, SMAST, University of Massachusetts Dartmouth; 9/1/00 – 9/1/05

Associate Fellow, SMAST, University of Massachusetts Dartmouth; 9/15/98 to 8/30/00

Research Associate, (adjunct professor), SEA Herring Project, University of Alaska Fairbanks; 2/25/96 to 9/15/98

Research Associate, EMAP (adjunct professor), Center for Marine Science Research, University of North Carolina at Wilmington; 05/27/94-02/10/96

RECENT AWARDS AND HONORS:

2017 Appointed to The National Academies of Sciences, Engineering, and Medicine steering committee for “Fisheries Research and Monitoring for Atlantic Offshore Development – A Workshop.” 22 May 2017.

2013 “The Scholar of the Year” award presented by the UMASS Faculty Federation at the University of Massachusetts Dartmouth, 4 December 2013.

2013. - The David H. Wallace Award from the National Shellfish Association. This award is given to individuals whose activities in shellfisheries, aquaculture and conservation have promoted understanding, knowledge, and cooperation among industry members, the academic community, and government, as exemplified by Mr. David H. Wallace during his lifetime. Recipients receive a plaque and lifetime membership in the Association. Nashville, 23 February 2013.

2013 - Marine Fisheries Field Research Group have been selected as this year's winner of the Outstanding Organization Award from the Southern New England Chapter (SNEC) of the American Fisheries Society. The Outstanding Organization Award recognizes academic, governmental, private, or tribal organizations and units for their current or historic advances in the stewardship of aquatic ecosystems, advancement of fisheries science, or service to the profession. 7 May 2013

FIVE RECENT PUBLICATIONS (CAREER TOTAL 65):

1. Bethoney, N. D. and K.D.E., Stokesbury. 2018. Methods for image based surveys of benthic macroinvertebrates and their habitat exemplified by the drop camera survey of the Atlantic sea scallop. JoVES, 137: 1-10; DOI: [doi:10.3791/57493](https://doi.org/10.3791/57493).

2. Bayer, S.R., R.A. Wahle, D.C. Brady, P.A., Jumars, K.D.E., Stokesbury, and J.D. Carey. 2018. Fertilization dynamics in scallop aggregations: reconciling model predictions and field measurements of density effects. *Ecospheres*, 9(8): e02359. 10.1002/ecs2.2359.
3. Harris, B.P., C.F. Adams, and K.D.E. Stokesbury. 2018. Persistent high-concentration sea scallop (*Placopecten magellanicus*) aggregations on Georges Bank. *Ecospheres* 9(3) e02133.
4. Asci, S.C., R.W. Langton, and K.D.E. Stokesbury. 2018. Estimating similarity in benthic communities over decades and in areas open and closed to fishing in the central Gulf of Maine. *Mar. Ecol. Prog. Ser.* 595: 15-26.
5. Stokesbury, K.D.E., C.E. O'Keefe, and B.P. Harris. 2016. Fisheries Sea Scallop, *Placopecten magellanicus*. In S. E. Shumway and G.J. Parsons, editors. *Scallops: biology, ecology and aquaculture*. Amsterdam: Elsevier. Pp719-732.

SYNERGISTIC ACTIVITIES:

I am the former Chair of the Department of Fisheries Oceanography at the University of Massachusetts Dartmouth and the Research Director of the Massachusetts Fisheries Institute, which is a partnership between the University and the state Division of Marine Fisheries; research projects include Atlantic herring, groundfish, lobsters and scallops. My primary research focus is the sea scallop program, including stock assessment, rotational fishery management strategies, growth and mortality estimates, gear development and environmental assessment. My major accomplishments in research have been developing the SMAST sea scallop video survey and an open-trawl video survey to address the scientific uncertainty in groundfish stock assessments. I have funded this research through 100 grants equaling \$50 million. This work has been published in 60 peer-reviewed scientific papers and 5 book peer-reviewed book chapters. On three occasions I was asked to presented testimonies for Congressional hearings in Washington DC on different components of this work. I have also presented this work in 80 scientific reports, 80 scientific conferences and 100 invited seminars. Over my career at SMAST, 20 of my students have graduated and produced 21 scientific papers based on their thesis research which has been presented in over 115 contributing papers and posters to regional, national and international conferences. My students have a very high rate of employment within their field upon graduation.

Miles A. Sundermeyer

Professor
 School for Marine Science and Technology
 University of Massachusetts Dartmouth
 New Bedford, MA 02744-1221

Guest Investigator
 Dept. of Applied Ocean Physics & Engineering
 Woods Hole Oceanographic Institution
 Woods Hole, MA 02543

Professional Preparation:

Univ. California, Santa Cruz	Santa Cruz, CA	Physics and Mathematics	B.A., 1991
Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program	Woods Hole, MA	Physical Oceanography	Sc.M., 1995
Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program	Woods Hole, MA	Physical Oceanography	Ph.D., 1998
Center for Marine Science and Technology, Univ. Massachusetts Dartmouth	New Bedford, MA	Postdoctoral Fellow	Aug. 1998– Aug. 2000

Appointments:

Professor, School for Marine Science and Technology, University of Massachusetts Dartmouth, September 2016–Present
 Graduate Program Director, School for Marine Science and Technology, University of Massachusetts Dartmouth / UMass Intercampus School of Marine Science, September 2017–Present
 Guest/Visiting Investigator, Department of Applied Ocean Physics & Engineering, Woods Hole Oceanographic Institution. August 1998–Present.
 Associate Professor w/ tenure, School for Marine Science and Technology, University of Massachusetts Dartmouth, September 2006–August 2016
 Assistant Professor, School for Marine Science and Technology, University of Massachusetts Dartmouth, February 2001–August 2006
 Research Associate, Center for Marine Science and Technology, University of Massachusetts Dartmouth, August 2000–February 2001
 Lecturer, Massachusetts Maritime Academy. Fall, 1999.
 Graduate Research Assistant, Department of Physical Oceanography, Woods Hole Oceanographic Institution. 1992–1998.

Products:**Most Relevant Recent Products:**

Rypina, I, A. Kirincich, S. Lentz, and **M. A. Sundermeyer**, 2016. Investigating the Eddy Diffusivity Concept in the Coastal Ocean. *J. Phys. Oceanogr.*, **46** (7), 2201–2218. doi: 10.1175/JPO-D-16-0020.1
 Shcherbina, A., **M. A. Sundermeyer**, et al. (38 authors), 2015. The LatMix Summer Campaign: Submesoscale Stirring in the Upper Ocean. *Bull. Amer. Meteor. Soc. (BAMS)*. **96**, 1257–1279. doi:10.1175/BAMS-D-14-00015.1.

Kunze, E, and **M. A. Sundermeyer**, 2015. The Role of Intermittency in Internal-Wave Shear Dispersion, *J. Phys Oceanogr.*, **45**, 2979-2990. doi: 10.1175/JPO-D-14-0134.1

Sundermeyer, M. A., E. Skillingstad, J. R. Ledwell, B. Concannon, E. A. Terray, D. A. Birch, S. D. Pierce, B. Cervantes, 2014. Observations of Large-Aspect Ratio Large Eddy Circulation in the Ocean Surface Mixed Layer. *Geophys. Res. Lett.*, **41**, 7584–7590, doi:10.1002/2014GL061637.

Sawabini, A., **M. A. Sundermeyer**, B. H. Howes, D. Schlezinger, 2014 Regional Forcing by Light on Dissolved Oxygen Levels in Shallow Temperate Estuaries. *Estuaries and Coasts*, **38**, 3, 1062-1076, doi: 10.1007/s12237-014-9879-1.

Other Relevant Products:

Sundermeyer, M. A., E. A. Terray, J. R. Ledwell, A. G. Cunningham, P. E. LaRocque, J. Banic, and W. J. Lillycrop, 2007. Three-Dimensional Mapping of Fluorescent Dye Using a Scanning, Depth-Resolving Airborne Lidar. *J. Atmos. Oceanic Technol.*, **24**, 1050–1065.

Kunze, E., J. M. Klymak, R.-C. Lien, R. Ferrari, C.M. Lee, **M. A. Sundermeyer**, and L. Goodman, 2015. Submesoscale Water-Mass Spectra in the Sargasso Sea. *J. Phys Oceanogr.*, **45** (5), 1325–1338, doi:10.1175/JPO-D-14-0108.1.

Klymak, J.M., R.K. Shearman, J. Gula, C. Lee, E.A. D’Asaro, L.N. Thomas, R.R. Harcourt, A.Y. Shcherbina, **M.A. Sundermeyer**, M.J. Molemaker, J.C. McWilliams, 2016. Submesoscale streamers exchange water on the North Wall of the Gulf Stream. *Geophys. Res. Lett.*, **43**, 1226–1233, doi:10.1002/2015GL067152.

Brunner-Suzuki, A.-M. E. G, **M. A. Sundermeyer**, M.-P. Lelong, 2014. Upscale Energy Transfer by the Vortical Mode and Internal Waves. *J. Phys. Oceanogr.*, **44.9**, 2446-2469.

Brunner-Suzuki, A.-M.E.G., **M.A. Sundermeyer**, M.-P. Lelong, 2012. Vortex Stability in a Large-Scale Internal Wave Shear. *J. Phys. Oceanogr.*, **42**, 1668–1683, doi:10.1175/JPO-D-11-0137.1.

Synergistic Activities:

Co-founder and UMass Dartmouth lead of UMass Experimental Center for Environmental Lidar (EXCEL), to develop and use state-of-the-art lidar remote sensing technologies for research and environmental applications.

Developed and teach graduate courses in Coastal Physical Oceanography, Case Studies in Estuarine Dynamics, Laboratory in Oceanography – Data and Methods, and Introductory Physical Oceanography; and undergraduate level Introductory Ocean Sciences at UMass Dartmouth.

Advised/Mentored undergraduate Dept. Electrical and Computer Engineering Senior Design project teams at UMass Dartmouth, (AY06-07, AY09-10, AY18-19).

Initiated hands on training field day on Buzzards Bay for students in Introductory Physical Oceanography course at UMass Dartmouth (AY09-10, AY13-14 through AY18-19).

Guest presentations on ocean processes and ocean mixing to 4th & 5th and 7th & 8th grade classrooms in Sandwich, MA public school (AY11-12 through AY17-18).

Jefferson T. Turner Ph.D.
Chancellor Professor
Department of Biology, and
School for Marine Science and Technology (SMAST)
University of Massachusetts Dartmouth
Dartmouth, MA 02740

Professional Preparation

1969 B.S. Biology, Guilford College, Greensboro, NC
1972 M.A. Marine Science, University of South Florida, St. Petersburg
1977 Ph.D. Oceanography, Texas A&M University

Appointments

1977-1978 Postdoctoral Researcher, University of West Florida, Pensacola
1978-1979 Associate Research Scientist, New York Ocean Science Laboratory, Montauk
1979-present Assistant Professor, Associate Professor, Professor, Chancellor Professor,
 University of Massachusetts Dartmouth

Selected Synergistic activities

Chair, Biology Department, University of Massachusetts Dartmouth, 2004 - 2006
Vice President, World Association of Copepodologists, 2005 - 2008
Teaching 4-6 undergraduate and graduate courses per year in biology, oceanography, and biogeography (1979 - present) – graduate course at SMAST: Biological Oceanography, 2 SMAST doctoral students (Christian Petitpas, Jana del Favero)
Collaboration with colleagues at Woods Hole Oceanographic Institution (WHOI), University of Maine, NOAA and US Food and Drug Administration in studies of red tide blooms in the Gulf of Maine, and toxin accumulation and transport in zooplankton (1998 - 2015)
Year-round monitoring of plankton communities in Buzzards Bay (since 1987) and Boston Harbor, Massachusetts Bay and Cape Cod Bay (since 1992)
Collaboration with Adrianna Ianora and other colleagues at the Stazione Zoologica, Napoli, Italy, on effects of phytoplankton diets on copepod reproductive success in the Adriatic Sea and Mediterranean (since 1997)
Collaboration with colleagues at WHOI and others on production and grazing studies at the shelf-break front south of New England (since 2016)

Publications (30 selected out of 115 peer-reviewed) (* current- or former-student authors)

Turner, J. T. and T. L. Hopkins. 1974. Phytoplankton of the Tampa Bay System. *Bulletin of Marine Science* 24: 101-121.
Turner, J. T. and J. G. Ferrante. 1979. Zooplankton fecal pellets in aquatic ecosystems. *BioScience* 29: 670-677.
Turner, J. T. (1981) Latitudinal patterns of calanoid and cyclopoid copepod diversity in estuarine waters of eastern North America. *Journal of Biogeography* 8: 369-382.
Turner, J. T. 1984. Zooplankton feeding ecology: contents of fecal pellets of the copepods *Eucalanus pileatus* and *Paracalanus quasimodo* from continental shelf waters of the Gulf of Mexico. *Marine Ecology Progress Series* 15: 27-46.
Turner, J. T., P. A. Tester, and R. L. Ferguson. 1988. The marine cladoceran *Penilia avirostris* and the "microbial loop" of pelagic food webs. *Limnology and Oceanography* 33:245-255.

- Turner, J. T. and P. A. Tester. 1997. Toxic marine phytoplankton, zooplankton grazers, and pelagic food webs. *Limnology and Oceanography* 42(5, part 2): 1203-1214.
- Turner, J. T., G. J. Doucette, C. L. Powell, D. M. Kulis, B. A. Keafer, D. M. Anderson (2000) Accumulation of red tide toxins in larger size fractions of zooplankton assemblages from Massachusetts Bay. *Marine Ecology Progress Series* 203: 95-107.
- Turner, J. T., A. Ianora, A. Miralto, M. Laabir, & F. Esposito. 2001. Decoupling of copepod grazing rates, fecundity and egg hatching success on mixed and alternating diatom and dinoflagellate diets. *Marine Ecology Progress Series* 220: 187-199.
- Turner, J. T., H. Levinsen, T. G. Nielsen & B. W. Hansen. 2001. Zooplankton feeding ecology: grazing on phytoplankton and predation on protozoans by copepod and barnacle nauplii in Disko Bay, West Greenland. *Marine Ecology Progress Series* 221: 209-219.
- Turner, J. T. (2002) Zooplankton fecal pellets, marine snow and sinking phytoplankton blooms. *Aquatic Microbial Ecology* 27: 57-102.
- Granéli, E. and J. T. Turner. 2002. "Top-down" regulation in ctenophore – copepod – ciliate – diatom – phytoflagellate communities in coastal waters: a mesocosm study. *Marine Ecology Progress Series* 239: 57-68.
- Turner, J. T. (2004) The importance of small planktonic copepods and their roles in pelagic marine food webs. *Proceedings of the 8th International Conference on Copepoda (INVITED PLENARY PRESENTATION)*, *Zoological Studies* 43: 255-266.
- Turner, J. T., G. J. Doucette, B. A. Keafer, D. M. Anderson (2005) ECOHAB-Gulf of Maine. Trophic accumulation of PSP toxins in zooplankton during *Alexandrium fundyense* blooms in Casco Bay, Gulf of Maine, April-June, 1998. II. Zooplankton abundance and size-fractionated community composition. *Deep-Sea Research II* 52: 2784-2800.
- Turner, J. T., *D. G. Borkman (2005) Impact of zooplankton grazing on *Alexandrium* blooms in the offshore Gulf of Maine. *Deep-Sea Research II* 52: 2801-2816.
- Turner, J. T., *D. G. Borkman, *J. A. Lincoln, *D. A. Gauthier, *C. M. Petitpas (2009) Plankton studies in Buzzards Bay, Massachusetts, USA. VI. Phytoplankton and water quality, 1987-1998. *Marine Ecology Progress Series* 376: 103-122.
- Turner, J. T. (2006) Harmful algae interactions with marine planktonic grazers, Chapter 20, p. 259-270. In: E. Granéli & J. T. Turner (editors), *Ecology of Harmful Algae*. Ecological Studies 189. Springer-Verlag, Berlin & Heidelberg.
- Hunt, C. D., *D. G. Borkman, P. S. Libby, R. Lacouture, J. T. Turner, & M. J. Mickelson. 2010. Phytoplankton patterns in Massachusetts Bay – 1992-2007. *Estuaries and Coasts* 33: 448-470.
- Turner, J. T. 2010. Zooplankton community grazing impact on a bloom of *Alexandrium fundyense* in the Gulf of Maine. *Harmful Algae* 9: 578-589.
- Turner, J. T., *D. G. Borkman, & P. S. Libby. 2011. Zooplankton trends in Massachusetts Bay, USA: 1998-2008. *Journal of Plankton Research* 33: 1066-1080.
- Deeds, J. R., *C. M. Petitpas, V. Shue, K. D. White, B. A. Keafer, D. J. McGillicuddy, Jr., P. J. Milligan, D. M. Anderson, & J. T. Turner. (2014) PSP toxin levels and plankton community composition and abundance in size-fractionated vertical profiles during spring/summer blooms of the toxic dinoflagellate *Alexandrium fundyense* in the Gulf of Maine and on Georges Bank, 2007, 2008, and 2010. 1. Toxin levels. *Deep-Sea Research II* 103: 329-349.

- *Petitpas, C. M., J. T. Turner, J. R. Deeds, B. A. Keafer, D. J. McGillicuddy, Jr., *P. J. Milligan, V. Shue, K. D. White, & D. M. Anderson. (2014) PSP toxin levels and plankton community composition and abundance in size-fractionated vertical profiles during spring/summer blooms of the toxic dinoflagellate *Alexandrium fundyense* in the Gulf of Maine and on Georges Bank, 2007, 2008, and 2010. 2. Plankton community composition and abundance. Deep-Sea Research II 103: 350-367.
- Turner, J. T. (2015) Zooplankton fecal pellets, marine snow, phytodetritus and the ocean's biological pump. Progress in Oceanography 130: 205-248.
- Ianora, A., M. Bastianini, Y. Carotenuto, R. Casotti, V. Roncalli, A. Miralto, G. Romano, A. Gerecht, A. Fontana, & J. T. Turner. (2015). Non-volatile oxylipins can render some diatom blooms more toxic for copepod reproduction. Harmful Algae 44: 1-7.
- *Petitpas, C. M., J. T. Turner, B. A. Keafer, D. J. McGillicuddy, Jr., & D. M. Anderson. 2015. Zooplankton community grazing impact on a toxic bloom of *Alexandrium fundyense* in the Nauset Marsh System, Cape Cod, Massachusetts, USA. Harmful Algae 47: 42-55.
- Roncalli, V., J. T. Turner, D. Kulis, D. M. Anderson, & P. H. Lenz. 2016. The effect of the toxic dinoflagellate *Alexandrium fundyense* on the fitness of the calanoid copepod *Calanus finmarchicus*. Harmful Algae 51: 56-66.
- *Borkman, D. G., P. S. Libby, M. J. Mickelson, J. T. Turner, & M. Jiang. 2016. Variability of winter-spring bloom *Phaeocystis pouchetii* abundance in Massachusetts Bay. Estuaries and Coasts 39: 1084-1099.
- *del Favero, J. M., M. Katsuragawa, M. de Lourdes Zani-Teixeira, & J. T. Turner. 2017. Spawning areas of *Engraulis anchoita* in the Southeastern Brazilian Bight during late-spring and early summer. Progress in Oceanography 153: 37-49.
- *del Favero, J. M., M. Katsuragawa, F. S. C. Oliveira, N. C. Tannure, M. L. Zani-Teixeira, & J. T. Turner. 2017. Seasonal and regional variation in egg size of the Argentine anchoita (*Engraulis anchoita*) in the southeastern Brazilian Bight. Fishery Bulletin 115: 517-531.
- *del Favero, J. M., M. Katsuragawa, M. de Lourdes Zani-Teixeira, & J. T. Turner. 2018. Modeling long-term fluctuations in the distribution and abundance of *Engraulis anchoita* eggs and larvae in the southeastern Brazilian Bight. Marine Ecology Progress Series 587: 159-173.
- *Borkman, D. G., P. Fofonoff, T. J. Smayda, & J. T. Turner. 2018. Changing *Acartia* spp. phenology and abundance during a warming period in Narragansett Bay, Rhode Island, USA: 1972-1990. Journal of Plankton Research 40: 580-594.

Graduate Thesis advisor/Undergraduate Researcher Advisor (U Mass. Dartmouth)

(5 went on to obtain Ph.D. degrees at MIT, URI, UConn, or U South Florida)**

Biology Undergraduates: Katie Boissonneault**, David Borkman**, David Gauthier, Jean Lincoln, Peter Milligan, Maille O'Brien**, Christian Petitpas, Cameran Sassman

Biology M.S. graduate students: David Borkman, Antone Chute, Walter Conley**, David Gauthier, John Hill, Jean Lincoln, Peter Milligan, Richard Pierce**, Christian Petitpas, Kate Howland, Elizabeth Larson

SMAS Ph.D. graduate students: Christian Petitpas, Jana del Favero

CURRICULUM VITAE
ELISABETE DE SANTIS BRAGA (DA GRAÇA SARAIVA)

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e-mail: edsbraga@usp.br

1. Professional Profile

Coordinator of the Laboratory of Biogeochemistry of Nutrients, Micronutrients and Tracers in the oceans Oceanographic Institute (LABNUT-IOUSP) – University of São Paulo – Brazil. Dedication in Chemical Oceanography, with special focus in nutrients (N, P and Si) as tracers of water masses in oceanic system and in biogeochemical cycles in coastal systems. Carbon system in context of marine primary production, acidification and pollution. Carbon system and biogeochemical cycles aimed at global changes. Water quality domain considering the eutrophication aspects. Study of human relation with the coastal ecosystems including social and cultural relations, exploitation of natural resources and the managements belong to my research. Anthropogenic influence on the environment resulting in impacts verified by the unbalance of biogeochemical cycles. Introduction of potentially toxic elements in seawater, heavy metal bioaccumulations and its reflex on the primary production or on the ocean acidification and alteration of the depth for the carbonate compensation and oxygen low effects as hypoxia. Organic matter in the hydrological systems and groundwater contamination.

2. Training and obtained titles

Master in Physical Oceanography (Chemical specialization) - Oceanographic Institute at USP – 1989
PhD in Biological Oceanography, Oceanographic Institute at USP-1995 sandwich in Chemistry Oceanography at the Occidental Brittany University (UBO) – Brest-France.
Post-Doctoral - Chemical Oceanography - IRD (ORSTOM) - French Guiana - 1997.
University professor engagement 1988-1989 (MS-1, MS-2) – 1995 (MS-3); Associated Professor (MS-5)-2003.
Full Professor (MS-6) - Chemical Oceanography - IOUSP 2014

Awards

Fellow Preserve Planet Earth-International Rotary Foundation -1994
Navy friend - Medal Almirante Tamandaré – 2006
Honorable mention ANA (National Water Agency) Award – 2007
Productivity scholarships search 1D level CNPq
Other scholarships received: CNPq, CAPES, Rotary International-France, ORSTOM-France

3. List of publications (2008-2018)

H14-) [Link para a página](#) MyResearcherID (ISI) ou MyCitations (Google Scholar).

<http://www.researcherid.com/rid/E-5285-2012> <https://scholar.google.com/citations?hl=en&user=xjcst1oAAAAJ>

- CORNAGGIA, FLAMINIA ; JOVANE, LUIGI ; ALESSANDRETTI, LUCIANO ; ALVES DE LIMA FERREIRA, PAULO ; LOPES FIGUEIRA, RUBENS C. ; RODELLI, DANIEL ; BUENO BENEDETTI BERBEL, GLÁUCIA ; **BRAGA, ELISABETE S.** . Diversions of the Ribeira River Flow and Their Influence on Sediment Supply in the Cananeia-Iguape Estuarine-Lagoonal System (SE Brazil). FRONTIERS IN EARTH SCIENCE, v. 6, p. (25) 1-10, 2018.
- BRAGA, ELISABETE DE SANTIS**; BERBEL, GLAUCIA BUENO BENEDETTI ; CHIOZZINI, VITOR GONSALEZ . Dissolved organic matter (C, N, P) on the Pernambuco coast and Fernando de Noronha archipelago (Tropical Zone of Western South Atlantic, Brazil) - A contribution to the evaluation of environmental impact. BRAZILIAN JOURNAL OF OCEANOGRAPHY (ONLINE) ^{JCR}, v. 66, p. 30-46, 2018.
- NARDELLI, ALLYSON E. ; CHIOZZINI, VITOR G.; **BRAGA, ELISABETE S.** ; CHOW, FUNGYI . Integrated multi-trophic farming system between the green seaweed *Ulva lactuca*, mussel, and fish: a production and bioremediation solution. JOURNAL OF APPLIED PHYCOLOGY ^{JCR}, v. 30, p. 1-10, 2018.
- BASTOS, ANA TERESA CORDEIRO CID ; **BRAGA, ELISABETE DE SANTIS** . Different silicon forms signalize an input of urbanized river and indicate the presence of phytoplankton with silicon structures

in the tropical coastal area of Recife (PE-Brazil). BRAZILIAN JOURNAL OF OCEANOGRAPHY ^{JCR}, v. 66, p. 104-114, 2018.

- **BRAGA, ELISABETE DE SANTIS**; CHIOZZINI, VITOR GONSALEZ ; BERBEL, GLÁUCIA BUENO BENEDETTI . Oligotrophic water conditions associated with organic matter regeneration support life and indicate pollution on the western side of Fernando de Noronha Island - NE, Brazil (3°S). BRAZILIAN JOURNAL OF OCEANOGRAPHY (ONLINE) ^{JCR}, v. 66, p. 73-90, 2018.
- SIQUEIRA, GILMAR W. ; APRILE, FABIO; IRION, GEORG ; **BRAGA, ELISABETE S.** . Mercury in the Amazon basin: Human influence or natural geological pattern?. JOURNAL OF SOUTH AMERICAN EARTH SCIENCES ^{JCR}, v. 86, p. 193-199, 2018.
- ***BRAGA, E. S.**; AZEVEDO, J. S.; OLIVEIRA, A.L. AND FÁVARO D. I. T., Trace Elements and Nuclear Abnormalities in Fish Species of Two Brazilian estuarine Regions – An Attempt to Increase the Matrix for Environmental Monitoring. Journal of Aquaculture & Marine Biology.v. 6(2),1-11. 2017: 00148. DOI: 10.15406/jamb.2017.06.00148.
- ***REGAUDIE-DE_GIOUX, AR** ; CASTAGNA, A ; FERREIRA, A ; ABBRECHT, M ; **BRAGA, ES** ; CIOTTI, AM . Influence of mixed upwelled waters on metabolic balance in a subtropical coastal ecosystem: São Sebastião Channel, southern Brazil. MARINE ECOLOGY PROGRESS SERIES, v. 573, p. 61-72, 2017.
- ***SIQUEIRA, GILMAR** ; APRILE, FABIO ; IRION, GEORG ; MARSHALL, BRUCE ; **BRAGA, ELISABETE** . Source and Distribution of Mercury in Sediments of the Brazilian Amazon Continental Shelf with Influence from Fluvial Discharges. American Chemical Science Journal, v. 15, p. 1-15, 2016.
- ***RIBEIRO, ANA LÍVIA N. L.** ; CHIOZZINI, VITOR G. ; **BRAGA, ELISABETE S.** ; YOKOYA, NAIR S. . Physiological responses and biofilter potential of *Hypnea aspera* (Rhodophyta, Gigartinales) cultivated in different availabilities of nitrate, ammonium, and phosphate. Journal of Applied Phycology, v. 18, p. 1057-1073, 2016.4.
- ***RODRIGUES, A. R.** ; **DE SANTIS BRAGA, E.** ; EICHLER, B. B. . LIVING FORAMINIFERA IN THE SHALLOW WATERS OF ADMIRALTY BAY: DISTRIBUTIONS AND ENVIRONMENTAL FACTORS. Journal of Foraminiferal Research, v. 45, p. 128-145, 2015.
- ***BERBEL, GLAUCIA B.B.** ; FAVARO, DEBORAH I.T. ; **BRAGA, ELISABETE S.** . Impact of harbour, industry and sewage on the phosphorus geochemistry of a subtropical estuary in Brazil. Marine Pollution Bulletin., v. 4, p. 128, 2015.
- ***FIGUEIREDO, J. A.** ; **MENOR, E. A.** ; TABOADA-CASTRO, M. T. ; TABOADA-CASTRO, M. M. ; RODRÍGUEZ-BLANCO, M. L. ; **BRAGA, E. S.** . Using hydrogeochemical signatures of stream water to assess pathways for rainfall events: towards a predictive model. Hydrological Processes (Print), v. 27, p. n/a-n/a, 2013.
- ***BERBEL, GLÁUCIA B. B.** ; **BRAGA, ELISABETE S.** . Phosphorus in Antarctic surface marine sediments - chemical speciation in Admiralty Bay. Antarctic Science, v. 4, p. 1-9, 2013.
- ***AZEVEDO, J.S.** ; **BRAGA, E.S.** ; SILVA DE ASSIS, H.C. ; OLIVEIRA RIBEIRO, C.A. . Biochemical changes in the liver and gill of *Cathorops spixii* collected seasonally in two Brazilian estuaries under varying influences of anthropogenic activities. Ecotoxicology and Environmental Safety, v. 96, p. 220-230, 2013.
- ***AZEVEDO, BRAGA, E. S.** ; RIBEIRO, C. A. O. . Nuclear abnormalities in erythrocytes and morphometric indexes in the catfish *Cathorops spixii* (Ariidae) from different sites on the southeastern Brazilian coast. Brazilian Journal of Oceanography, v. 60, p. 323-330, 2012
- EICHLER, P. P. ; **RODRIGUES, A. R.** ; **EICHLER, B. B.** ; **BRAGA, E. S.** ; **CAMPOS, E. J.** Tracing latitudinal gradient, river discharge and water masses along the subtropical South American coast using benthic Foraminifera assemblages. Brazilian Journal of Biology. v. 72, p. 723-759, 2012.
- ***FÁVARO, D. I. T.** ; **SILVA, P. S. C.** ; **MAZZILLI, B. P.** ; CAVALLARO, G. P. ; TADDEI, M. H. ; BERBEL, G. . B. B. ; **BRAGA, E. S.** . Sediment geochemistry in Admiralty Bay (Antarctica): trace, rare earth elements and radionuclides. Pesquisa Antartica Brasileira, v. 5, p. 11-24, 2012.
- RODRIGUES, A.R.; MALUF, J.C.C.; **BRAGA, E.S.** & EICHLER, B.B., 2010. Recent benthic foraminiferal distribution and related environmental factors in Ezcurra Inlet, King George Island, Antarctica. *Antarctic Science*, ISSN:ISSN 0954-1020, Vol. 22, p.343-360, DOI: 10.1017/S0954102010000179.
- ***AZEVEDO, J.S.**; LOPES, B. ; KATSUMITE, A. ; **BRAGA, E. S.** ; ROCHE, H. ; RIBEIRO, C. A. O. ; BEBIANNO, M. J. A. . Evidence of contamination by oil and oil products in the Santos-São Vicente estuary, São Paulo, Brazil. Brazilian Journal of Oceanography, v. 60, p. 117-126, 2012.
- ***SOUZA, A. P. R.** ; **BRAGA, E. S.** ; **BERTOTTI, M.** . On Site Stripping Voltammetric Determination of Zn(II), Cd(II) and Pb(II) in Water Samples of the Cananéia-Iguape Estuarine-Lagoon Complex in São Paulo State, Brazil. Journal of the Brazilian Chemical Society (Impresso) ^{JCR}, v. 23, p. 1320-1326, 2012
- ***AZEVEDO J. S.** ; **BRAGA, E. S.** ; **FAVARO, D. T.** ; **PERRETTI, A. R.** ; **REZENDE, C. E.** ; **SOUZA, C. M. M.** . Total mercury in sediments and in Brazilian Ariidae catfish from two estuaries under different anthropogenic influence. Marine Pollution Bulletin. ^{JCR}, v. 62, p. 2724-2731, 2011.
- ***AZEVEDO J. S.**; **BRAGA, E. S.** . Caracterização hidroquímica para qualificação ambiental dos estuários de Santos-São Vicente e Cananéia. Arquivos de Ciências do Mar, v. 44, p. 52-61, 2011
- ***SOUZA, A. P. R.** ; **SALLES, M. O.** ; **BRAGA, E. S.** ; **BERTOTTI, M.** . Determination of Dissolved Zn(II) and Cd(II) in Estuarine Water by Using a Bismuth Film Microelectrode. Electroanalysis (New York, N.Y.) ^{JCR}, v. 23, p. 2511-2515, 2011.
- ***AZEVEDO, J. S.**; SERAFIM, A.; COMPANY, R.; **BRAGA, E. S.**; FÁVARO, D.I.T. & BEBIANNO, M. J., 2009. Biomarkers of exposure to metal contamination and lipid peroxidation in the benthic fish *Cathorops spixii* from two

estuaries in South America, Brazil. *Ecotoxicology (London)*, ISSN: 0963-9292, Vol.18, nº8, p:1001-. DOI: [10.1007/s10646-009-0370-x](https://doi.org/10.1007/s10646-009-0370-x).

- AZEVEDO, J.S.; FERANDEZ, W.S.; FARIAS, L.A.; FÁVARO, D.I.T. & **BRAGA, E.S.**, 2009. Use of *Cathorops spixii* (Agassiz, 1829) as bioindicator of pollution of trace metals in the Santos Bay, Brazil. *Ecotoxicology (London)*, ISSN: 0963-9292, Vol.18, nº5, p:577-586. DOI: [10.1007/s10646-009-0315-4](https://doi.org/10.1007/s10646-009-0315-4).
- AOYAMA, M.; BARWELL-CLARKE, J.; BECKER, S.; BLUM, M.; **BRAGA, E.S.**; COVERLY, S.C.; CZOBK, E.; DAHLLOF, I.; DAI, M.H.; DONNELL, G.O.; ENGELKE, C.; GONG, G.C.; HONG, G.H.; HYDES, D.J.; JIN, M.M.; KASAI, H.; KEROUEL, R.; KIYOMONO, Y.; KNOCKAERT, M.; KRESS, N.; KROGSLUND, K.A.; KUMAGAI, M.; LETERME, S.; LI, Y.; MASUDA, S.; MIYAO, T.; MOUTIN, T.; MURATA, A.; NAGAI, N.; NAUSCH, G.; NGIRCHECHOL, M.K.; NYBAKK, A.; OGAWA, H.; VAN OOIJEN, J.; OTA, H.; PAN, J.M.; PAYNEE, C.; PIERRE-DIPLESSIX, O.; PUJO-PAY, M.; RAABE, T.; SAITO, K.; SATO, K.; SCHIMIDT, C.; SCHUETT, M.; SHAMMON, T.M.; SUN, J.; TANHUA, T.; WHITE, L.; WOODWARD, E.M.S.; WORSFOLD, P.; YEATS, P.; YOSHIMURA, T.; YOUENOU, A. & ZHANG, J.Z., 2008. 2006 Inter-laboratory comparison study for reference material for nutrients in seawater. *Technical Reports of the Meteorological Research Institute*, ISSN: 0386-4049 – V. 58, p. 1-104.

4. Patents registered

- **BRAGA, E.S.; TEIXEIRA, C. & BONETO, R. F., 1998 (inventores).*** Equipment photo-oxidation of dissolved organic matter in the water. U.S. Patent Number P. I. 9,302,548, granted on 26/05/1998. Partnership with USP and FAPESP (90/3375-1). The Industrial Property Journal,, n. 1431, p. 128, 1998.
- **BRAGA, E. S.; TEIXEIRA, C.; BONETO, R. F. & OLIVEIRA, W.N., 1998 (invs)**Auto matic water sampler wet and total precipitation. Patent number under P. I. 9,302,552, granted in 26/05/1998.Parceria USP and FAPESP (process no. 90/3375-1) Journal of Industrial Property n. 1431, p. 128, 1998.

5. Quantitative indicators

• Published books:	07
• Publications in journals with selective editorial policy:	75
• Expanded Summaries	68
• National and international abstracts	137
• National and international abstracts	12
• Book chapters:	31
• Dissertation and defended oriented:	19
• Doctoral theses directed and co-orient. already defended:	10
• Supervision of Post-Doc	06
• Reception Newly Doctor	02

6. Research Projects Participation (PI)

Current

Variability of the Meridional Transports across the SAMOC Basin-wide Array (SAMBAR) SAMBAR is a new contribution to SAMOC aiming at a better understanding of the interannual variability of the heat content and meridional transports across the SAMOC Basin-wide Array (SAMBA) and the impacts on the South Atlantic Circulation, on the Regional Climate and on the MOC stability. SAMBAR will maintain and enhance the existing observing array with the deployment of new instruments and the conduction of oceanographic cruises (Fig. 1). The planned research, which also includes data analyses and numerical modeling, will be carried out through a synergistic collaboration amongst a large team of first-class international scientists.

VALO GRANDE – Biogeochemical Indicators in Coastal Planning Considering the Risks Caused by Extreme Climatic Changes: Case of the Cananéia-Iguape Estuarine-Lagunar Complex and Coastal Platform- **BPCCEX-CELCIPC**

7. Guildlines in progress – Post Graduation/IOUSP (enable in 2017)

- **Master students:**Orientation: Carolina Diás Gomez (2017), Ana Maria de Sousa (2016)
- **PhD students:** Chiara Machado Vieira (2013) and Bruno Otero Sutti (2017); Co-orientation Samuel Hora Yang (2017)
- **Undergraduate – scientific inititation:** Carolina Lavigne, Luma Pereira, Giovana Barbosa e Victor Rodrigues, Henrique José Dias, Luma Pereira
- **Students Culture and Extension:** Leire Augusto Campiteli de Azevedo, Vanessa Regina Silva Xavier, Luiza Mendonça Miranda.

- **Technical improvement:** Vitor Chiozzini (CNPq) e ITI- Wilson N. Oliveira (ITI) Henrique Miguel (ITI)
- **Supervision of Post-Doc:** Glaucia Bueno Benedetti Berbel.

8. Other Information

- **Postdoctoral:** 1997. Chemical Oceanography: **ORSTOM** - Cayenne, French Guiana. Labor. Oc. Physics of the Oceans. Advisor: Dr Claude Oudot. Research: Study of variability of movement of intermediate waters in the equatorial boreoeste based on data projects: CITHER 1 and ETAMBOT 1 (**WOCE**) Period: 24/03 to 24/06/1997. Financial support: IRD – France

•

Participation in other Projects of National and International Research: **PROANTAR VI** (1988), NITAM (FAPESP n 90/3375-1, 1991-1993). **Projects linked to WOCE:** **Romanche 1** (France, 1991), **CITHER 1 and 2** (France, 1993-94), **ETAMBOT-WOCE 1 and 2** (France 1995-1996). **PADCT/CNPq-IOUSP** (94-98). Project: Study of groundwater discharge in coastal regions using ²²²Rn as a natural tracer: IPEN/IOUSP, FAPESP n. 99/0836-1. 06/11/2003 to 06/12/2003—IOUSP. **Beagle Project** -JAMSTEC (Japan-Brazil). Participation in IBSA meeting - India, Brazil and South-2008. **LA PLATA** and **SAMOC** participation.

CARECOS – responsible - Study of the balance of carbon cycle in the coastal region and its potential ocean shipping – with emphasis in the coastal region of Pernambuco State. – FAPESP. **INCT-TMCOcean-** sub project responsible - Transfer of materials at the interface continent/ocean on the coast of the East-Northeast Brazil CNPq 573.601/2008-9- Coordinator of new areas

9. Charges

Director of Oceanographic Institute (2017- 2021). Head of Department of Physical, Chemical and Geological Oceanography - Institute of Oceanography – São Paulo University (IOUSP) (2013-2017). Chairman of Culture and Extension IOUSP (2004-2013), member of the Congregation of IOUSP; Director of the Science Museum of University of São Paulo (2004-2010), Full Member of the Ethics Committee of the IOUSP; Substitute Member of the Committee on International Relations - IOUSP; Chairman of the Scientific Advisory Oceanographic Museum (IOUSP). Coordinator of the Sub - Area Chemical Oceanography of the SCORE - SOUTH REVIZEE Program. Unifying agent of chemistry REVIZEE. President of the Third Symposium of Oceanography (SBO) Program. VSBO. Member of the Committee on Graduate IOUSP. Coordinator of the Laboratory of Oceanographic Instrumentation IOUSP. Coordinator of Laboratory of Biogeochemistry of Nutrients, Micronutrients and Trace in Oceans (LABNUT–IOUSP). FAPESP delegate on a mission to search agreement with the Academy of Sciences of Finland (AKA). Member of negotiations to establish academic / scientific agreement with the University of Liverpool.

10. Oceanographic cruises: About 50,000 nautical miles sailed in large vessels, national and international performing scientific work.

CURRICULUM VITAE

Name: Frederico Pereira Brandini

Professional Filiation

Oceanographic Institute of São Paulo University, Praça do Oceanográfico 191, Cidade Universitária, São Paulo, SP, CEP 05508-120 phone: 0055-11-30916611; e-mail: brandini@usp.br

Scientific Formation

1976. Bachelor in Biological Sciences at the Bioscience Institute of São Paulo University.

1979-1981. Master's Degree in Biological Oceanography at the Tokyo University of Fisheries, Japan, Thesis: *"Primary Productivity Studies of Phytoplankton in Coastal Areas - Tokyo Bay"*

1982-1986. Doctor's Degree in Biological Oceanography at the Oceanographic Institute of São Paulo University, Dissertation Title: *Hidrografia e Características do Fitoplâncton da Região Sueste do Brasil: Produção Primária, Biomassa e Composição.*

1991-1992. Post-Doc position at the Alfred-Wegener-Institute for Polar and Marine Research (supervisor Viktor Smetacek)

2014 – Visiting Scientist at the Rutgers Department of Marine and Coastal Sciences (hosted by Paul Falkowski)

Professional Carrier

2009-present. Professor at Oceanographic Institute, São Paulo University, Brazil

2006-2009. Associate Professor, Federal University of Paraná State, Brazil

1998-2006 - Assistant Professor, Federal University of Paraná State, Brazil 1994-1998. Director of the Center for Marine Studies, Federal University of Paraná State, SouthernBrazil.

1993-1996. Member of the Marine Science Committee from the Ministry of Science and Technology, Brazilian Government.

1993-1996. Scientific *ad hoc* advisor of the Ministry of Science and Technology, Brazilian Government, on questions relating to marine affairs and policy at the Intergovernmental Oceanographic Commission of UNESCO, Paris.

1993-1995. Chairman of the Brazilian UNESCO/IOC/Ocean Sciences and Living Resources Program. 1994-1996. Brazilian National Representative to the Scientific Committee on Oceanic Research – SCOR

1996-1998. Member of the Oceanographic Committee of the National Council for

Scientific and Technological Development (CNPq) 1981-2005. Senior Lecturer, Federal University of Paraná State, Brazil

Peer reviewed publications in the last 10 years

(See all publications at lattes.cnpq.br/4481852991645727)

- Gérikas Ribeiro, Catherine ; Lopes Dos Santos, Adriana ; Marie, Dominique ;**Brandini, F.P.**; Vaultot, Daniel. 2018. Small eukaryotic phytoplankton communities in tropical waters off Brazil are dominated by symbioses between Haptophyta and nitrogen-fixing cyanobacteria. ISME Journal, v. online, p. 1-15.
- Müller, M. N. ; Krabbenhöft, A. ; Vollstaedt, H. ; **Brandini, F. P.** ; Eisenhauer, A. 2018. Stable isotope fractionation of strontium in coccolithophore calcite: Influence of temperature and carbonate chemistry. Geobiology, v. online, p. 1-10, 2018.
- Brandini, F. P.**; Tura, Pedro M. ; Santos, Pedro P.G.M. 2018. Ecosystem responses to biogeochemical fronts in the South Brazil Bight. Progress in Oceanography, v. 164, p. 52-62.
- Namiki, Claudia ; Rocha, Maria Luiza Flaquer Da ; Katsuragawa, M. ; Zani-Teixeira, Maria De Lourdes ; **Brandini, F. P.** 2017. First record of an *Apterichtus kendalli* (Gilbert, 1891) (Anguilliformes, Ophichthidae) leptocephalus in the Southeast Brazilian Bight: a southward occurrence record extension. Check List, Journal Of Species List And Distribution, v. 13, p. 2107.
- Bergo, Natascha M. ; Signori, Camila N. ; Amado, André M. ; **Brandini, F.P.** ; Pellizari, Vivian H. 2017. The Partitioning of Carbon Biomass among the Pico- and Nano-plankton Community in the South Brazilian Bight during a Strong Summer Intrusion of South Atlantic Central Water. FRONTIERS IN MARINE SCIENCE, v. 4, p. 1-12, 2017.
- Lopes, R. M. ; Marcolin, C. ; **Brandini, F.P.** 2016. Influence of oceanic fronts on mesozooplankton abundance and grazing during spring in the south-western Atlantic. Marine and Freshwater Research, v. 67, p. 626.
- Rigonato, Janaina ; Branco, Luis Henrique Zanini ; **Brandini, F.P.** ; Gama, Watson Arantes ; Genuário, Diego Bonaldo ; Alvarenga, Danilo Oliveira ; Fiore, Marli Fatima. 2016. *Aliterella atlantica* gen. nov., sp. nov. and *Aliterella antarctica* sp. nov., novel members of coccoid cyanobacteria. International Journal of Systematic and Evolutionary Microbiology (Print), v. 66, p. 169.
- Andriguetto-Filho, José Milton ; Da Natividade, Cláudio Dybas ; **Brandini, F. P.**; Teixeira, Rodrigo De Almeida . 2016. Local hydrography and fishing drive life cycle strategies and population dynamics of the sea-bob shrimp *Xiphopenaeus kroyeri* in a coastal subtropical environment in Brazil. Hydrobiologia (The Hague. Print), v. 777, p. 2631.
- Gérikas Ribeiro, Catherine ; Lopes Dos Santos, Adriana ; Marie, Dominique ; Helena Pellizari, Vivian ; **Brandini, F.P.**; Vaultot, Daniel. 2016. Pico and nanoplankton abundance and carbon stocks along the Brazilian Bight. PeerJ, v. 4, p. e2587.
- Gérikas Ribeiro, Catherine ; Marie, Dominique ; Lopes Dos Santos, Adriana ; **Brandini, F.P.**; Vaultot, Daniel 2016. Estimating microbial populations by flow cytometry: Comparison between instruments. Limnology & Oceanography-Methods, v. 14, p. 750-758.

- Olguín Salinas, H.F., **Brandini, F.P.** & Boltovskoy, D. 2015. Latitudinal patterns and interannual variations of spring phytoplankton in relation to hydrographic conditions of the southwestern Atlantic Ocean (34°–62°S). *Helgol Mar Res* 69: 177. <https://doi.org/10.1007/s10152-015-0427-6>.
- Cabral, Ana Caroline ; Nogueira Júnior, Miodeli ; Nagata, Renato Mitsuo ; **Brandini, F.P.** 2015. Are free-floating planktonic hydroids (Cnidaria, Hydrozoa) common components of the pelagic fauna from the South Brazilian Bight?. *Journal of the Marine Biological Association of the United Kingdom* (Print), v. 00, p. 1-8.
- Rigonato, Janaina ; Alvarenga, Danillo O. ; Branco, Luis H. Z. ; Varani, Alessandro M.; Brandini, F. P.; Fiore, Marli F. 2015. Draft Genome Sequence of a Novel Culturable Marine Chroococcalean Cyanobacterium from the South Atlantic Ocean. *Genome Announcements*, v. 3, p. e00384-15-2.
- Nogueira Júnior, Miodeli ; **Brandini, F.P.**; Codina, Juan Carlos Ugaz 2015. Diel Vertical Dynamics of Gelatinous Zooplankton (Cnidaria, Ctenophora and Thaliacea) in a Subtropical Stratified Ecosystem (South Brazilian Bight). *Plos One*, v. 10, p. e0144161.
- Nogueira Júnior, Miodeli ; **Brandini, F.P.**; Haddad, Maria Angélica. 2015. First record of the hydromedusa *Aequorea macrodactyla* (Leptothecata: Aequoreidae) in Brazilian waters. *Marine Biodiversity: international journal of marine science*, v. 46, p. 737-742.
- Nagata, R. M. ; Nogueira Junior, M. ; **Brandini, F. P.**; Haddad, M. A., 2014. Spatial and temporal variation of planktonic cnidarian density in subtropical waters of the Southern Brazilian Bight. *Journal of the Marine Biological Association of the United Kingdom* (Print), p. 1-14.
- Brandini, F.P.**; Miodeli N., Monica S. Ugaz-Codina, J. & Noernberg, M. A. 2014. Deep chlorophyll maximum and plankton community response to oceanic bottom intrusions on the continental shelf in the South Brazilian Bight. *Continental Shelf Research*, v.89, p.61-75.
- Nogueira Júnior, Miodeli ; **Brandini, F.P.**; Codina, Juan C.U. 2014. Distribution of planktonic cnidarians in response to South Atlantic Central Water intrusion in the South Brazilian Bight. *Continental Shelf Research*, v. 1, p. 1-10.
- Bouzon, JI ; Vargas, Sm ; Oliveira Neto, Jf ; Stoco, Ph ; **Brandini, F.P.** 2014. Cryptic species and genetic structure in *Didemnum granulatum* Tokioka, 1954 (Tunicata: Ascidiacea) from the southern Brazilian coast. *Brazilian Journal of Biology* (Impresso), v. 74, p. 923-932, 2014.
- Cordeiro, T. A., **Brandini, F.P.**, Rosa, R. S., Sassi, R. 2013. Deep chlorophyll maximum in Western Equatorial Atlantic - How does it interact with islands slopes and seamounts? *Marine Science*, v.3, p.30-37.
- Brandini, F.P.** 2013. Marine biodiversity and sustainability of fishing resources in Brazil: a case study of the coast of Paraná state. *Regional Environmental Change* (Print), v.13, p.01-11.
- Fonseca, Alessandra Larissa D'oliveira; Machado, Eunice Da Costa; **Brandini, F.P.**; Brandini, Nilva. 2013. Microphytobenthic biomass on a subtropical intertidal flat of Paranaguá bay (Southern Brazil): spatio-temporal distribution and the influence of environmental conditions. *Brazilian Journal of Oceanography* (Online), v. 61, p. 83-92.
- Miyashita, L. K., Brandini, F.P., Martinelli Filho, J.E., Fernandes, L.F. & Lopes, R.M. 2012. Comparison of zooplankton community structure between impacted and non-

- impacted areas of Paranaguá Bay Estuarine Complex, south Brazil. *Journal of Natural History*, v.46, p.1557-1571.
- Bouzon L., Janayna ;**Brandini, F.P.**; M. Rocha, Rosana 2012. Biodiversity of Sessile Fauna on Rocky Shores of Coastal Islands in Santa Catarina, Southern Brazil. *Marine Science*, v. 2, p. 39-47.
- Brandini, F. P.**; Silva, A. S. 2011. Epilithic community development on artificial reefs deployed along a cross-shelf environmental gradient off Paraná state, southern Brazil. *Brazilian Journal of Oceanography (Impresso)* **JCR**, v. 59, p. 43-53.
- Fernandes, L. F. ; **Brandini, F.P.** 2010. The potentially toxic diatom *Pseudo-nitzschia* H. Peragallo in the Paraná and Santa Catarina states, Southern Brazil. *Iheringia. Série Botânica*, v. 65, p. 47-62, 2010.
- Fonseca, A. L., Brandini, N., Machado, E. C., Brandini, F. P. 2008. Variação espacial e sazonal da produção primária micro-fitobêntica em uma planície entremarés subtropical. *Insula* (Florianópolis). , v.37, p.19-34.
- Castro Filho, B.; **Brandini, F.P.**; Pires-Vanin, A.M. S.; Miranda L.B. 2006. Multidisciplinary Oceanographic Processes on the Western Atlantic Continental Shelf between 4°N and 34°S. In: Allan R. Robinson and Kenneth Brink (Eds), *The Sea*, Vol. 14 - The Global Coastal Ocean: Interdisciplinary Regional Studies and Syntheses, Chapter 8, vol 14, p.259-293

PERSONAL DETAILS

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ACADEMIC QUALIFICATIONS

Ph.D. Physical Oceanography 2006

Florida State University – Florida, USA

Supervisor: Professor Allan James Clarke

Thesis Title: Interannual Flow off Southern California and its Influence on Water Properties and Marine Life

M.Sc. Physical Oceanography 2001

Oceanographic Institute – University of Sao Paulo – Sao Paulo, Brazil

Supervisor: Professor Belmiro Mendes de Castro Filho

Dissertation Title: Resposta da Plataforma Continental de So Paulo Forante de Vento Transiente

B.Sc Physics 1999

Institute of Physics – University of Sao Paulo – Sao Paulo, Brazil

PROFESSIONAL EXPERIENCE

Assistant Professor 2010–present

Oceanographic Institute–University of Sao Paulo

Post-Doctoral Research 2009

Université Pierre et Marie Curie–Laboratoire d’Océanographie de Villefranche (LOV)

Villefranche-sur-Mer, France

Supervisor: Dr. Fabrizio D’Ortenzio

Post-Doctoral Research 2007–2008

Université Pierre et Marie Curie

Laboratoire d’Océanographie et du Climat : Expérimentations et Approches Numriques (LOCEAN)

Paris, France

Supervisor: Prof. Claude Frankignoul and Prof. Gilles Reverdin

PUBLICATIONS

- A dataset of temperature and salinity in the South Brazil Bight: Identifying water mass interfaces (2018)
M Dottori, INB Dalsenter, DC Napolitano, ICA da Silveira
Data in brief 20, 1297-1304

- Hydrodynamics of a subtropical tidal flat: Araçá Bay, Brazil (2018)
E Siegle, M Dottori, BC Villamarin
Ocean & Coastal Management 164, 4-13
- Evaluating the gravity wave energy potential off the Brazilian coast (2018)
C Pegorelli, M Dottori, JF Fortes
Brazilian Journal of Oceanography 66 (2), 220-233
- The role of remote wind forcing in the subinertial current variability in the central and northern parts of the South Brazil Bight (2018)
M Dottori, BM Castro
Ocean Dynamics 68 (6), 677-688
- Physical Oceanography of the SW Atlantic Shelf: A Review (2018)
AR Piola, ED Palma, AA Bianchi, BM Castro, M Dottori, RA Guerrero, ...
Plankton Ecology of the Southwestern Atlantic, 37-56
- A Amazônia Azul: recursos e preservação (2017)
BM Castro, FP Brandini, M Dottori, JF Fortes
Revista USP, 7-26
- Hydrodynamics and water properties at the entrance of Araçá Bay, Brazil (2015)
M Dottori, E Siegle, BM Castro
Ocean Dynamics 65 (12), 1731-1741
- Subinertial and tidal currents on the Abrolhos Bank shelf (2013)
BM Castro, M Dottori, AF Pereira
Continental Shelf Research 70, 3-12
- Low-frequency physical variations in the coastal zone of Ubatuba, northern coast of São Paulo State, Brazil (2013)
SS Valentim, MEC Bernardes, M Dottori, M Cortezi
Brazilian Journal of Oceanography 61 (3), 187-193
- O mar de amanhã, com as mudanças climáticas de hoje (2010)
BM Castro, FP Brandini, IEKC Wainer, M Dottori
Ciência e Cultura 62 (3), 40-42
- Rossby waves and the interannual and interdecadal variability of temperature and salinity off California (2009)
M Dottori, AJ Clarke
Journal of Physical Oceanography 39 (10), 2543-2561
- The response of the Sao Paulo Continental Shelf, Brazil, to synoptic winds (2009)
M Dottori, BM Castro
Ocean dynamics 59 (4), 603-614
- Planetary wave propagation off California and its effect on zooplankton (2008)
AJ Clarke, M Dottori
Journal of Physical Oceanography 38 (3), 702-714

SUPERVISION

MSc supervision (completed)

- Paula Birocchi. Estudo do impacto de efluentes dos emissários submarinos nas áreas adjacentes ao canal de São Sebastião, SP. 2018.
- Rafaela Farias do Nascimento. Resposta da Plataforma Continental de São Paulo ao vento sinótico: estudos numéricos. 2017.

- Pedro Henrique Lima Silva Moraes. Hidrodinâmica da Plataforma Continental Interna do estado de São Paulo. 2016.
- Francisco Thiago Franca Parente. Hidrodinâmica da Plataforma Continental da bacia Sergipe-Alagoas. 2016.
- Ácmon Francisco Pedrosa Bhering. Correntes Transversais à na Plataforma Continental de São paulo e sua Influência na Atividade Fitoplanctônica. 2015.

MSc supervision (current)

- Srgio Rafael Del’Giovannino Jr.
- Guilherme Yukio Seki
- Danilo Augusto Silva

ADMINISTRATIVE EXPERIENCE

Main Nominations

- International Affairs Advisor – University of Sao Paulo (March 2014 – May 2015)
- Vice–Coordinator of the General Administration – University of Sao Paulo (November 2015 – August 2016)
- Coordinator of the General Administration – University of Sao Paulo (August 2016– January 2018)

SHORT CURRICULUM VITAE - JOSEPH HARARI (December 2018)

Institute of Oceanography of the University of Sao Paulo (IOUSP) - joharari@usp.br

1) Graduation and higher degrees

Year	Title or activity	Institution
1973	Graduate level	B. S. in Physics Institute of Physics - University of Sao Paulo (USP)
1977	M. Sc.	M. Sc. In Physical Oceanography Institute of Oceanography (USP)
1984	Ph. D.	Ph. D. in Meteorology Institute of Astronomy and Geophysics (USP)
1991	Associate Professor	Associate Professor in Physical Oceanography Institute of Oceanography (USP)

2) Professional History

1. Assistant Professor in the Department of Physical Oceanography of the Oceanographic Institute at USP - July 1981 to January 1985.
2. Assistant Professor - Ph. D., in the Department of Physical Oceanography of the Oceanographic Institute at USP, January 1985 to December 1991.
3. Post of Assistant Professor, ref. MS-2, Department of Physical Oceanography of the Oceanographic Institute at USP, in January 1991.
4. Lecturer (Associate Professor) in the Department of Physical Oceanography of the Oceanographic Institute at USP, since December 1991.
5. Associate Professor - Level 2, Department of Physical, Chemical and Geological Oceanography of the Oceanographic Institute at USP, since October 2012.

3) List of most relevant scientific results

1. HARARI, J. & FERREIRA, F. R. & DEGASPARI, F. A. & SARTOR, S. M. – 2013 – “Numerical modeling of hydrodynamics and dispersion of sewage in the Bay of Santos, Brazil” – Rev. Brasileira de Recursos Hídricos (RBRH), vol. 18 (1), p.205-214.
2. KATSURAGAWA, M. & Dias, J. F. & HARARI, J. & NAMIKI, C. & ZANI – TEIXIERA, M. L. – 2014 – “Patterns in larval fish assemblages under the influence of the Brazil current” – Continental Shelf Research - DOI: 10.1016/j.csr.2014.04.024.
3. CAMARGO, R. & HARARI, J. – 2014 – “Tides and Wind-driven Circulation in the Tropical and Southern Atlantic Ocean: The BRAZCOAST System” - Atmospheric and Oceanic Science Letters, v. 7, p. 476-480.
4. PEREIRA, N. E. S. & HARARI, J. & CAMARGO, R. – 2014 – “Correlations of Remote Sensing Chlorophyll-a Data and Results of A Numerical Model of the Tropical and South Atlantic Ocean Circulation” - Journal of Geology and Geosciences, vol. 3 (6), 10 p. doi: 10.4172/2329-6755.1000171.
5. ROVERSI, F. & ROSMAN, P. C. C. & HARARI, J. – 2016 – “Analysis of the trajectories of continental waters affluent to the Santos estuary system” – Revista Brasileira de Recursos Hídricos (RBRH), Version On-line ISSN 2318-0331, vol. 21 (1), p. 242 - 250.
6. HARARI, J. & PEREIRA, N. E. S. & CAMARGO, R. – 2016 – “Detection of Variabilities and Trends in the Tropical and South Atlantic Ocean Using Hydrodynamic Numerical Modeling” – Hydrology: Current Research, Journal of

- Waste Water Treatment and Analysis, vol. 7 (2), 10 p., doi:10.4172/2157-7587.1000242.
7. HARDESTY, B. D. & HARARI, J. & ISOBE, A. & LEBRETON, L. & MAXIMENKO, N. & POTEMRA, J. & VAN SEBILLE, E. & VETHAAK, A. D. & WILCOX, C. – 2017 – “Using Numerical Model Simulations to Improve the Understanding of Micro-plastic Distribution and Pathways in the Marine Environment”. *Frontiers in Marine Science*, v. 4, p. 71-79, doi: 10.3389/fmars.2017.00030.
 8. MARENGO, J. ; MULLER-KARGER, F. ; PELLING, M. ; REYNOLDS, C. J. ; MERRILL, S. B. ; NUNES, L. H. ; PATERSON, S. ; GRAY, A. J. ; LOCKMAN, J. T. ; KARTEZ, J. ; MOREIRA, F. A. ; GRECO, R. ; HARARI, J. ; SOUZA, C. R. G. ; ALVES, L. M. ; HOSOKAWA, E. K. ; TABUCHI, E. K. . – 2017 - An Integrated Framework to Analyze Local Decision Making and Adaptation to Sea Level Rise in Coastal Regions in Selsey (UK), Broward County (USA), and Santos (Brazil). *American Journal of Climate Change*, v. 06, p. 403-424, ISSN Online: 2167-9509.
 9. BIÉ, ALBERTO JOSÉ; DE CAMARGO, RICARDO; MAVUME, ALBERTO FRANCISCO; HARARI, JOSEPH – 2017 – “Numerical modeling of storm surges in the coast of Mozambique: the cases of tropical cyclones Bonita (1996) and Lisette (1997)”. *OCEAN DYNAMICS*, v. 67, p. 1443-1459, <https://doi.org/10.1007/s10236-017-1095-7>; Online ISSN1616-7228.
 10. Giannini, Maria Fernanda Colo & Harari, Joseph & Ciotti, Aurea Maria The use of CBERS (China-Brazil Earth Resources Satellite) to trace the dynamics of total suspended matter at an urbanized coastal area. *Braz. J. Oceanogr.*, June 2017, vol.65, no.2, p.309-323. ISSN 1679-8759.

4) List of current funding for research

1. Collaborator of the Project "Integrated Oceanography and Multiple Uses of the Continental Shelf and Adjacent Ocean", in the program National Institutes of Science and Technology (INCT) CNPq / FNDCT, since September 2011.
2. Collaborator of the Project "Morphodynamic Response of Brazilian Southeast Beaches to the Effects of Sea Level Rise and Extreme Oceanographic and Meteorological Events up to 2100", with the support of the Coordination of Improvement of Higher Education Personnel - CAPES, according to the process 88881.146051 / 2017-01, since July 2017.

5) Supervision of students in progress, with scholarships

Graduate students

1. Joselene Marques - PhD in Environmental Science at PROCAM / USP, Institute of Energy and Environment of USP (IEEUSP), since July 2014. Project: Correlation of environmental and health conditions in coastal regions of Brazil.
2. Renan Braga Ribeiro - Doctorate in Environmental Science at PROCAM / USP, Institute of Energy and Environment of USP (IEEUSP), since August 2016. Project: Forecasting of bathability with the use of operational numerical modeling for the beaches of Santos Bay.
3. Celina Maria Alves Honorio - MSc in Environmental Science at PROCAM / USP, Institute of Energy and Environment of USP (IEEUSP), since February 2017. Project: Constructive solution to contain floods of maritime origin in the region of Ponta da Praia, Santos, with minimal environmental impact.

4. Bruna Crasnojan Chicano - Master's degree in Environmental Science at PROCAM / USP, Energy and Environment Institute of USP (IEEUSP), since February 2017. Project: Electricity generation by a Solar Tower: sustainability, benefits for the environment and social development.
5. Matheus Souza Ruiz - Master in Oceanography, Physical Oceanography, at the USP Oceanographic Institute, since February 2018. Project: Analysis of hydrodynamic processes in the Santos-São Vicente estuary system through numerical modeling.

Under graduate students

1. Lucas Garcez Gonçalves da Silva - student of Bachelor of Oceanography in the Oceanographic Institute at USP. Project: Modeling the hydrodynamics of the coastal region involving the bays of Ilha Grande, Sepetiba and Guanabara (RJ).
2. Paola Galluzzi Polesi - student of Bachelor of Oceanography in the Oceanographic Institute at USP. Project: Analysis of the circulation in the coastal region of Paraná through numerical modeling.

6) Quantitative indicators

1. Published books:	01
2. Publications in journals with selective peer review policy:	46
3. Chapters in books:	20
4. M. Sc. Theses oriented and defended successfully:	33
5. Ph. D. Theses oriented and defended successfully:	06
6. Dissertations of Graduation Course Conclusion:	19
7. Number of citations (Academic Google):	943

7) Link to MyCitations (Google Scholar)

<https://scholar.google.com.br/citations?user=CvHN7AgAAAAJ&hl=pt-BR&citsig=AMstHGTZ9xuZKNQxiGviBm3962VggYADrQ>

8) Other information

Chapters of books recently published

1. CAMARGO, R. & HARARI, J. - 2015 - "Tides" - chapter of the book "Introduction to the Sciences of the Sea", by Editora Textos, Pelotas (RS), Organizers: Jorge Pablo Castello & Luiz Carlos Krug, ISBN 978-85-68539-00-2) (602 p.), p. 226-255.
2. SOUZA, M. R. A & HARARI, J. - 2015 - "Public Policies and Water Quality in Coastal Regions" - chapter of the Proceedings of the First Interdisciplinary Symposium on Environmental Science, I SICAM, Organizers: Clara Ribeiro Camargo, Fernanda Susi Luccas, Joaquim Alves da Silva Jr. and Juliana Ribeirão de Freitas, published by the Institute of Energy and Environment of the University of São Paulo (IEE USP), 363 pp., ISSN: 2358-274X, p. 236-245.

Recently published book

1. HARARI, J. - 2015 - "Fundamentals of Numerical Modeling in Oceanography" - (ISBN 978-85-918934-0-9), Editor SALT Sea & Limno Technology, 246 p.



FAPESP CURRICULAR SUMMARY

DANIEL EDUARDO LAVANHOLI DE LEMOS – 2017

1. EDUCATION AND PROFESSIONAL APPOINTMENTS

- a. *Bachelor in em Oceanography – FURG, 1991*
- b. *M.Sc. in Biological Oceanography – USP, 1996*
- c. *D.Sc. in Biological Oceanography – USP, 2000*
- d. *Young Investigator Award FAPESP, 2000*
- e. *Professor of Aquaculture at Departament of Biological Oceanography, Oceanographic Institute of the University of São Paulo - 2001*
- f. *Associate Professor (Livre-Docência) at Departament of Biological Oceanography, Oceanographic Institute of the University of São Paulo - 2012*

2. AWARDS AND HONORS

- a. *Research fellowship from Instituto Iberoamericano de Cooperación de la Agencia Española de Cooperación Internacional no Instituto de Ciencias Marinas de Andalucía, Cadiz, Spain (01/01-31/12/1993);*
- b. *Best Student Paper Award by The Crustacean Society. IV International Crustacean Congress, July 1998, Amsterdam, The Netherlands;*
- c. *Founder and leader of Aquaculture Laboratory (LAM), Oceanographic Institute of the University of São Paulo since 2001;*
- d. *Best Ph.D. thesis in Biological Oceanography, FUNDESPA Prize 2002;*
- e. *Second best scientific paper in Biological Oceanography, FUNDESPA Prize 2002;*
- f. *Fellow of CNPq-level 2 (2007-2016);*
- g. *Young Investigator Award CNPq, 2008-2011.*
- h. *FAO Global Conference on Aquaculture, Member of Expert Panel (Sustainable Use of Resources). Phuket, Thailand, 2010;*
- i. *Best Student Paper Award by the World Aquaculture Society (Supervisor). World Aquaculture 2011, Natal, Brazil;*
- j. *Coordinator of Reserach Project and Network “Feeding Tomorrow’s Fish: Feeds and Feeding Regimes Environmental and Economically Sustainable Marine Aquaculutre”, Science without Borders Program (CNPq), Special Visiting Researcher: Dr. Albert G.J. Tacon, 2012-2016;*
- k. *Leader of Aquaculture Development at University of São Paulo Research System (office of the Provost of Research) since 2014;*

3. RESEARCH OUTPUTS

3.1 PUBLICATIONS

1. CARVALHO, R. A.P.L.F. ; OTA, R. H. ; KADRY, V. O. ; TACON, A. G.J. ; LEMOS, D. Apparent digestibility of protein, energy and amino acids of six protein sources included at three levels in diets for juvenile white shrimp *Litopenaeus vannamei* reared in high performance conditions. *Aquaculture*, v. 465, p. 223-234, 2016.
2. LEMOS, D., TACON, A. G. J. Use of phytases in fish and shrimp feeds: a review. *Reviews in Aquaculture*, 2016 (doi: 10.1111/raq.12138). (Citations Google Scholar: 5)
3. RODRÍGUEZ-ESTRADA, U., YASUMARU, F., TACON, A.G.J., LEMOS, D. Cobia (*Rachycentron canadum*): a selected annotated bibliography on aquaculture, general biology and fisheries 1967-2015. *Reviews in Fisheries Science and Aquaculture*, v. 24: p. 1-97, 2015. (Citations Google Scholar: 1)

4. DAVID, G. S.; CARVALHO, E.; LEMOS, D.; SILVEIRA, A. N.; DALLAGLIO-SOBRINHO, M. Ecological Carrying Capacity for intensive tilapia (*Oreochromis niloticus*) cage aquaculture in a large hydroelectrical reservoir in Southeastern Brazil. *Aquacultural Engineering*, v. 66, p. 30-40, 2015. (Citations Google Scholar: 11)
5. YASUMARU, F.; LEMOS, D. Species specific *in vitro* protein digestion (pH-stat) for fish: method development and application for juvenile rainbow trout (*Oncorhynchus mykiss*), cobia (*Rachycentron canadum*), and Nile tilapia (*Oreochromis niloticus*). *Aquaculture*, v. 426-427, p. 74-84, 2014. (Citations Google Scholar: 16)
6. COSTA-PIERCE, B.; BARTLEY, D.; HASAN, M.; YUSOFF, F.; KAUSHIK, S. J.; RANA, K.; LEMOS, D.; BUENO, P.; YAKUPITIYAGE, A. Responsible use of resources for sustainable aquaculture. In: Subasinghe, R.P., Arthur, J.R., Bartley, D.M., De Silva, S., Halwart, M., Hishamunda, N., Mohan, C.V., Sorgeloos, P. eds. (Org.). *Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture 2010*. Roma: FAO, Food and Agriculture Organization and NACA, Network of Aquaculture Centres in Asia, 2012, p. 113-147. (Citations Google Scholar: 28)
7. LEMOS, D.; TACON, A. G. J. A rapid low-cost laboratory method for measuring the *in-vitro* protein digestibility of feed ingredients and feeds for shrimp. *Aquaculture Asia Pacific* 7, 18 – 21, 2011.
8. LEMOS, D.; LAWRENCE, A.; SICCARDI, A. Prediction of apparent protein digestibility of ingredients and diets by *in vitro* pH-stat degree of protein hydrolysis with species-specific enzymes for juvenile Pacific white shrimp *Litopenaeus vannamei*. *Aquaculture (Amsterdam)*, v. 295, p. 89-98, 2009. (Citações Google Scholar: 48)
9. LEMOS, D.; GERMANO, A.; FERREIRA NETTO, B. Energy budget of juvenile fat snook *Centropomus parallelus* fed live food. *Comparative Biochemistry and Physiology. A, Molecular & Integrative Physiology*, Holanda, v. 144, p. 33-40, 2006. (Citações Google Scholar: 23)
10. LEMOS, D.; EZQUERRA, J.; GARCIA, F. Protein digestion in penaeid shrimp: digestive proteinases, proteinase inhibitors and feed digestibility. *Aquaculture (Amsterdam)*, Amsterdam, Holanda, v. 186, p. 89-105, 2000. (Citações Google Scholar: 96)

3.2 PROCESS/TECHNIQUE

1. *In vitro* determination of feed protein digestion in farmed shrimp and fish species using species-specific digestive enzymes recovered from the target species. Development and application with feed industry since 2000.

4. RESERACH FUNDING (ONGOING)

2.1 Regular Research Support

Coordinator: Daniel E. L. Lemos

Project: Cobia farming in Southeastern Brazil (SP, RJ): feeding and nutrition, environmental interactions and economy of existing models (PeixeMar, 2016/10772-9).

Period: 11/2016 to 11/2018

Funding: FAPESP

2.2 Research and Development

Coordinator: Daniel E. L. Lemos

Project: *In vitro* protein digestion during early life stages of marine shrimp.

Period: 01/2016 to 12/2017

Funding: INVE Technologies NV (Belgium)

2.3 Research and Development

Coordinator: Daniel E. L. Lemos

Project: AQUINOVA: inovação na infraestrutura de pesquisa em aquicultura na Universidade de São Paulo.

Period: 10/20126 to 10/2017

Funding: Financiadora de Estudos e Projetos (FINEP)

5. SUPERVISION (FELLOWSHIP)

3.1 Fanny Ayumi Yasumaru – post-doc INVE Technologies/FUSP 01/2016-12/2017. *In vitro* protein digestion during early life stages of marine shrimp.

3.2 Ricardo Haruo Ota. Researcher FUSP, 04/2016-10/2017. Feeds and feeding regimes in shrimp farming.

6. METRICS

Published papers	40
Citations (Google scholar)	827
h-index (Google scholar citations)	16
Book	1
Book chapters	5
M.Sc. students supervised	5
D.Sc. students supervised	5
Post-docs supervised	4

Link para Google Scholar: <https://scholar.google.com/citations?hl=en&user=W6dfdEwAAAAJ>

7. ADDITIONAL PROFESSIONAL INFORMATION

- USP Aquaculture Network (Re:Aqua): coordinator
- Aquatic animal experimental stock USP,Ubatuba: supervisor
- In charge of teaching Aquaculture in under and at graduate degrees in USP; Oceanographic Institute and Veterinary School
- Ongoing network and research relationship with public institutions and companies in Spain, Belgium, Mexico, Canada, Argentina, United States, Chile, Australia and Denmark
- Coordinator for aquaculture laboratory activities in Ubatuba (cages, tanks, feed) and São Paulo (analysis, *in vitro*)
- Team leader, USP project “Innovation in teaching sustainable use of marine environment for farming animals and plants (AquaLab, office of the Provost of Undergraduate Studies). Pioneer initiative in Ubatuba

Curriculum Vitae –Tito Monteiro da Cruz LOTUFO

Date of birth: December 5th, 1972

Position: Associate Professor, Vice-Head of the Biological Oceanography Department, Oceanographic Institute, University of São Paulo

Current research interest

- Marine Biogeography and Biodiversity
- Tunicates Systematics and Ecology
- Reef Ecology

Education & Position held

- 1993- B.Sc in Biological Sciences, University of São Paulo
- 1997- M.Sc. in Ecology, University of São Paulo
- 2002 – D.Sc. in Zoology, University of São Paulo
- 2002-2004 – Visiting Professor, Fisheries Engineering Department, Federal University of Ceará
- 2004-2009 – Associate Professor, Fisheries Engineering Department, Federal University of Ceará
- 2009-2010 – Visiting Scientist, Scripps Institution of Oceanography, University of California San Diego
- 2010-2014 - Associate Professor, Marine Sciences Institute, Federal University of Ceará
- 2018 –Livre Docência (L.D. / Habilitation) in Biological Oceanography, University of São Paulo
- 2014-present –Associate Professor, Oceanographic Institute, University of São Paulo

Awards

- 2004 Boto de Cristal, IBAMA

Editorial duties

- Associate Editor - Frontiers in Marine Science, 2014-
- Associate Editor – Biota Neotropica, 2010-
- Subject Editor –Zookeys, 2016-
- Theme Editor – Revista de Investigaciones Marinas (Cuba), 2012-
- ScientificAdvisoryBoardmember – Arquivos de Ciências do Mar, 2006-

Research Management and Expertise

- Coordinator of the Reef Biology Laboratory, IOUSP, since 2014
- Coordinator of the Animal Biology Laboratory, 2002-2008
- Coordinator of the Animal Ecology Laboratory, 2008-2014
- Vice-Head of the Biological Oceanography Department, Oceanographic Institute, University of São Paulo
- Secretary of the Brazilian Marine Biology Association (ABBM) since 2012
- Associate Editor of the journals Frontiers in Marine Biology (since 2014), Biota Neotropica (Since 2010), andZooKeys (since 2016)
- Thematic Editor of the Revista de Investigaciones Marinas (Cuba) since 2012.
- ScientificBoardMemberof Arquivos de Ciências do Marsince 2006
- Reviewer of more than 20 peer reviewed journals (e.g. Scientific Reports, Molecular Phylogenetic and Evolution, Oecologia)
- Member of 9 hiring boards for 6 different Brazilian universities (USP, UNICAMP, UFRJ, UFC, UNIFESP, UFERSA)
- Reviewer for Brazilianfunding agencies (CNPq, CAPES, FACEPE)
- Member of National (SISBIOTA-Mar, INCT BIONAT), and International (SARCE, GiGA) research networks, and international projects (CoML, NAGISA, Moorea BIOCODE)

Teaching,students supervision and outreach

- Teaching in undergraduate courses and graduate courses for programs in Fisheries Engineering, Biology, Oceanography, Tropical Marine Sciences on average 280-320 hours/year, including invertebrate and vertebrate zoology, marine ecology, biogeography, systematics, data analysis and statistics, and benthic ecology.
- Program coordinator of the Oceanography B.Sc. program (2008-2009 at UFC) and Tropical Marine Sciences graduate program for M.Sc. and D.Sc. (2013-2014 at UFC)

- Concluded supervision of 15 M.Sc. students, 9 D.Sc. students and 25 undergraduate students from UFC and USP.
- Participation on TV, radio, newspaper and magazines interviews for local and national networks.
- Member of the council of the Tupinambas Ecological Station and Alcatrazes Wildlife Refuge, representing IOUSP.
- Coordinator of many different outreach activities aimed at popularizing science for the general public.

Research income

Coordinator or participant of national (22) and international (5) projects including:

- Coordinator of Project "USE OF AUTONOMOUS REEF MONITORING STRUCTURES TO INVENTORY AND MONITORING MARINE CRYPTIC FAUNA", FAPESP/BIOTA Call 2017 – Project 2017/11948-6.
- Coordinator of the Environmental Characterization of the Ceará Basin (Petrobras) (2002-2004)
- Coordinator of project "Ascidians from São Pedro and São Paulo Archipelago" CNPq PROARQIPÉLAGO 56/2005, Project 55.8437/2005-2 (2006-2009)
- Coordinator of project "Biogeography of the Equatorial Atlantic Ascidians" CNPq Young Researchers 06/2008 - Faixa A, Project No. 572341/2008-3.
- Coordinator of project "Phylogeny of the Didemnidae" CNPq Universal 014/2010 Faixa A, Project No. 482594/2010-1.
- Coordinator of project "Phylogeography of the species of *Mulloidichthys* Whitley 1929 and *Pseudupeneus* Bleeker 1862, from the Atlantic and Eastern Pacific" MCT/CNPq n° 70/2009, Project No. 552238/2010-4.
- Coordinator of project "Conservation genetics of endangered sharks and rays" CAPES PNPD institucional 2012.
- Coordinator of project "Review of the Phlebobranchia (Tunicata: Asciacea)" CNPq Universal 14/2012 - Faixa A, Project No. 476928/2012-5
- Participant of the BIOTA-FAPESP program since 2000
- Participant of PROBIO "Marine Biota of Ceará", funded by MMA / BID, 2002-2004.
- Participant of Census of Marine Life project "Census of Coral Reef Ecosystems (CReefs): Understudied Species and the Biodiversity of French Frigate Shoals (alt: Maro Reef), Northwestern Hawaiian Islands Marine National Monument", 2006-2009.
- Participant of the Moorea BIOCODE project, funded by Gordon & Betty Moore Foundation, 2009.
- Participant of SISBIOTA-Mar - National Network on Marine Biodiversity, from 2011 to present.
- Participant of BrBOL – Brazilian Barcode of Life initiative, 2011-2014.
- Participant of SARCE – South American Research Group on Coastal Ecosystems, funded by TOTAL foundation.
- Participant of Thematic Project "Integrative Approach on the Sustainable Prospection of Marine Natural Products: from the biodiversity to anticancer substances", FAPESP project 2015/171776.

Publications and conferences

- 44 peer-reviewed publications, H=9 (Scopus / ISI), 263 citations (ISI),
- 3 published books, and 8 book chapters (including Springer and Elsevier as publishers)
- >50 communications in national and international congresses
- 3 invited communications in congress or workshops

Selected references illustrating current research interest

More available at <http://lattes.cnpq.br/2207175779648809>

- COSTA-LOTUFO, L. V. ; CARNEVALE-NETO, F. ; TRINDADE-SILVA, A. E. ; SILVA, R. R. ; SILVA, G. G. Z. ; WILKE, D. V. ; PINTO, F. C. L. ; SAHM, B. D. B. ; JIMENEZ, P. C. ; MENDONÇA, J. N. ; LOTUFO, T. M. C. ; PESSOA, O. D. L. ; LOPES, N. P. . Chemical profiling of two congeneric sea mat corals along the Brazilian coast: adaptive and functional patterns. *CHEMICAL COMMUNICATIONS*, v. 54, p. 1952-1955, 2018.
- DURANTE, L. M. ; CRUZ, I. ; LOTUFO, T. M. C. . The effect of climate change on the distribution of a tropical zoanthid (*Palythoa caribaeorum*) and its ecological implications. *PeerJ* v. 6, p. e4777, 2018.
- DA SILVA OLIVEIRA, FRANCISCA ANDRÉA ; MICHONNEAU, FRANÇOIS ; da Cruz Lotufo, Tito Monteiro . Molecular phylogeny of Didemnidae (Asciacea: Tunicata). *Zoological Journal of the Linnean Society*, v. 180, p. 603-612, 2017.
- BARROSO, CRISTIANE XEREZ ; LOTUFO, TITO MONTEIRO DA CRUZ ; MATTHEWS-CASCON, HELENA . Biogeography of Brazilian prosobranch gastropods and their Atlantic relationships. *Journal of Biogeography* (Print), v. 43, p. 2477-2488, 2016
- PAIVA, S. V. ; OLIVEIRA FILHO, Ronaldo Rui de ; LOTUFO, T. M. C. . Ascidians from Rocas Atoll, northeast Brazil. *Frontiers in Marine Science*, v. 2, p. 1-18, 2015.

Name: Michel Michaelovitch de Mahiques

1) Academic Education

Year	Title	Institution
1983	BSc Geology	Institute of Geosciences, University of São Paulo
1992	PhD	Institute of Oceanography, University of São Paulo
1998	Post-Doc	Free Professor - Institute of Oceanography, University of São Paulo

2) Professional background

1995 – 1998 - Assistant Professor, Institute of Oceanography, University of São Paulo

1998 – 2005 - Adjunct Professor, Institute of Oceanography, University of São Paulo

2005 – Present - Full Professor, Institute of Oceanography, University of São Paulo

2009 - 2013 – Director, Institute of Oceanography, University of São Paulo

2013 – 2017 – Vice-Director, Institute of Oceanography, University of São Paulo

3) Up to 10 recent relevant scientific results (last 5 years)

1. **de Mahiques, M.M.**, Hanebuth, T.J.J., Martins, C.C., Montoya-Montes, I., Alcántara-Carrió, J., Figueira, R.C.L., Bicego, M.C., 2016. Mud depocentres on the continental shelf: a neglected sink for anthropogenic contaminants from the coastal zone. Environmental Earth Sciences 75.
2. **de Mahiques, M.M.**, Hanebuth, T.J.J., Nagai, R.H., Bicego, M.C., Figueira, R.C.L., Sousa, S.H.M., Burone, L., Franco-Fraguas, P., Taniguchi, S., Salaroli, A.B., Dias, G.P., Prates, D.M., Freitas, M.E.F., 2017a. Inorganic and organic geochemical fingerprinting of sediment sources and ocean circulation on a complex continental margin (São Paulo Bight, Brazil). Ocean Science 13, 209-222.
3. **de Mahiques, M.M.**, Schattner, U., Lazar, M., Sumida, P.Y.G., Souza, L.A.P.d., 2017b. An extensive pockmark field on the upper Atlantic margin of Southeast Brazil: spatial analysis and its relationship with salt diapirism. Heliyon 3, e00257.
4. dos Santos, R.F., Nagaoka, D., Ramos, R.B., Salaroli, A.B., Taniguchi, S., Figueira, R.C.L., Bicego, M.C., Lobo, F.J., Schattner, U., **de Mahiques, M.M.**, 2018. Metal/Ca ratios in pockmarks and adjacent sediments on the SW Atlantic slope: Implications for redox potential and modern seepage. Journal of Geochemical Exploration 192, 163-173.

5. Ferreira, P.A.d.L., Figueira, R.C.L., Siegle, E., Asp Neto, N.E., Martins, C.d.C., Schettini, C.A.F., Maciel, P.M., García-Rodríguez, F., **de Mahiques, M.M.**, 2016. Using a cesium-137 (¹³⁷ Cs) sedimentary fallout record in the South Atlantic Ocean as a supporting tool for defining the Anthropocene. *Anthropocene* 14, 34-45.
6. Franco-Fraguas, P., Burone, L., **de Mahiques, M.M.**, Ortega, L., Carranza, A., 2016. Modern sedimentary dynamics in the Southwestern Atlantic Contouritic Depositional System: New insights from the Uruguayan margin based on a geochemical approach. *Marine Geology* 376, 15-25.
7. Lourenço, Rafael A., Magalhães, Caio A., **de Mahiques, M.M.**, Taniguchi, S., Bícigo, Márcia C., 2017. Distribution of terrigenous and marine material along the Southeastern Brazilian continental margin. *Regional Studies in Marine Science* 14, 118-125.
8. Moura, R.L., Amado-Filho, G.M., Moraes, F.C., Brasileiro, P.S., Salomon, P.S., **de Mahiques, M.M.**, Bastos, A.C., Almeida, M.G., Silva, J.M., Araujo, B.F., Brito, F.P., Rangel, T.P., Oliveira, B.C.V., Bahia, R.G., Paranhos, R.P., Dias, R.J.S., Siegle, E., Figueiredo, A.G., Pereira, R.C., Leal, C.V., Hajdu, E., Asp, N.E., Gregoracci, G.B., Neumann-Leitao, S., Yager, P.L., Francini-Filho, R.B., Froes, A., Campeao, M., Silva, B.S., Moreira, A.P.B., Oliveira, L., Soares, A.C., Araujo, L., Oliveira, N.L., Teixeira, J.B., Valle, R.A.B., Thompson, C.C., Rezende, C.E., Thompson, F.L., 2016. An extensive reef system at the Amazon River mouth. *Science Advances* 2, e1501252-e1501252.
9. Schattner, U., Lazar, M., Souza, L.A.P., ten Brink, U., **de Mahiques, M.M.**, 2016. Pockmark asymmetry and seafloor currents in the Santos Basin offshore Brazil. *Geo-Marine Letters* 36, 457-464.
10. Schattner, U., Lobo, F.J., García, M., Kanari, M., Ramos, R.B., **de Mahiques, M.M.**, 2018. A detailed look at diapir piercement onto the ocean floor: New evidence from Santos Basin, offshore Brazil. *Marine Geology* 406, 98-108

4) Present funded projects

Feições anômalas de fundo no talude superior do Sul do Brasil (Fapesp, São Paulo).
2016/22194-0

5) Present Supervisions

- Felipe Rodrigues. M.Sc. Fapesp.
- Ivo Dias Vieira. PhD. CAPES.
- Jorge Luis dos Passos Nascimento. PhD. Fapesp.
- Larissa Demarco. MSc.

- Mauricio Gaspar Filho. MSc
- Raíssa Basti Ramos. MSc. CAPES.

6) Quantitative indicators.

- 1) Books published: 2
- 2) Scientific papers: 118
- 3) In press: 0
- 3) Book chapters: 7
- 4) MSc Supervisions: 19
- 5) PhD Supervisions: 6
- 6) Number of citations, according to Google Scholar: 2664 (12 October 2018)
- 7) H Index (Google Scholar): 28

7) Link to MyResearcherID (ISI) or MyCitations (Google Scholar) and other identifications

- <http://www.researcherid.com/rid/D-1526-2010>
- http://scholar.google.com.br/citations?view_op=list_works&hl=pt-BR&user=_3fG0UMAAAAJ&citft=1&email_for_op=mahiques%40usp.br
- https://www.researchgate.net/profile/Michel_Mahiques
- Orcid number 0000-0002-5249-5610
- Scopus number 5534681900

8) Other biographic informations.

- Scientific and administrative coordinator of the RV Alpha Crucis Project (2010-2013)
- Adjunct Coordinator of the area of Geosciences at CAPES (Ministry of Education), from 2014 to 2017
- 36.56 points on Research Gate

Curriculum vitae
Olga Tiemi Sato, Ph.D.
Updated in 14/12/2018.

1 Education

Ph.D. - Physical Oceanography - University of Rhode Island, 1997.

Dissertation title: "Seasonal and low frequency variability in the meridional heat flux at 36°N in the North Atlantic Ocean."

Supervisor: Dr. H. Thomas Rossby.

M.S. - Physical Oceanography - University of São Paulo (USP), 1989.

Thesis title: "The Sverdrup Balance in the South Atlantic Ocean".

Supervisor: Dr. Affonso da S. Mascarenhas Jr..

B.A. - Physics (Teaching degree) - University of São Paulo, 1988.

B.S. - Physics - University of São Paulo, 1985.

2 Professional Experience

1. 2009–present: Professor Doctor - Oceanographic Institute –USP, Brazil;
2. 2008–2009: Adjunct Professor- UFABC, Brazil;
3. 2007–2008: Curator of the Science Library - City Library System of São Paulo, Brazil;
4. 2004–2006: Post-Doc - Oceanographic Institute – USP, Brazil;
5. 2000–2003: Post-Doc - National Institute for Space Research (INPE), Brazil ;
6. 1998–2000: Post-Doc - Jet Propulsion Laboratory /California Institute of Technology (JPL/Caltech/NASA) – USA.

3 Articles

- [1] Christopher S Meinen, Sabrina Speich, Alberto R Piola, Isabelle Ansorge, Edmo Campos, Marion Kersalé, Thierry Terre, Maria Paz Chidichimo, Tarron Lamont, **O. T. Sato**, et al. Meridional overturning circulation transport variability at 34.5° S during 2009-2017: Baroclinic and barotropic flows and the dueling influence of the boundaries. *Geophysical Research Letters*, 2018.
- [2] P. Castellanos, E.J.D. Campos, J. Piera, **O. T. Sato**, and M.A.F. Silva Dias. Impacts of agulhas leakage on the tropical atlantic western boundary systems. *Journal of Climate*, (2017), 2017.
- [3] Marouan Bouali, **O. T. Sato**, and P. S. Polito. Temporal trends in sea surface temperature gradients in the south atlantic ocean. *Remote sensing of environment*, 194:100–114, 2017.
- [4] Christopher S Meinen, Silvia L Garzoli, Renellys C Perez, Edmo Campos, Alberto R Piola, Maria Paz Chidichimo, Shenfu Dong, and **O. T. Sato**. Characteristics and causes of Deep Western Boundary Current transport variability at 34.5° S during 2009-2014. *Ocean Science*, 13(1):175, 2017.

- [5] M. B. Ferreira, V. Barroso Junior, **O. T. Sato**, C. E. P. Ribeiro, P. S. Bernardo, and P. S. Polito. Propagação acústica na água modal subtropical do Atlântico Sul. *Anais Hidrográficos*, 2016.
- [6] M Bouali, **O. T. Sato**, and P. S. Polito. An algorithm to improve the detection of ocean fronts from whiskbroom scanner images. *Remote Sensing Letters*, 6(12):942–951, 2015.
- [7] Paulo S Polito and **O. T. Sato**. Do eddies ride on rossby waves? *Journal of Geophysical Research: Oceans*, 120(8):5417–5435, 2015.
- [8] A. B. Villas Bôas, **O. T. Sato**, A. Chaigneau, and G. P. Castelão. The signature of mesoscale eddies on the air-sea turbulent heat fluxes in the south atlantic ocean. *Geophysical Research Letters*, 42(6):1856–1862, 2015.
- [9] **O. T. Sato** and P. S. Polito. Observation of South Atlantic subtropical mode waters with Argo profiling float data. *J. Geophys. Res.*, 2014.
- [10] **O. T. Sato** and P. S. Polito. Influence of salinity on the interannual heat storage trends in the Atlantic estimated from altimeters and Pilot Research Moored Array in the Tropical Atlantic data. *J. Geophys. Res.*, 113(C02008), 2008.
- [11] P.S. Polito and **O. T. Sato**. Global Interannual Trends and Amplitude Modulations of the Sea Surface Height Anomaly from the TOPEX/Jason-1 Altimeters. *Journal of Climate*, 21(12):2824–2834, 2008.
- [12] P. S. Polito, **O. T. Sato**, and I. Wainer. Height variability from the MIROC–IPCC model for the 20th century compared to that of the TOPEX/POSEIDON altimeter. *Ocean Modelling*, 24(3-4):73–91, 2008.
- [13] **O. T. Sato** and P. S. Polito. Comparison of the global meridional Ekman heat flux estimated from four winds sources. *J. Phys. Oceanogr.*, 35(1):94–108, 2005.
- [14] Paulo Simionatto Polito and **O. T. Sato**. Patterns of sea surface height and heat storage associated to intraseasonal rossby waves in the tropics. *Journal of Geophysical Research: Oceans*, 108(C12), 2003.
- [15] **O. T. Sato**, P. S. Polito, and W. T. Liu. Intra–decadal variability in the Ekman heat flux from scatterometer winds. *Geophys. Res. Let.*, 29(17), 2002.
- [16] A. S. Mascarenhas Jr., **O. T. Sato**, E. G. Silva, and S. L. Castillo. El esfuerzo del viento, su rotacional e el transporte de sverdrup en el atlántico sur. *Bol. Inst. Esp. Oceanogr.*, 17(3 y 4):1–12, 2001.
- [17] **O. T. Sato** and T. Rossby. Seasonal and low frequency variability in the meridional heat flux at 36°N in the North Atlantic. *J. Phys. Oceanogr.*, 30(3):606–621, 2000.
- [18] **O. T. Sato**, P. S. Polito, and W. T. Liu. The importance of in situ salinity for altimeter heat storage estimation. *Geophys. Res. Let.*, 27(4):549–551, 2000.
- [19] P. S. Polito, **O. T. Sato**, and W. T. Liu. Characterization of the heat storage variability from TOPEX/POSEIDON at four oceanographic sites. *J. Geophys. Res.*, 105(C7):16,911–16,921, 2000.
- [20] **O. T. Sato** and T. Rossby. Seasonal and low frequency variations in dynamic height anomaly and transport of the Gulf Stream. *Deep-Sea Res.*, 42:149–164, 1995.

3.1 Other noteworthy publications

1. Sato, O. T. - The oceanic heat flux measured by satellites. (in Portuguese: Fluxo de calor oceânico medido através de Satélites) In: Ronald Buss de Souza. (Org.). Oceanografia por

Satélites. São Paulo, 148-165, 2005.

2. Carr, M.-E., **O. T. Sato**, and P. S. Polito. New production and nutrient availability estimated from satellite altimeter. *Geophysical Research Abstracts*, 6:02386, 2004.
3. Carr, M.-E., **O. T. Sato**, and P. S. Polito. Interannual variability in new production and nutrient availability (1993-2003) estimated from satellite altimeter: Changes in the north pacific. *Eos Trans. AGU, Ocean Sci. Meet. 2004 Suppl., Abstract OS31K-05*, 2003, 84(52), 2004.

4 Grants awarded

1. "Observations of interannual variations of the MOC in the South Atlantic from Argo and satellite data". **PI: Olga Sato**. Process CNPq Universal 422096/2018-0. Duration: 2018–2021.
2. "Interannual Variability of the Meridional Transports across the SAMOC Basin-wide Array (SAMBAR)". **PI: Edmo Campos. Co-PI: Olga Sato**. Process FAPESP: 2017/09659-6. Duration: 10/2017 to 10/2022.
3. "Investigating the formation and maintenance of Subtropical Mode Water in the South Atlantic (SAMOWA)". **PI: Olga Sato**. Process FAPESP: 2015/26450-8. Duration: 01/04/2016 to 21/03/2019.
4. "Characterization of Rossby waves and the alignment of vortices over them". **PI: Paulo Polito**. Edital Universal 2014, CNPq. Duration: 2014–2016.
5. "Environmental Characterization and Evaluation of Biogenic Resources of the Brazilian Continental Margin and Adjacent Ocean Zone - CARBOM". **PI: Frederico P. Brandini**. Edital MCT/CNPq/FNDCT Nº 71/2010. National Institutes of Science and Technology in Ocean Sciences. Duration: 2011–2015.
6. "Investigating the interannual variability of salinity in the South Atlantic (VARSALES)". **PI: Olga Sato**. Proc. 2010/15511-2. FAPESP. Duration: 2010–2013.
7. "Monitoring of the Upper Branch of the Shallow Cells in the Atlantic using Satellites" - Proc. 558283/2009-8. Project under Edital MCT/CNPq/CT-Hidro/CT-Infra 38/2009 - South Atlantic and climate changes. **PI: Olga Sato**. Duration: 2009–2011.
8. "Impact of the Southwestern Atlantic ocean on South American climate for the 20th and 21st centuries (SANSO)"; **PI: Tércio Ambrizzi**. Duration: 2011–2017. FAPESP.
9. "Environmental Characterization and Evaluation of Biogenic Ocean Resources from Brazilian Continental Shelf and Adjacent Oceanic Zone - CARBOM"; **PI: Frederico P. Brandini**. Duration: 2011–2015. CNPq. INCT-Oceans.
10. "Study of trends in the winds and its derivatives over the sea surface through remote sensing" - Proc. 2008/542060, financed by FAPESP. **PI: Paulo Polito**. Duration: 2009–2011.
11. "The relationship between salinity variability patterns and thermodynamic variables in the ocean-atmosphere system in the South and tropical Atlantic". CNPq. Ref. 484592/2006-8. **PI: Olga Sato**. 2006–2008.
12. "Productivity, sustainability and use of Abrolhos Bank Ecosystem (PRO-Abrolhos)" CNPq. Ref. 001/2005 (Millennium Institutes). **PI: Eurico Cabral de Oliveira Filho**. 2005–2008.

13. "Development and maintenance of the internet portal for the GOOS–Brazil in the South and Tropical Atlantic". Regional Office of GOOS–Brasil/COI. **PI: Olga Sato**. Duration: 2003–present.
14. "Comparative study of estimates of sea surface height and heat storage from altimeters, lagrangian profilers and numerical modeling", funded by CNPq. Ref. Universal 477959/2004-0. PI: Paulo S. Polito. Co-PI: **Olga Sato**. 2004–2006.
15. "Prototype system for the oceanic and coastal forecast in the Brazilian east coast". Ref. CT-Petro/MCT/CNPq 017/2004. PI: Ilson C. A. da Silveira. 2004.
16. "Remote sensing center for studies of dynamical processes and oceanic fluxes at a global scale." (FAPESP-JP-01/06921-3) funded by FAPESP. PI: Dr. Paulo Polito from INPE (Brazil); **Co-PI: Olga Sato**. 2002–2006.
17. "A new method to estimate new production from satellite altimeter" (MDAR-0066-0002) funded by NASA as a contribution to the Earth Science Enterprise's Modeling and Data Analysis Research (NRA-99-OES-04). PI: Dr. Mary-Elena Carr from JPL (USA), 1999.

5 Participation in conferences (last 5 years):

5.1 Session's chair

- AMOS–ISCHMO 2018, February 5-9, Sydney, Australia: *South Atlantic Ocean: circulation, processes, observations and modelling: Paulo Polito, **Olga Sato**, Angela Maharaj, Regina Rodrigues.*

5.2 Presentations

1. **Sato, O. T.**, P. Polito, P. Bernardo, and A. S. Taschetto. "Climate drivers of the South Atlantic Subtropical Mode Water". AMOS–ISCHMO 2018. Sydney, Australia. 2018.
2. Bernardo, P. and **Sato, O. T.** "Subtropical mode water volume changes in the South Atlantic". AMOS–ISCHMO 2018 Sydney, Australia. 2018.
3. Taschetto, A. S., **Sato, O. T.**, P. Polito, and A. Maharaj. "Climate drivers of the Brazil-Malvinas Confluence variability". AMOS–ISCHMO 2018 Sydney, Australia. 2018.
4. **Sato, O. T.**, Piero S. Bernardo, Paulo S. Polito, and Andrea S. Taschetto. "Teleconnections of the South Atlantic Subtropical Mode Water at interannual scales". Good Hope for Earth Sciences, Joint Assembly 2017 of IAPSO-IAMAS-IAGA. Cape Town, South Africa. 2017.
5. **Sato, O. T.**, Piero S. Bernardo, Márcio B. Ferreira, and Paulo S. Polito. "Interannual variability of the subtropical mode water in the South Atlantic". CLIVAR 2016 Open Science Conference. Qingdao, China. 2016.
6. **Sato, O. T.**, Edmo Campos, Paola Castellanos, and Fabrício Oliveira. "Seasonal to inter-annual variability of the meridional heat fluxes in the South Atlantic" CLIVAR 2016 Open Science Conference. Qingdao, China. 2016.
7. Birocchi, P.; **Sato, O. T.**, and Bernardo, P. S.. "The Influence of Subtropical Mode Water in Nutrients in the South Atlantic". 2016 Ocean Sciences Meeting, AGU/ASLO/TOS 2016 Ocean Sciences New Orleans, LO, USA. 2016.
8. Bernardo, P. S. and **Sato, O. T.** "The Volumetric Variability of Subtropical Mode Water in the South Atlantic". 2016 Ocean Sciences Meeting, AGU/ASLO/TOS 2016 Ocean Sciences New Orleans, LO, USA. 2016.

9. Ferreira, M. B., P. S. Bernardo, **Sato, O. T.**, and Polito, P. S. "Caracterização da água modal subtropical do Atlântico Sul: um estudo observacional", X OMARSAT. Arraial do Cabo, RJ, Brazil. 2015.
10. Bernardo, P. S., M. B. Ferreira, and **Sato, O. T.** "Estudo da variação volumétrica da água modal Subtropical do Atlântico Sul" X OMARSAT. Arraial do Cabo, RJ, Brazil. 2015.
11. Birocchi, P., P. S. Bernardo, and **Sato, O. T.** "O impacto da presença da água modal subtropical em nutrientes". X OMARSAT. Arraial do Cabo, RJ, Brazil. 2015.
12. **Sato, O. T.** "Subtropical mode water in the South Atlantic and its effect upon the MOC". Collaboration of the Overturning-circulation observing arrays in the Atlantic (COCOA) workshop. National Oceanography Centre, Southampton, UK. 2015.
13. **Sato, O. T.** and P. S. Polito. "The Process of Formation and Dissipation of South Atlantic Subtropical Mode Water". Ocean Sciences Meeting 2014. Hawaii. USA. 2014.
14. Polito, P. S., **Sato, O. T.**, and S. Krieger. "Global trends in the wind stress from microwave remote sensing". Ocean Sciences Meeting 2014. Hawaii. USA. 2014.
15. Villas Boas, A. M.; **Sato, O. T.**; Chaigneau, A.; and Castelão, G. P. "The signature of mesoscale eddies on the ocean-atmosphere turbulent heat fluxes in the South Atlantic". Ocean Sciences Meeting 2014. Hawaii. USA. 2014.

6 Student orientation and post-doc supervision

1. Marouan Bouali. Postdoctoral fellow. "Seasonal and interannual trends of the sea surface temperature and chlorophyll submesoscale fronts in the South Atlantic ocean". 2015–2017. FAPESP.
2. Maurício R. Rocha. Ph.D. candidate. "Variations in the meridional overturning circulation (MOC) in the South Atlantic: impacts in the oceanic heat flux and in the climate of the South America". Ongoing. CAPES.
3. João Pedro M. de Amorim. M.S. candidate. "MOC variability observed from altimeters and Argo profiles". Ongoing. CAPES.
4. Piero Silveira Bernardo. Ph.D. candidate. "Importance of the regional dynamics in the interannual variation of subtropical modal waters volume in the South Atlantic". Ongoing. CNPq.
5. Thais Marina Fernandes. M.S. candidate. "Detection of subtropical mode water of the South Atlantic using satellite data". Ongoing. CAPES.
6. Giovana Jeremias Andrade. M.S. candidate. "The influence of the Deep Western Boundary Current in the Meridional Overturning Circulation in the South Atlantic". Ongoing. FAPESP.
7. Lucas Carnier Casaroli. M.S. candidate. "Low frequency variability in the Meridional Overturning Circulation in the South Atlantic and its influence on primary productivity". Ongoing. CAPES.
8. Matheus Vasconcellos Cortezi (M.S.). "Observations of the South Atlantic Subtropical Mode Water using PIES data". Graduated in 2017. CAPES.
9. Marcio Borges Ferreira (Ph.D.). "Characterization and spatial distribution of subtropical mode water in the Confluence Brazil-Malvinas Confluence". Graduated in 2017. Brazilian Navy.

10. Piero Silveira Bernardo (M.S.). "Study of anomalies in the volume of the subtropical mode water of the South Atlantic in the processes of dissipation, subduction and advection". Graduated in 2016. CAPES.
11. Ana Beatriz de F. M. Villas Bôas (M.S.). "The contribution of the mesoscale vortices in the surface heat in the South Atlantic". Graduated in 2014. FAPESP.
12. Ingrid Brizotti (M.S.). "Analysis of the Surface Net Heat Balance in the Subtropical South Atlantic ocean using satellite data". Graduated in 2009. CAPES.
13. Adviser of 21 undergraduate students in physical oceanography projects from which 14 of them successfully defended their bachelor's degree conclusion monograph (2005–2018).

7 Quantitative Indicators

1	Publication in peer reviewed periodicals	20
2	Chapter in books	1
3	Post-doc supervisions	1
4	Doctorate dissertation supervised	3
	Doctorate dissertation defended	1
5	Master thesis supervised	8
	Master thesis defended	4
6	Undergraduate supervisions	21
	Undergraduate monograph defended	14
7	Leading role in research projects (PI)	6
	Participation in projects	16
8	Citations received	354

8 Links for Citations

- <http://scholar.google.com/citations?user=hF546DoAAAAJ>
- <http://www.researcherid.com/rid/G-3656-2013>
- <https://orcid.org/0000-0003-0751-4373>

Polito, P. S.

 <https://orcid.org/0000-0003-2217-3853>

Polito, Paulo Simionatto

Main Research Topics

Oceanography, Physical Oceanography, Air-Sea Interaction, Remote Sensing, Satellite Oceanography, Rossby Waves, Heat Storage, Climate, Sea Level, Radar Altimetry, Data Analysis, Image Processing

Public Professional Profiles

ResearcherID: F-3040-2013 (<http://www.researcherid.com/rid/F-3040-2013>)

Scopus Author ID: 7003649557 (<http://www.scopus.com/inward/authorDetails.url?authorID=7003649557&partnerID=MN8TOARS>)

Employment

Universidade de São Paulo, Instituto Oceanográfico :São Paulo, SP
2003-10-17 to present: Professor Doutor (Oceanografia Física Química e Geológica)

Instituto Nacional de Pesquisas Espaciais Sao Jose dos Campos, SP
2000-12-01 to 2003-10-02 : Postdoctoral Scholar (Earth Observation)

NASA Jet Propulsion Laboratory: Pasadena, CA
1997-04-14 to 1999-11-20 : Postdoctoral Scholar (Earth Science)

Education and qualifications

University of Rhode Island Narragansett Bay Campus Narragansett, RI
1990 to 1997 : Ph.D. (Physical Oceanography)

Universidade de São Paulo Instituto de Física Sao Paulo, SP
1981 to 1986 : B.Sc.

Funding (23)

Interannual Variability of the Meridional Transports Across the SAMOC
Basin-wide Array (SAMBAR)
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)
2017-12 to 2022-11:
GRANT_NUMBER: 2017/09659-6

Equatorial Waves in the Atlantic Ocean and its Influence on the
Phytoplankton
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2016-10 to 2017-06
GRANT_NUMBER: 2016/16506-9

Investigating the formation and maintenance of Subtropical Mode
Water in the South Atlantic (SAMOWA)
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2016-04 to 2018-03
GRANT_NUMBER: 2015/26450-8

Untangling the drivers of ocean variability in the Southwest Atlantic
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2016-03 to 2018-03
GRANT_NUMBER: 2015/50324-2

Rossby Wave Characterization and Alignment of Vortices over Them
National Council for Scientific and Technological Development (Brasília)
2014-12-09 to 2017-12-31
GRANT_NUMBER: 447109/2014-6
URL: https://grants.uberresearch.com/501100003593/CNPq_5bd8c5eade/Rossby-wave-characterization-and-alignment-vortices-on-them (https://grants.uberresearch.com/501100003593/CNPq_5bd8c5eade/Rossby-wave-characterization-and-alignment-vortices-on-them)

Plankton Detection in the Ocean Surface by High-Resolution Sensor
Technology
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2014-05 to 2016-10
GRANT_NUMBER: 2013/17633-6

The Upper Branch of the Atlantic Meridional Overturning Circulation
modulated by the Tropical Atlantic Dynamics
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2013-10 to 2015-09
GRANT_NUMBER: 2013/11825-0

An improvement on the gas transfer velocity model with application to scatterometer data
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2012-09 to 2013-08
GRANT_NUMBER: 246477/2012-1

Analysis of ocean response to Intertropical Convergence Zone variations due to Tropical Instability Waves and/or Short Rossby Waves
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)
2011-08 to 2013-03
GRANT_NUMBER: 2011/03720-9

Investigating the Interannual Variations in Salinity in the South Atlantic (VARSALES)
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)
2011-08 to 2013-07
GRANT_NUMBER: 2010/15511-2

Study of Wind Trends in Sea Surface and Its Derivatives via Remote Sensing
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2011-03 to 2013-02
GRANT_NUMBER: 306656/2011-6

Study of Wind Trends on the Surface of the Sea and its Derivatives Through Remote Sensing.
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)
2010-09 to 2012-09
GRANT_NUMBER: 2008/54206-0

Analysis of the Vertical Influence of Long Rossby waves in the South Atlantic
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)
2010-08 to 2012-02
GRANT_NUMBER: 2010/04454-8

Tri - Dimensional Characterization of Intra - Seasonal Variability in the Western Tropical Atlantic
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2008-11 to 2010-10
GRANT_NUMBER: 473723/2008-5

Study of Large - Scale Ocean - Atmosphere Interaction Processes
Through Remote Sensing
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2008-03 to 2011-03
GRANT_NUMBER: 302895/2008-6

Distribution of Oceanographic Data Collected by Satellites
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2006-11 to 2008-10
GRANT_NUMBER: 502516/2005-4

Center for Space Technology for the Study of Dynamic Processes in the
Ocean at a Global Scale
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2006-03 to 2009-03
GRANT_NUMBER: 304031/2005-4

Comparison of the Global Meridional Ekman Heat Flux Estimated from
Four Winds Sources.
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2004-11 to 2005-10
GRANT_NUMBER: 2004/12676-0

Patterns of Sea Surface Height and Heat Storage Associated to
Intraseasonal Rossby Waves in the Tropics.
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2004-10 to 2005-05
GRANT_NUMBER: 2004/07264-4

Comparative study of estimates of dynamic height and heat stored by
altimeters, Lagrangean profilers and numerical model
Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brasília)
2004-03 to 2006-02
GRANT_NUMBER: 477959/2004-0

Center of Space Technology for Study of Dynamic Processes and
Oceanic Flows in Global Scale.
Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São
Paulo)
2002-02 to 2003-10
GRANT_NUMBER: 2001/10675-8

Center of Space Technology for Study of Dynamic Processes and Oceanic Flows in Global Scale.

Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)

2002-02 to 2006-03

GRANT_NUMBER: 2001/06921-3

2001 AGU Fall Meeting California - USA

Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo, São Paulo)

2001-12 to 2001-12

GRANT_NUMBER: 2001/10031-3

Articles (33)

Kelps' Long-Distance Dispersal: Role of Ecological/Oceanographic Processes and Implications to Marine Forest Conservation

Diversity

2018

DOI: 10.3390/d10010011

In situ shifts of predominance between autotrophic and heterotrophic feeding in the reef-building coral *Mussismilia hispida*: an approach using fatty acid trophic markers

Coral Reefs

2018

DOI: 10.1007/s00338-018-1692-z

EID: 2-s2.0-85046551114

Mesoscale eddy detection in satellite imagery of the oceans using the Radon transform

Progress in Oceanography

2018

DOI: 10.1016/j.pocean.2018.08.003

EID: 2-s2.0-85053086129

Temporal trends in sea surface temperature gradients in the South Atlantic Ocean

Remote Sensing of Environment

2017

DOI: 10.1016/j.rse.2017.03.008

EID: 2-s2.0-85016152882

Source: Scopus - Elsevier

Can a minimalist model of wind forced baroclinic Rossby waves produce reasonable results?

Ocean Dynamics

2016

DOI: 10.1007/s10236-016-0935-1

WOSUID: WOS:000373123300006

Influence of the South China Sea Biweekly Sea Surface Temperature on the South China Sea Summer Monsoon Especially during the Indian Ocean Dipole

Atmosphere - Ocean

2016

DOI: 10.1080/07055900.2015.1130682

EID: 2-s2.0-84959077680

An algorithm to improve the detection of ocean fronts from whiskbroom scanner images

Remote Sensing Letters

2015

DOI: 10.1080/2150704X.2015.1093187

WOSUID: WOS:000362451300004

Do eddies ride on Rossby waves?

Journal of Geophysical Research: Oceans

2015

DOI: 10.1002/2015JC010737

EID: 2-s2.0-84941997656

Observation of South Atlantic subtropical mode waters with Argo profiling float data

Journal of Geophysical Research: Oceans

2014

DOI: 10.1002/2013JC009438

EID: 2-s2.0-84902813912

Source: Scopus - Elsevier

Seasonal dynamics of megafauna on the deep West Antarctic Peninsula shelf in response to variable phytodetrital influx

Royal Society Open Science

2014

DOI: 10.1098/rsos.140294

EID: 2-s2.0-84958025661

Characterization of westward propagating signals in the South Atlantic from altimeter and radiometer records

Remote Sensing of Environment

2013

DOI: 10.1016/j.rse.2013.03.019

WOSUID: WOS:000319233200028

Characterization of westward propagating signals in the South Atlantic from altimeter and radiometer records (vol 134, pg 367, 2013)

Remote Sensing of Environment

2013

DOI: 10.1016/j.rse.2013.05.031

WOSUID: WOS:000324156600027

Global interannual trends and amplitude modulations of the sea surface height anomaly from the TOPEX/Jason-1 altimeters

Journal of Climate

2008 : journal-article

DOI: 10.1175/2007JCLI1924.1

EID: 2-s2.0-48749114737

Source: Scopus - Elsevier

Height variability from the MIROC - IPCC model for the 20th century compared to that of the TOPEX/POSEIDON altimeter

Ocean Modelling

2008

DOI: 10.1016/j.ocemod.2008.04.007

EID: 2-s2.0-49649117092

Impact of biannual rossby waves on the Indian Ocean Dipole

IEEE Geoscience and Remote Sensing Letters

2008

DOI: 10.1109/LGRS.2008.919505

WOSUID: WOS:000258144600024

Influence of salinity on the interannual heat storage trends in the Atlantic estimated from altimeters and Pilot Research Moored Array in the Tropical Atlantic data

Journal of Geophysical Research: Oceans

2008

DOI: 10.1029/2007JC004151

EID: 2-s2.0-42549120633

Potential impacts of polar fronts on sedimentation processes at
Abrolhos coral reef (South-West Atlantic Ocean/Brazil)

Continental Shelf Research

2008

DOI: 10.1016/j.csr.2007.11.003

EID: 2-s2.0-39249083695

Anti-persistence in the global temperature anomaly field

Nonlinear Processes in Geophysics

2007

EID: 2-s2.0-36549037639

Influence of pacific on Southern Indian ocean Rossby waves

Pure and Applied Geophysics

2007 : journal-article

DOI: 10.1007/s00024-007-0230-7

EID: 2-s2.0-34548329074

Source: Scopus - Elsevier

Western Pacific modulation of large phytoplankton blooms in the
central and eastern equatorial Pacific

Journal of Geophysical Research-Biogeosciences

2006

DOI: 10.1029/2005JG000084

WOSUID: WOS:000240990800002

Comparison of the global meridional Ekman heat flux estimated from
four wind sources

Journal of Physical Oceanography

2005

DOI: 10.1175/JPO-2665.1

EID: 2-s2.0-14744301186

Influence of Rossby waves on nutrient dynamics and the plankton
community structure in the North Pacific subtropical gyre

Journal of Geophysical Research C: Oceans

2004

DOI: 10.1029/2003JC001976

EID: 2-s2.0-3543001628

Global characterization of Rossby waves at several spectral bands

Journal of Geophysical Research C: Oceans

2003 : journal-article

EID: 2-s2.0-0038537549

Source: Scopus - Elsevier

Patterns of sea surface height and heat storage associated to intraseasonal Rossby waves in the tropics

Journal of Geophysical Research C: Oceans

2003

EID: 2-s2.0-1842661602

Intra-decadal variability in the Ekman heat flux from scatterometer winds

Geophysical Research Letters

2002

EID: 2-s2.0-0036768084

Unusual large-scale phytoplankton blooms in the equatorial Pacific

Progress in Oceanography

2002

DOI: 10.1016/S0079-6611(02)00137-4

EID: 2-s2.0-2242477524

Oceanic and atmospheric anomalies of tropical instability waves

Geophysical Research Letters

2001

DOI: 10.1029/2000GL012400

WOSUID: WOS:000168831000024

Atmospheric manifestation of tropical instability wave observed by QuikSCAT and tropical rain measuring mission

Geophysical Research Letters

2000

DOI: 10.1029/2000GL011545

EID: 2-s2.0-0034352687

Characterization and validation of the heat storage variability from TOPEX/Poseidon at four oceanographic sites

Journal of Geophysical Research: Oceans

2000

EID: 2-s2.0-0033669390

Correlation-based interpolation of NSCAT wind data

Journal of Atmospheric and Oceanic Technology

2000

EID: 2-s2.0-0033754428

Importance of salinity measurements in the heat storage estimation
from TOPEX/POSEIDON

Geophysical Research Letters

2000

DOI: 10.1029/1999GL011003

EID: 2-s2.0-0034353453

NASA scatterometer provides global ocean-surface wind fields with
more structures than numerical weather prediction

Geophysical Research Letters

1998

EID: 2-s2.0-7344226186

Long baroclinic Rossby waves detected by TOPEX/POSEIDON

Journal of Geophysical Research C: Oceans

1997

EID: 2-s2.0-0030974803

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Short Curriculum Vitae

Ilson Carlos Almeida da Silveira

1) Training

- BSc - Rio de Janeiro State University (1984)
- MSc - University of São Paulo (1990)
- PhD - University of New Hampshire (1996)
- Post-doctoral fellowship - University of Rhode Island (1997)

2) Professional history

- Assistant Professor (“Professor Doutor”) - University of São Paulo (1997)
- Associate Professor (“Professor Associado”) - University of São Paulo (2007)
- Full Professor (“Professor Titular”) - University of São Paulo (2011)

3) Publications

Theses

- Silveira, I. C. A. da, 1990, “Contribution to the study of the tropospheric oceanic circulation: Western equatorial Atlantic”. MSc dissertation, University of São Paulo, 185 pp.
- Silveira, I. C. A. da, 1996, “Meandering and Eddy Formation in Separating Western Boundary Currents”. PhD thesis, University of New Hampshire, 228 pp.
- Silveira, I. C. A. da, 2007, “The Brazil Current System in the Campos basin, Rio de Janeiro state”. Liber Docentia (Habilitation) thesis, University of São Paulo, 159 pp.

Selected Papers

- Silveira, I. C. A. da, L. B. de Miranda and W. S. Brown, 1994, On the origins of the North Brazil Current, **J. Geophys. Res.**, 99 (C11), 22501-22512.
- Silveira, I. C. A. da, G. R. Flierl and W. S. Brown, 1999, Dynamics of separating western boundary currents, **J. Phys Oceanogr.**, 29(2), 119-144.
- Silveira, I. C. A. da, W. S. Brown and G. R. Flierl, Dynamics of the North Brazil Current Retroflection from the WESTRAX observations, **J. Geophys. Res.**, 105(C12), 28559-28583, 2000.
- Silveira, I. C. A. da, A. C. K. Schmidt, E. J. D. Campos and Y. Ikeda. The Brazil Current off

southeast Brazil, **Braz. J. Oceanogr.** 48(2):171-183, 2000.

- Campos, E. D. J., D. Velhote and I. C. A. da Silveira, 2000, Shelf break upwelling driven by Brazil Current cyclonic meanders, **Geophys. Res. Lett.**, 27(6), 751-754.
- Silveira, I. C. A. da and G. R. Flierl, Eddy formation in 2.5-layer, quasi-geostrophic **J. Phys. Oceanogr.**, 32(2), 729-745, 2002.
- Mahiques, M. M. de, I. C. A. da Silveira and S. H. M. e Sousa, 2002. Post-LGM sedimentation on the outer shelf/upper slope of the northernmost part of the São Paulo Bight, Southeastern Brazil. **Marine Geology**, 181(4), 387-400.
- Silveira, I. C. A. da, L. Calado and C.P.F. Francisco, 2003. Linear instability of vertical shear in meridional geophysical jets. **Braz. J. Geophys.**, 21(2), 133-144.
- Urbano, D.F. and I. C. A. da Silveira, 2003. Dynamic structure of the equatorial countercurrents of the Atlantic ocean at 44°W. **Braz. J. Geophys.**, 21(2), 145-161.
- Silveira, I.C.A.da; Calado, L.; Castro, B.M; Cirano, M.; Lima, J.A.M. & Mascarenhas, A. de S. 2004. On the baroclinic structure of the Brazil Current-Intermediate Western Boundary Current system at 22°-23°S. **Geophysical Research Letters**, v 31.
- Mahiques, M. M. de; Tessler, M.G; Ciotti, A. M.; Silveira, I. C. A. da; Mello e Sousa, S. H. de; Figueira, R. C. L.; Tassinari, C. C. G.; Furtado, V. V. & Passos, R. F.. 2004. Hydrodynamically driven patterns of recent sedimentation in the shelf and upper slope off Southeast Brazil. **Continental Shelf Research**, 24 1685-1697.
- Goes, M.; Molinari, R.; Silveira, I. C. A. da & Wainer, I., 2005. Retroflections of the North Brazil Current During February 2002. **Deep-Sea Research I**. 52, 647-667.
- Mahiques, M. M. de; Bicego, M.C.; Silveira, I. C. A. da; Sousa, S.H.M. Lourenço, R.A. & Fukumoto, M.M., 2005. Modern sedimentation in the Cabo Frio upwelling system, Southeastern Brazilian shelf. **Anais da Academia Brasileira de Ciências**, 77(3), 535-548.
- Urbano, D.F.; Jochum, M. and I. C. A. da Silveira, 2006. Rediscovering the second core of the Atlantic NECC. **Ocean Modelling**, 12(1), 1-15.
- Schmidt, A. C. K. ; Ceccopieri, W. ; Silveira, I. C. A. ; Lima, J. A. M.. Parametric-analytical model for the velocity structure of the Brazil Current System. **Revista Brasileira de Geofísica**, v. 21, p. 75-91, 2007.
- Pereira, A. F. ; Castro, B. M. ; Calado, L. ; Silveira, I. C. A.. Numerical Simulation of the M2 internal tides in the South Brazil Bight and their interaction with the Brazil Current. **Journal of Geophysical Research**, v. 112, p. 1-17, 2007.
- Mahiques, Michel M. de ; Fukamoto, M M ; Silveira, I. C. A. ; Bicego, Marcia Caruso ; Lourenço, Rafael A ; Souza, A, S. H. M.. Sedimentary changes on the Southern Brazilian upper slope during the last 35000 years. **Anais da Academia Brasileira de Ciências**, v. 79, p. 171-

181, 2007.

- Silveira, I. C. A. ; Lima, J. A. M. ; Schmidt, A. C. K. ; Ceccopieri, W ; Sartori, A ; Francisco, Cayo Prado Fernandes ; Fontes, R . Is the meander growth in the Brazil current system off Southeast Brazil due to baroclinic instability?. **Dynamics of Atmospheres and Oceans**, p. 187, 2008.
- Calado, L. ; Gangopadhyay, A. ; Silveira, I. C. A. . Feature-oriented regional modeling and simulations (FORMS) for the western South Atlantic: Southeastern Brazil region. **Ocean Modelling** (Oxford), p. 48-64, 2008.
- Mahiques, Michel M. de ; Tassinari, C ; Marcolini, S ; Violante, R ; Figueira, R ; Silveira, I. C. A. ; Burone, L ; De Mello Souza, S. Nd and Pb isotope signatures on the Southeastern South American upper margin: Implications for sediment transport and source rocks. **Marine Geology**, v. 250, p. 51-63, 2008.
- Fernandes, Alexandre M. ; da Silveira, Ilson C.A. ; Calado, Leandro ; Campos, Edmo J.D. ; Paiva, Afonso M. . A two-layer approximation to the Brazil Current Intermediate Western Boundary Current System between 20 S and 28 S. **Ocean Modelling** (Oxford), v. 29, p. 154-158, 2009.
- de Mahiques, Michel Michaelovitch ; Coaracy Wainer, Ilana Klein ; Burone, Leticia ; Nagai, Renata; de Mello e Sousa, Silvia Helena ; Lopes Figueira, Rubens Cesar ; Silveira, Ilson Carlos Almeida da; Bicego, Márcia Caruso ; Vicente Alves, Daniel Pavani ; Hammer, yvind . A high-resolution Holocene record on the Southern Brazilian shelf: Paleoenviromental implications. **Quaternary International**, v. 206, p. 52-61, 2009.
- Yoshinaga, Marcos Y. ; Sumida, Paulo Y.G. ; Silveira, Ilson C.A. ; Ciotti, Áurea M. ; Gaeta, Salvador A. ; Pacheco, Luiz F.C.M. ; Koettker, Andréa G. Vertical distribution of benthic invertebrate larvae during an upwelling event along a transect off the tropical Brazilian continental margin. **Journal of Marine Systems**, v. 79, p. 124-133, 2010.
- Calado, L. ; da Silveira, I.C.A. ; Gangopadhyay, A. ; de Castro, B.M. . Eddy-induced upwelling off Cape São Tomé (22°S, Brazil). **Continental Shelf Research**, v. 30, p. 1181-1188, 2010.
- Soutelino, R.G.; I.C.A. da Silveira; A. Gangopadhyay; J.A. Miranda. Is the Brazil Current eddy-dominated to the north of 20S? **Geophysical Research Letters**, v. 38, 2011.
- Francisco, C. P. F.; da Silveira, I. C. A.; Campos, E. J. D. Dynamics of the Brazil-Malvinas Confluence: Energy Conversions. **Journal of Physics**, v. 285, 2011.
- Soutelino, R. G.; Gangopadhyay, A.; Da Silveira, I. C. A. The roles of vertical shear and topography on the eddy formation near the site of origin of the Brazil Current. **Continental Shelf Research**, v. 70, p. 46-60, 2013.
- Arruda, W. Z., Campos, E. J., Zharkov, V., Soutelino, R. G., & da Silveira, I. C. Events of equatorward translation of the Vitoria Eddy. **Continental Shelf Research**, 70, 61-73, 2013.

- Rocha, C. B., Tandon, A., Silveira, I. C., & Lima, J. A. M. Traditional quasi-geostrophic modes and surface quasi-geostrophic solutions in the Southwestern Atlantic. **Journal of Geophysical Research: Oceans**, 118(5), 2734-2745. 2013.
- Rocha, C. B., da Silveira, I. C. A., Castro, B. M., Lima, J. A. M. Vertical structure, energetics, and dynamics of the Brazil Current System at 22°S–28°S. **Journal of Geophysical Research: Oceans**. v. 119, p 52-69, 2014.

3.3. Book chapters

- Marone, E. ; Knoppers, B. ; Souza, W. L. ; Silveira, I. C. A. ; Godoi, S. S. de . The Brazil Current Typology and Physical-biogeochemical Domains. In: Kon-Kee Liu, Larry Atkinson, Renato Quinones, Liana Talaue-McMannus. (Org.). Carbon and Nutrient Fluxes in Continental Margins: A Global Synthesis. New York: Springer-Verlag, 2009, v. , p. 153-170.
- Castro, B. M. ; Lorenzetti, J. A. ; Silveira, I. C. A. ; Miranda, L. B. . Diagnosis of the state of the art knowledge of the thermohaline structure and the circulation between Cape São Tomé (RJ) and Chuí (RS). In: Carmen Lúcia Wongtschowski, Lauro Saint-Pastous Madureira. (Org.). The oceanographic environment of the shelf and slope of the southeast and south regions of Brazil. 1st edition. São Paulo: EDUSP/IMESP, 2006, v. 1, p. 11-120.

4) Coordination of Research Projects

- DINBRAS Project - “Dynamics of the meandering and eddy generation of the Brazil Current between Cape São Tomé (22°S) and Cape Santa Marta (28°S)”. Granted by FAPESP via case 1998/0572-2, with validity from 05/01/1998 to 10/30/2003.
- INCLINA Project - “The role of baroclinic instability in the meandering and generation of western boundary current eddies in the separation of the coast”. Granted by FAPESP via case 1998/1380-0, with validity from 06/01/1998 to 05/31/2000.
- AVEGEO Project – “Evaluation of the velocity structure of the North Brazil Current generated with the sectional version of the Princeton Ocean Model”. Granted by FAPESP via case 2000/06985-9, with validity from 09/01/2000 a 08/31/2004.
- CNPq-NSF international cooperation project with professor Glenn R. Flierl of the Massachusetts Institute of Technology (USA). Granted by CNPq via case 91.00018/98-7, within the scope of the DINBRAS project.
- ABROLHOS Project - “Space-time variations of the oceanic circulation in the surroundings of Abrolhos Bank and Espírito Santo basin”. Granted by CNPq via case 472005/2004-9, with validity from 2004 to 2008.
- PRO-ABROLHOS Project - “Productivity, sustainability, and use of the Abrolhos Bank ecosystem”. Coordinator of the mesoscale hydrography sub-project. Granted by CNPq via case

420219-2005-6, with validity from 2005 to 2009.

- SPOC Project - “coastal and oceanic forecasting system prototype for east Brazil”. Granted by CNPq via case 504750/2004-6.
- CERES Project - “The Brazil Current recirculation in the Santos Basin”, funded by PETROBRAS.
- SISCOR Project - “Patterns of the western boundary currents off the Brazilian coast”. Granted by CNPq via case 474409-2008-2.
- REMARSUL Project – “The Brazil Current processes on the South Brazil continental margin”. Granted by CAPES
- ILHAS Project – Can an archipelagus fertilize the South Atlantic Subtropical Gyre? Granted by CAPES and FAPESP

5) Student Supervision

MSc Theses –as advisor

- Carlos Augusto Chaves Leal Silva, MSc in Physical Oceanography (IOUSP), March/1998 - October/2000. Concluded. Funding: Brazilian Navy.
- Leandro Calado, MSc in Physical Oceanography (IOUSP), March 1999-June 2001. Concluded. Funding: FAPESP.
- Alexandre Macedo Fernandes, MSc in Physical Oceanography (IOUSP), March/1999-December/2001. Concluded. Funding: FAPESP
- Paulo Henrique Rezende Calil, MSc in Physical Oceanography (IOUSP), March/1999-June/2002. Concluded.
- Filipe Pires Alvarenga Fernandes, MSc in Physical Oceanography (IOUSP), March/2003-August/2005. Concluded. Funding: FAPESP.
- Rafael Augusto de Mattos, MSc in Physical Oceanography (IOUSP), March/2004- April/2006. Concluded. Funding: FAPESP.
- Saulo Müller Soares, MSc in Physical Oceanography (IOUSP), March/2005- July/2007. Concluded. Funding: CNPq.
- Rafael Guarino Soutelino, MSc in Physical Oceanography (IOUSP), March/2006- July/2008. Concluded. Funding: CNPq.

- Fernando de Oliveira Marin, Rafael Guarino Soutelino, MSc in Physical Oceanography (IOUSP), March/2006- July/2008. Concluded. Funding: Brazilian Navy.
- Paulo Roberto Silva Barros, MSc in Physical Oceanography (IOUSP), March/2006-January/2009. Concluded. Funding: FAPESP.
- Diogo Peregrino Correa Pereira, MSc in Physical Oceanography (IOUSP), March/2006-July/2009. Concluded. Funding: FAPESP.
- Leandro Ponsoni, MSc in Physical Oceanography (IOUSP), October/2007-November/2010. Concluded. Funding: FAPESP.
- Herminio Foloni Neto, MSc in Physical Oceanography (IOUSP), March/2009-February/2011. Concluded. Funding: FUJB.
- Leilane Gonçalves dos Passos, MSc in Physical Oceanography (IOUSP), March/2009 – February/2012. Funding: CNPq.
- Thiago Podadera Costa, MSc in Physical Oceanography (IOUSP), March/2009 – February/2012. Funding: FUJB.
- César Barbedo Rocha, MSc in Physical Oceanography (IOUSP), February/2011-June/2013. Funding: FAPESP.
- Ronaldo Mitsuo Sato, MSc in Physical Oceanography (IOUSP), February/2012-2014. Funding: CNPq
- André Paloczzy Filho, MSc in Physical Oceanography (IOUSP), February/2013-2015. Funding: FAPESP.
- Tiago Carrilho Biló, MSc in Physical Oceanography (IOUSP), February/2013-2015. Funding: FAPESP.
- Pedro Silveira Calixto, MSc in Physical Oceanography (IOUSP), February/2014-2016. Funding: CNPq.
- Iury Tercius Simões Sousa, MSc in Physical Oceanography (IOUSP), February/2015-2017. Funding: FAPESP.
- Hélio Miguel Reis Almeida, MSc in Physical Oceanography (IOUSP), February/2015-2017. Funding: CAPES.
- Fabricio Rodrigues Lapolli, MSc in Physical Oceanography (IOUSP), February/2016-2018. Funding: CNPq.

PhD Dissertations –as advisor

- André Campos Kersten Schmidt, PhD in Physical Oceanography (IOUSP), March/1998-April/2003. Concluded. Funding: FAPESP.
- Sueli Susana de Godoi, PhD in Physical Oceanography (IOUSP), March/1999-September/2005. Concluded.
- Leandro Calado, PhD in Physical Oceanography (IOUSP), July/2001-April/2006. Concluded. Funding: PETROBRAS/FUSP. Co-supervised by Prof. Avijit Gangopadhyay (UMD).
- Domingos Fernandes Urbano Neto, PhD in Physical Oceanography (IOUSP), March/2000-August/2005. Concluded. Funding: FAPESP.
- Cayo Prado Fernandes Francisco, PhD in Physical Oceanography (IOUSP), March/2002-2007. Concluded. Funding: FAPESP.
- Wellington Ceccopieri Belo, PhD in Physical Oceanography (IOUSP), March/2006-July/2011. Concluded. Funding: PETROBRAS.
- Juliana Albertoni de Miranda, PhD in Physical Oceanography (IOUSP), October/2007-February/2013. Funding: CNPq.
- Rafael Guarino Soutelino, PhD in Physical Oceanography (IOUSP), August/2008-December/2012. Funding: CNPq. Co-supervised by Prof. Avijit Gangopadhyay (UMD).
- Ana Paula Morais Krelling, PhD in Physical Oceanography (IOUSP) July/2010 –March/2015t. Funding: CNPq. **First UMD-USP Double Degree PhD.** Joint advisory with Prof. Avijit Gangopadhyay (DEOS/SMAST/UMD)

Co-Supervision

- Elcio Patti Jr., PhD in Physical Oceanography (IOUSP), co-advising with Edmo Campos, September/1997 - July/2001. Concluded. Funding: CAPES.
- Ana Cristina de Freitas, MSc in Physical, Chemical and Geological Oceanography (FURG). Co-advising with Osmar Olinto Möller Jr., March/2000 - August/2003. Concluded. Funding: CAPES.

Post-doctoral Supervision

- André Campos Kersten Schmidt, Post-doc in Physical Oceanography (IOUSP), 2007-2008. Concluded. Funding: CNPq.
- Hebe Queiroz, Post-doc in Physical Oceanography (IOUSP), March/2008 - March/2009. Concluded. Funding: CNPq.

- Cayo Prado Fernandes Francisco, Post-doc in Physical Oceanography (IOUSP), 2007-2008. Concluded. Funding: FUNDESPA.

6) Quantitative indicators

- CNPq National Research Fellowship – Level 1D
- H factor of **23** according to *Google Scholar* and **16** according to *Scopus*
- Concluded advisings and supervisions:
 - Undergraduate scientific initiation/BSc. Theses: 21
 - MSc dissertations: 20
 - PhD theses: 9
 - Post-docs: 3
- Participation in 22 oceanographic open ocean cruises, 11 as chief scientist

CV Summary – Alexander Turra

1) Professional history

Year	Title or activity	Institution
1994	Undergraduate in Biological Sciences	UNICAMP
1998	Master in Ecology	UNICAMP
2003	PhD in Ecology	UNICAMP

2) Professional history

N	Occupation	Period	Institution
01	Assistant Professor	03/2003-02/2006	Fundação de Ensino Octávio Bastos
02	Assistant Professor	03/2006-03/2015	Instituto Oceanográfico, Universidade de São Paulo
03	Associated Professor	03/2015-04/2018	Instituto Oceanográfico, Universidade de São Paulo
04	Full Professor	04/2018-	Instituto Oceanográfico, Universidade de São Paulo

3) List of **10 most relevant** research results related to the project (Full list is available at <http://lattes.cnpq.br/9028595280598723>)

N	Publication
01	Li, J.; Lusher, A.; Rotchell, J.; Company, S.D.; TURRA, A.; Bråte, I.L.N.; Sun, C.; Hossain, M.S.; Li, Q.; Kolanthasamy, P.; Shi, H., 2018. Using mussel as a global bioindicator of coastal microplastic pollution. <i>Environmental Pollution</i> , 224: 522-533.
02	Schlacher, T.A.; Lucrezi, S.; Connolly, R.M.; Peterson, C.H.; Gilby, B.I.; Maslo, B.; Olds, A.D.; Walker, S.J.; Leon, J.X.; Huijbers, C.M.; Weston, M.A.; TURRA, A.; Hyndes, G.A.; Holt, R.A.; Schoeman, D.S. 2015. Human threats to sandy beaches: A meta-analysis of ghost crabs illustrates global anthropogenic impacts. <i>Estuarine, Coastal and Shelf Science</i> , 169: 56-73.
03	TURRA, A.; Manzano, A.B.; Dias, R.J.; Mahiques, M.M.; Barbosa, L.; Balthazar-Silva, D.; Moreira, F., 2014. Three-dimensional distribution of plastic pellets in sandy beaches: shifting paradigms. <i>Nature Scientific Reports</i> , 4: 4435.
04	Taniguchi, S.; Colabundo, F.I.; Dias, P.S.; Oliveira, R.; Fisner, M.F.; TURRA, A.; Izar, G.M.; Abessa, D.S.A.; Saha, M.; Hoseda, J.; Yamashita, R.; Takada, H.; Lourenco, R.A.; Magalhaes, C.A.; Bicego, M.C.; Montone, R.C., 2016. Spatial variability in persistent organic pollutants and polycyclic aromatic hydrocarbons found in beach-stranded pellets along the coast of the state of São Paulo, southeastern Brazil. <i>Marine Pollution Bulletin</i> , 106: 87-94.
05	Vedolin, M.C.; Theophilo, C.Y.S.; Figueira, R.C.L.; TURRA, A., 2017. Spatial variability in the concentrations of metals in beached microplastics. <i>Marine Pollution Bulletin</i> , 129: 487-493.
06	Fisner, M.F.; Taniguchi, S.; Bicego, M.C.; Moreira, F.; TURRA, A. 2013. Polycyclic aromatic hydrocarbons (PAHs) in plastic pellets: Variability in the concentration and composition at different sediment depths in a sandy beach. <i>Marine Pollution Bulletin</i> , 70: 219-226.
07	Petracco, M.; Cardoso, R.S.; TURRA, A., 2013. Patterns of sandy-beach macrofauna production. <i>Journal of the Marine Biological Association of the UK</i> , 93: 1717-1725.
08	Petracco, M.; Cardoso, R.S.; Corbisier, T.N.; TURRA, A. 2012. Brazilian sandy beach macrofauna production: a review. <i>Brazilian Journal of Oceanography</i> , 60: 473-484.
09	Santos, D.M.; Sant'Anna, B.S.; Sandron, D.C.; Cardoso de Souza, S.; Cristale, J.; Marchi, M.R.R.; TURRA, A., 2010. Occurrence and behavior of butyltins in intertidal and shallow subtidal surface sediments of an estuarine beach under different sampling conditions. <i>Estuarine, Coastal and Shelf Science</i> , 88: 322-328.
10	Amaral, A.C.Z.; Denadai, M.R.; Rizzo, A.E.; TURRA, A., 2003. Intertidal macrofauna in Brazilian subtropical sandy beach landscapes. <i>Journal of Coastal Research</i> , 35: 446-455.

4) List of **current research grants** with funding from any agency or company

N	Title	Coordinator	Budget	Period	Grant agency
01	National Institute for Science and Technology – Climate Changes/ Sub-Network Coastal Zones	Carlos Nobre (INPE) / Carlos Alberto Eiras Garcia (IO/FURG)	R\$ >5.0M	01/2009-12/2018	CNPQ/FAPESP/FINEP/Rede Clima-MCT
02	MODA – Oceanographic monitoring and environmental diagnostic in the coastal zone of São Paulo state	Frederico Brandini (IOUSP)	R\$ 1.1M	01/2011-12/2018	FINEP
03	MARPLAST – Plastic litter in the Brazilian coast: baseline and monitoring	Alexander Turra (IOUSP)	R\$ 1.3K	04/2012-12/2019	PLASTIVIDA
04	GESAMP Working Group 40 - Sources, fate & effects of micro-plastics in the marine environment - a global assessment	Peter Kershaw (CEFAS, UK) (IOUSP) Alexander Turra (PI/IOUSP)	£>1.0M	04/2012-12/2018	GESAMP, IOC, PlasticsEurope, American Plastics Council
05	Assessment of marine ecosystem services at the Latin-American Antares time-series network	Milton Kampel (INPE) Alexander Turra (PI/IOUSP)	US\$ 1.2M	02/2014-12/2018	IAI (Inter-American Institute for Global Change Research)
06	FAPESP Marine ferromanganese deposits — a major resource of Etech elements (MarineE-tech)	Frederico Brandini (IOUSP) Alexander Turra (PI/IOUSP)	£5.0M (NERC) + £1.0M (FAPESP)	04/2015-03/2019	FAPESP
07	Environmental governance of the macrometropole of São Paulo in the context of climatic variability	Pedro Roberto Jacobi (FEUSP)	R\$526K	06/2017-05/2022	FAPESP
08	Evaluation of the current and future potential for Marine Protected Areas (MPA) to safeguard the biodiversity, function and resilience of subtidal rocky seascapes in subtropical Brazil	Daniel Gorman (CEBIMar/USP)	R\$286K US\$ 22.3K	02/2018-01/2022	FAPESP

CV Summary – Alexander Turra

5) List of ongoing supervisions, with students holding a fellowship

N	Type	Name	Title	Grant agency
01	IC	Andreza Caroline Caiero	Optimization of computed tomography method applied to obtain gastropod shell internal volume	FAPESP
02	IC	Guilherme Gonçalves Marques	The culinary as a cultural resistance strategy of traditional coastal communities	no scholarship
03	IC	Francisco Frateschi	Analysis of social participation in the management of the State Park of Ilha Anchieta	no scholarship
04	IC	Guilherme Frutoso	Use of collaborative online platforms as a tool to assess beach uses	no scholarship
05	Master	Mariana Martins de Andrade	Ecosystem based management as a tool to environmental impact assessment: a case study in Araçá Bay	CAPES
06	Master	Juliana Nascimento Silva	The population of the clam <i>Tivela mactroides</i> in Caraguatatuba Bay: monitoring and analysis of threats	no scholarship
07	Master	Thaís Fonseca Rech	Strategies to evaluate the status of the clam <i>Tivela mactroides</i> (Born, 1778) (Bivalvia) in the list of endangered species of São Paulo state	CAPES
08	Master	Iara Martins Ottoni	Opportunities and challenges of a participatory and incremental strategy to characterize and map the uses of sandy beaches in the northern coast of São Paulo state	CAPES
09	Master	Mayara de Oliveira	Analysis of the overlap of territorial management tools as a support to beach conservation: a case study in the northern coast of São Paulo (Brazil)	CAPES
10	Master	Marina Ribeiro Correa	Does beach management considers Ecosystem Services and their vulnerability to Climate Changes?	CAPES
11	PhD	Paola Franzan Sanchez	Evaluation of the importance of the Araçá Bay on the connectivity of mangroves, using biological models with different larval dispersal capacities	CAPES
12	PhD	Maila Paisano Guilhon e Sá	Guidelines and strategies to the marine spatial planning in the context of the exploration of polymetallic structures in the Rio Grande Rise	FAPESP
13	PhD	Flávia Cesa	Textile microplastics: socio-environmental responsibility and associated stakeholders	CAPES
14	PhD	Ivan Rodrigo Abrão Laurino	Biodiversity processes as the basis to assess sandy beach vulnerability to extreme climatic events	CAPES
14	PhD	Yasmina Michel Liliane Shah Esmaeili	Fish communities of sandy beach surf zones: Unraveling the myths, exploring different methodologies and providing knowledge for management strategies (co-supervision)	CAPES
15	PD	Fernanda Terra Stori	Building sustainability in marine-coastal ecosystems: an analysis of social-ecological resilience indicators and criteria of planning instruments in the Northern Coast of São Paulo State (Brazil)	FAPESP
16	PD	Leopoldo Cavaleri Gerhardinger	Coordination of knowledge-networks for the co-evolution of Brazilian polycentric ocean governance systems	FAPESP
17	PD	Guilherme Nascimento Corte	Preserving sandy beaches: biodiversity, goods and services, and impacts on a neglected ecosystem	FAPESP
18	PD	Luciana Yokoyama Xavier	Beach management trends in Brazil: targeting social-ecological resilience	FAPESP
19	PD	Leandra Regina Gonçalves Torres	Opportunities and weakness of integrated coastal management on the São Paulo coast in the context of macro-metropolis governance	FAPESP
20	PD	Hélio Hermínio Checon	Preserving sandy beaches: biodiversity, goods and services, and impacts on a neglected ecosystem	CNPq

6) Academic quantitative indicators

Indicator	N
Book series – n. of books (in press)	1 (1)
Books (in press)	8 (1)
Publications in journals with selective editorial policy (accepted)	151 (7)
Book chapters (in press)	21 (2)
Supervised and concluded Master's dissertations (co-advising)	18 (5)
Supervised and concluded PhD thesis (co-advising)	6 (4)
Supervised and concluded Post-docs	14
Citations – ISI (papers/times cited/h)	147/1231/21
Citations – Scopus (papers/times cited/h)	143/1506/23
Citations – Google scholar (papers/times cited/h)	147/2389/29
Citations – ResearchGate (papers/times cited/h)	151/2082/29

7) Links for citation reports

Index	link
MyResearcherID (ISI)	http://www.researcherid.com/rid/G-1352-2012
Scopus	https://www.scopus.com/authid/detail.uri?authorId=6603778221
MyCitations (Google Scholar)	http://scholar.google.com.br/citations?user=3OVdL04AAAAJ
ResearchGate	https://www.researchgate.net/profile/Alexander_Turra

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8) Other relevant biographical information

N	Information
01	Coordinator of the process of elaboration of the Agenda 21 of the Northern Coast of São Paulo state (2006-2007)
02	Member of the Scientific Council of Environmental Research of the São Paulo State (2007-2009)
03	Participant of the Climate Network of the Ministry of Science and Technology and Science and Technology National Institute for Climate Changes / Coastal Zones (2009-)
04	Participant of the Millennium Assessment Follow-Up within the Sub-Global Assessment Network (2009-)
05	Coordinator of the Brazilian Network for Monitoring Benthic Coastal Habitats (ReBentos) (2010-)
06	President of the V Oceanography Brazilian Symposium (Santos, Brazil/2011)
07	Member of the Ad hoc Advisory group for the Intergovernmental Oceanographic Commission (IOC/UNESCO) Medium Term Strategy (2014-2022) Ocean Sciences Section (2012)
08	Member of the GESAMP Working Group 40 on "Sources, fate and effects of microplastics in the marine environment – a global assessment" (2012-)
09	Representative in the Integrative Group of the Coastal Management Program in the Inter-ministry Commission for the Resources of the Sea (2012-)
10	Participant of the IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services)(2013-)
11	Member of the Coastal Zone Task Force of the Brazilian National Plan for Adaptation to Climate Changes (2013-)
12	Member of the Working Group on Biodiversity and Climate Changes of the Brazilian National Plan for Adaptation to Climate Changes (2013-)
13	Member of the Pool of Experts of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socio-economic Aspects (2014-)
14	Member of the International Scientific Committee of the 2nd International Ocean Research Conference (Barcelona, Spain/2014)
15	Convener of the Third International Symposium on the Effects of Climate Change on the World's Oceans (Santos, Brazil/2015)
16	President of the VII International Sandy Beach Symposium (Ilhabela, Brazil/2015)
17	Rapporteur of Life Sciences in the Environmental Assessment Group of the Brazilian Antarctic Program (2014-)
18	Member of the Editorial Board of Nature Scientific Reports (2015-)
19	Member of the Advisory Group of the Study on Marine Plastic Debris and Microplastics at UNEP (UNEA-2) (2015-2016)
20	Member of the Research Group on Environment and Society at the Advanced Sciences Institute of São Paulo University (2015-)
21	Author of the "Chapter 36B. South Atlantic Ocean" at the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (First World Ocean Assessment; 2016)
22	Member of the Council of the Brazilian Coastal and Marine Protected Areas Project (Project GEF-Mar; 2017-)
23	Member of the Brazilian Delegation to the Third United Nations Environmental Assembly (UNEA 3; 2017)
24	Member of the Brazilian Delegation at the Ad Hoc Open-Ended Expert Group on Marine Litter and Microplastics at the United Nations Environment (2018-)
25	Editor of the series "Brazilian Marine Biodiversity" at Springer Verlag (https://www.springer.com/series/15050)
26	Member of the Steering Committee of Brazilian Plan to Combat Marine Litter (2018-)
27	Chairholder of the UNESCO Chair for Ocean Sustainability (2018-)
28	Coordinator of the São Paulo School of Advanced Science on Ocean Interdisciplinary Research and Governance (https://spsasocean.wixsite.com/spsas-ocean)
29	Member of the Working Group for the Marine Biome at the Public Federal Prosecutor's Office (2018-)
30	Author of the chapter "Trends and impacts of the drivers of degradation and recovery of the biodiversity and ecosystem services" at the Brazilian Platform on Biodiversity and Ecosystem Services (2018)
31	Author of the chapters "Biodiversity at stake" and "Marine science" at the policy document "Science Project for Brazil" prepared by the Brazilian Academy of Science (2018)
32	Distinction as "Brazilian Navy Friendship" (2018)

São Paulo, November 28th 2018



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