DEPARTAMENTO DE CIENCIAS MARINAS

Informe Anual 2022-2023

Preparado por

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Annual Report Department of Marine Sciences (2022-2023)

A. Executive Summary

The Department of Marine Sciences (DMS) has provided graduate education in marine sciences for over 54 years. It was officially founded on August 19, 1968, after the first master's in marine sciences program at the Mayagüez Campus was approved by the Puerto Rico Higher Education Council. The doctorate (Ph.D) program in Marine Sciences was approved four years later, in 1972. They were the first masters and doctoral program at the Mayagüez campus. By design, the DCM is the only department in the UPR system that concentrates 100% on graduate studies and research.

The mission and goals of the Department of Marine Sciences (DCM) are like those of the School of Arts and Sciences, and the university in general. They emphasize excellence in graduate education and training, the advance of knowledge through high quality research in Marine Sciences, and the betterment of the people and economics of Puerto Rico. The DCM thrives in promoting a better understanding of the marine environment within the areas of biological, physical, chemical and geological oceanography; training graduate students in marine science; serving the community and the interest of the UPR system and the government.

During the academic year of 2022-23, the DMS accepted four (4) doctoral and ten (10) masters applications, for a total of 40 master's and 15 doctoral students (N= 55) during 2022-23. At the end of the year, the DMS awarded six (6) Master of Science, and five (5) Doctor of Philosophy degrees in marine sciences, which represented 9% (Ms.C) and 50% (Ph.D) respectively of the total degrees awarded by all the departments of the School of Arts and Sciences of the Mayagüez campus for 2022-23. The Dean of Academic Affairs supported a request by the DMS director to award a post-morten doctoral degree to Rebecca Becicka, a DMS doctoral student who lost her life in a tragic accident in 2022 (appendix 1).

All graduating students filled in the exit assessment forms, included in the Student Learning Assessment Outcome manual.

Eighteen (18) new applications for the academic year 2023-24 were received. Fourteen were accepted and four quality applications had to be rejected because there were no available faculty to supervise these new graduate students. The faculty members of the DCM are saturated supervising the already enrolled graduate students, and they could not attend any other students. This is the first time in 55 years that this has happened, and is a clear sign of the critical situation of the DMS due to lack of professors.

With the unfortunate passing of Professor Govind Nadathur Ph.D on July 21, 2022, the total number of active DMS teaching faculty is only SEVEN (7). Other faculty includes one researcher, one emeritus professor, and one part-time professor. Neither one teaches courses in the graduate program. The bulk of the academic and research activities, therefore, fall on only seven professors, a critical level to maintain a high quality, comprehensive graduate program in marine sciences. There is an URGENT need to hire new professors to ensure the quality and survival of the program.

The Chancellor authorized a Job Announcement (23-04) to fill position 146-A1 left vacant by Dr. Nadathur. Immediately after this, the DMS posted the announcement for the open position. The Personnel Committee selected three outstanding candidates from a pool of 18 applicants and completed the interview and selection process by June 30st. The selected candidate was informed and officially offered the Assistant Professor position on July 5, 2023. The immigration office is waiting for the signed contract to request the appropriate visa and complete the process.

The Personnel committee unanimously recommended granting Dr. Cruz Motta the requested promotion to Full Professor. His case was presented to the Arts and Sciences Personnel Committee on March 3, 2023 and was approved during the A&S Personnel Meeting of April 13, 2023. The administrative board approved the promotion of Dr. Cruz-Motta to the rank of Professor effective July 1, 2023 (Certification 22-23-157).

The financial aid to our graduate students improved significantly due to external funding linked to new research projects awarded to DMS faculty, and collaborative projects between the DMS and NGOs and other institutions. Fifteen (15) teaching assistantships were funded with institutional funds distributed between the Departments of Biology (11) and Geology (4). Two (2) research assistantships were funded by EcoElectrica (MOU). The total amount of funding for these 17 assistantships was $66,306.74 (appendix 2).

Fifty four (54) research assistantships were funded with external funds provided by research grants awarded to DMS faculty members and other sources (appendix 1). The total amount of funding from was $174,101.60. A NASA funded project to Dr. R. Armstrong supported ($11,632.5) nine (9) undergraduate students working in different projects in Magueyes. Fourteen graduate students receive hourly wages (jornal) to assist in different tasks, including research projects and maintenance of the invertebrate collection. The total amount was ($27,253).

A new program “Professional Masters in Marine Sciences” with two plans (Plan II and Plan III) is in the final steps of the approval process. The two new plans were designed to provide a more general education in marine sciences adaptable to more flexible professional demands to attract students with more extensive preparation.

Two new courses were approved and certified to increase and strengthen the academic diversity of the program. Two new courses were submitted for approval to complement our curriculum, course # CMOQ-6008 “Open Data Science in Chemical Oceanography” and CIMA-6007 “Professional Ethics in the Oceanic Sciences” were recently approved (certification # 23-22 and 23-13 respectively).

Productivity in terms of peer-reviewed publications was high again. A total of twenty-two (22) peer-reviewed manuscripts were published in recognized journals, four (4) technical reports were submitted to agencies, and eleven (11) manuscripts are under review in recognized journals. Students are listed as senior/co-authors authors in 19 of all the published/submitted manuscripts, which represents a 57% participation (appendix 2).

Several seminars (hybrid format) and a workshop were provided by faculty, students and visitors. The DCM faculty gave eight (8) virtual presentations while the DCM students carried out twenty (20) (appendix 3) departmental seminars. Three seminars were offered by visiting researchers [Dr. Howard Lasker (SUNNY), Dr. Francisco “Cisco” Werner (NOAA), and Dr. Jaime Palter (U. de Rhode Island) and a workshop on new technologies to monitor coral reef communities was organized by Dr. Antonio Ortiz

(Reef Scaping) and Ms.C Miguel Figuerola (DNRA) with the help of AECIMA, the student association of the DMS.

AECIMA continues to be very active offering virtual talks, organizing and carrying out several educational and community-outreach activities, as well as organizing the sixth Symposium in Marine Sciences on March 4th. 2023, for students and professors.

Dr. R. Armstrong collaborated with Dr. Juan Torres (NASA/ARC) in preparing and teaching, a bi-lingual ARSET summer course entitled "Monitoring Aquatic Vegetation with Remote Sensing". July 12, 14 and 19, 2022.
He participated in a teacher's training course sponsored by the EcoExploratorio. They covered basic information on the new *Sargassum* problem, its impact and benefits. July 17, 2022. Over 30 fishers from Puerto Rico visited the lab in Isla Magueyes for a tour and talks on *Sargassum* and other topics of interest as part of a workshop conducted by the Marine Resources Education Program (https://www.gmri.org/stories/mrep-puerto-rico). August 2022. Collaboration with Puerto Rico Space Grant Consortium in a 2-day workshop on the use of NASA remote sensing technology and the MUREP Sargassum Project to a group of 12 teachers from Puerto Rico. November 2022. Participated in the 3rd. Researchers Fair at the UPRM campus and collaborated with the Puerto Rico Space Grant Consortium in a 3-day workshop on Sargassum to a group of 13 teachers from Puerto Rico

Dr. W. Schmidt presented as a co-author in the American Geological Union meeting in Chicago, December 2022, a result of his participation in the deep dives with the Alvin submersible in the norther Caribbean. He participated in a workshop for the region of the South Atlantic (between the African and American coasts) and the Wider Caribbean area on the United Nations Regular Process – World Ocean Assessment.

Dr. JJ Cruz-Motta Cruz Motta was invited to give a presentation meeting "50 años de SENALMAR, Cartagena, Colombia. He also presented at the International Symposium of Coral Reefs in Bremmen, Germany, July 2022 and the 7th scientific meeting of fisheries management councils of USA.

Dr. Ernesto Weil presented as a Co-author at the International Symposium of Coral Reefs in Bremen, Germany, July 2022, and was invited to give a plenary talk on coral reef diseases and the status of Caribbean reefs at California State University, Northridge Campus in California on February 2023.

Jaaziel García, graduate student, participated in the 11th World Sponge Conference, Leiden, Netherlands (October 8-19, 2022) sponsored by the Sloan Foundation and Sea Grant College Program. Darimar Dávila, graduate student participated in the 2023 Women in Sciences Leadership Workshop at the University of Arizona on April 12-13, 2023 sponsored by the Sargassum Remote Sensing project of Dr. Roy Armstrong.

During the fiscal year of 2022-23, the DMS received a total of $ 103,623 from the use of lab space, boats, dive tanks, and dormitories from CARICOOS, Ecoelectrica, federal agencies, visitors, students and faculty members' grants. These funds are used for the maintenance and improving of our facilities and equipment, and the purchase a new equipment such as dive tanks, outboard engines, spare parts, new air conditioners to replace old units, etc.

Institutional funds for maintenance of the Magueyes lab facilities in La Parguera were used for gasoline, diesel, motor oil, cleaning, spare parts, laboratory equipment and the update of our three (3) classrooms, one in Mayagüez and two Magueyes ($62,973). The Faculty of Arts and Sciences provided $32,716.32 for updating equipment for non-teaching staff. Through this, several pieces of equipment were acquired with the purpose of improving technological resources. The "Center of Technology Information (CTI)" provided $31,176.58 to improve the teaching laboratories and classroom to be able to provide local and distance teaching and conferences.

Ten (10) research proposals submitted by DMS faculty (Pi and Co-PI) to Federal agencies (EPA-DNRA, NASA), institutions (Purdue University, Schmidt Institution) and foundations (Wenner Green Foundation) were approved during this year for a total of $ 3,747,556 in research funding, and several projects started during 2022-23. (Appendix 4a and 4b).

Two other proposals in which the DMS (Dr. E.Weil) is a collaborator (co-PI), submitted to NOAA by ISER (an NGO) with other collaborators and the DNRA for a total of $ 11,189,000, were approved during 2022-23. The projects are now in the process of starting. The projects include funding to improve the sea-water system at Magueyes, extension of the coral-culture area, including a roof, and funds for graduate students.

Over the past year, the DMC and its marine station provided services (boats, dormitories, diving, classroom and conference room, lab and office space to all our faculty and students, and over 667 visitors from local, mainland (USA), and international institutions and agencies. Thirty four (34) groups (N= 276 people) were from U.S. and International Universities and Agencies, 11 groups (N= 153 people) from local schools or community groups, and 21 groups (N= 240 people) from local Universities, NGO's and government agencies (Appendix 5).

One thousand four hundred and nineteen (1419) people benefited from the DCM logistical support to carry out research and academic (courses, workshops) field trips in the La Parguera Natural Reserve (LPNR) and other nearby coastal marine localities. Our small (outboard engines) boats were used in 425 field trips including: 251 research field trips by DCM students, professors and visitors, 27 educational trips, 78 student's thesis-related research trips, and 69 field trips for the DMS courses. The larger and medium-sized vessels were used in eight (8) research trips, one (1) for educational trip and two field trip as part of departmental classes.

The department has increased its outreach and community service activities thanks to the help of AECIMA and several professors and administrative personnel assistance. One major task was the involvement of the DMS in the development of a marine science "program" for the new Montesori School Alejandro Tapia Rivera in the community of La Parguera. The DMS has provided information, materials, talks and logistical support for several visits of the students to our lab facilities. Recently, DMS collaborated with a series of workshops on coastal marine ecosystems and environmental and scientific photo-journalism during June of 2023.

B.- Mission and Vision of the DMS

The mission of the Department of Marine Sciences is to promote a greater understanding of the marine environment within the core areas of biological oceanography, physical oceanography, chemical oceanography, and geological oceanography. The specific goals of the department are to increase knowledge in the marine sciences, to train graduate students in the marine sciences, and to serve the

community. Original research by both faculty and students is the central focus of the department's program, emphasizes the complementary and mutualistic relationship among these goals.

The Department offers two postgraduate programs in Marine Sciences: Master and Doctorate. The Master program can be conducted using three different plans: (i) Plan I with thesis, (ii) Plan II with project or (iii) Plan III by coursework only. Students successfully completing Plan I (Thesis) will be conferred the Master of Science degree (M.Sc.), whereas those completing Plan II (Project) or Plan III (Coursework) will be conferred a Professional Master degree (P.M.). In addition, those students enrolled in Plan I (Thesis), will be able to specialize in one of the following areas: Biological, Chemical, Geophysical and Physical Oceanography. The Doctorate program leads to the degree of Doctor of Philosophy (Ph.D.) in Marine Sciences and students enrolled in this program will also be able to specialize in one of the four oceanography areas listed above. These programs encompass both the full breadth of these disciplines and the specialization needed to develop specific technical and analytical skills within a larger scientific context. The program seeks to produce graduates with a strong background in marine sciences able to critically analyze problems and offer solutions through the application of scientific knowledge and research. Students are prepared for careers in teaching, research, and industry, as well as resource and environmental management.

The vision of the DMS:

- To increase knowledge of the marine environment by means of scientific research and transmitting this knowledge to the larger academic and stakeholder community.
- To contribute to social and economic development of Puerto Rico through the conservation and sustainable uses of the marine environment and its resources.
- To provide leadership and serve as a model department for graduate education on the Mayagüez Campus.

C.- To institutionalize a culture of strategic planning and assessment

The last version of the DMS strategic plan was valid from 2014-until 2022. The plan included eight objectives, each one described in terms of the strategies to develop and the metrics to evaluate the success of achieving the Objectives (appendix 6). Objectives one and two are of critical importance because they include strategies to increase the quality, number, diversity and expertise of professor in the department, strengthen links with other academic units, provide teaching experience through Graduate teaching assistantships and support research assistantships by increasing external funding supplies and equipment, develop efficient administrative/reporting/evaluation protocols appropriate for a graduate/research program. The metrics to evaluate this objective include: number, composition and area of expertise of the DMS faculty, number of formal and new agreements with other departments (UPRM) and/or institutions, number of new TAs and RAs available to the DMS students, number of research theses supported with external funds, number and funding of external grants, and number of new courses created and offered.

There are several examples fitting the metrics established to evaluate the compliance of the DMS with the goals established in the strategic plan. For example, the number of new student applications to the DMS Graduate program has been steadily increasing in the last years. Between 2017 and 2021, the

department accepted a total of 27 graduate students, 23 in the master's program and 4 in the doctoral program. In 2022, 14 new students started in the program, and just recently, we received 18 applications for the Fall semester of 2023.

In terms of the critical number of faculty, the department has been pressuring the administration to provide new faculty positions to increase and diversify the actual numbers to maintain and/or increase the quality of the program.

A new program “Professional Masters in Marine Sciences” with two plans (Plan II and Plan III) is in the final steps of the approval process. The two new plans were designed to provide a more general education in marine sciences adaptable to more flexible professional demands to attract students with more extensive preparations. the DCM benefits from a greater demand for admissions to the Department (30% increase in applications the first semester offered), a reduction in graduation time, an increase in the graduation rate, and an increase in collaborations between departments and with the private industry in general. This program does not require a master's thesis, which makes it attractive to students who do not want, or cannot develop a research project to graduate. Many of our regular students are waiting to switch to this program, which essentially eliminated the requirement of a theses research project.

Two new courses were approved and certified to increase and strengthen the academic diversity of the program. Two new courses were submitted for approval to complement our curriculum, course # CMOQ-6008 “Open Data Science in Chemical Oceanography” and CIMA-6007 “Professional Ethics in the Oceanic Sciences” were recently approved (certification # 23-22 and 23-13 respectively).

The valuation committee of DMS is developing an assessment protocol and metrics to evaluate the status (i.e. full or partial completion) of the different objectives in our strategic plan. However, we consider that various important metrics (number of graduates, number of peer-reviewed publications, number of approved proposals and total amount of external funding awarded, number of applications to the program, etc.) are good indicators and valuable components of this process, and we use them as a measurement of improvement (or not) and success.

New projects worth $ 3,747,556 were started during this year. They brought funding for several research assistantships for DMS students. External funding from collaborative projects and MOUs with private companies have also increased the number of available research assistantships. Two continuing collaborations, Eco-Electrica and CARICOOS provided funds to purchase much needed equipment and also, funds for DMS students.

Most of the resources needed to fulfill the objectives come from the DMS regular budget, the rotative accounts, and the external funds from research grants.

D.- To lead higher education throughout Puerto Rico while guaranteeing the best education for our students

The educational goals of the DMS are clearly stated in the mission and vision statements, the Student Outcome Learning Assessment (2016) and the DMS Strategic Plan (2026-2022), and in the Student Manual (2021).

The Department of Marine Sciences is the only one offering a bi-lingual, comprehensive, high quality graduate program in marine sciences in Puerto Rico and the Caribbean. Graduates from this program are highly competitive professionals and most of them have found jobs in local government and federal agencies, higher education/research institutions, and the private sector. Therefore, the UPRM-DMS is the leader institution providing graduate training to Puerto Rican and Caribbean students.

The DMS is well known across the marine science and academic circles because of the high-quality graduates and the high quality of our research and productivity (peer-reviewed publications and collaborations). The department is completing a curricular review, has submitted a request for approval for a new Professional Masters in Marine Science program, continues to update and improve the academic and training coursework (field work, experimental designs), and develop innovative research areas (i.e. coral reef diseases, *Sargassum* impact, water quality assessment, on-land culture of corals, sea urchins, crabs and fish associated to outreach and community training activities, and develop new courses and research projects.

The number of applications and registered students varies across semesters, with the Fall semester usually with the higher number of applications. Overall however, if we look at the trend over time (Fig. 1), this number has been highly variable, mostly influenced by the total number of professors in the DMS that can take and advise graduate students, the financial situation of Puerto Rico and the University, and the lack of stability of the university with student and employee strikes that tend to scare away potential student. Fig. 1 presents the temporal variability of the total number of active students (both Ph.D and Ms.C) over time. The maximum number of registered students was in 2004 when the DMS had a full complement of 24 professors covering all sorts of research and academic areas in marine sciences. The lowest number was 46 in 2012 (50% reduction), when the number of professors was declining (Fig. 2) and there were several long strikes within the system, increased to 60 by 2015 and has been varying between 50 and 60, even though the number of professors have dropped to a critical number of 11 by 2018 and below ten since then (Fig. 2). As mentioned above, the department is in a critical situation due to the low number of faculty that is already advising an average of 6 graduate students per professor, which is high and takes a lot of time.

Fig. 1. Total number of active graduate students in the DMS over time.

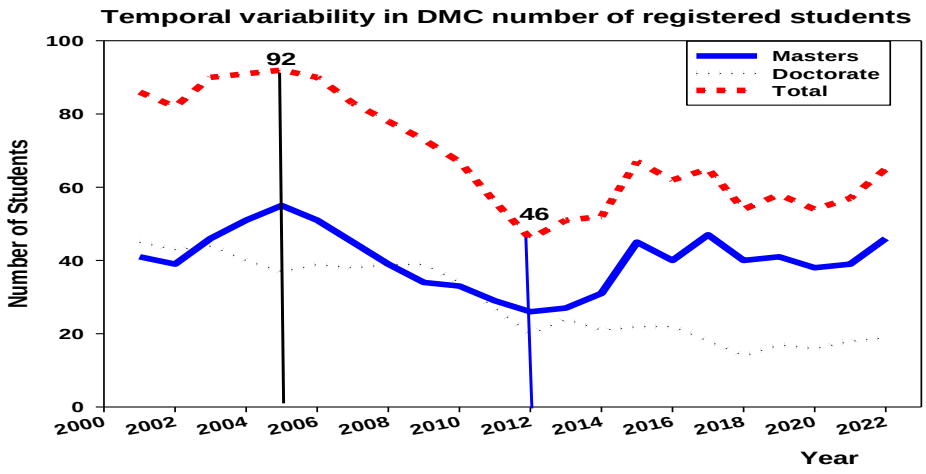
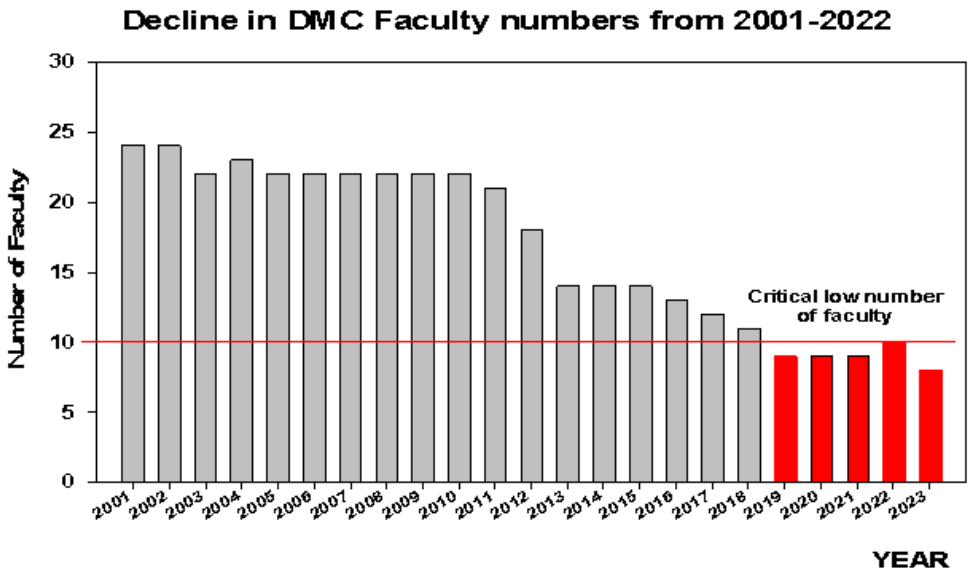


Fig. 2. Temporal decline in the total number of active professors in the DMS between 2001 and 2022. The graph shows a decline of 63% in the number of faculty (from 24 to 9 in 2021). The red line indicates a critical number of professors under which the quality and diversity of the graduate program is suffering.



D.1- Curricular reviews

A curricular revision of the graduate program of the Department of Marine Sciences was approved b. the Academic Senate on June 19, 2020 [Certification 20-52 (SA-RUM)]. The DMS faculty has been revising and updating the list of courses offered for our graduate program. Several courses were eliminated (old, or have no professor), and others were inactivated for lack of professors to teach them. This is the main problem the graduate program is facing and it will not improve until the Administration allows the DMS to hire new professors. The current professors (7) teach a total of 31 courses (not including special topics or theses) between the two semesters of each academic year. Some of these courses are not offered every semester due to other commitments (other courses, research, etc.) by the professors. The very important areas such as marine botany, marine physiology, ichthyology, aquaculture, and fisheries biology do not have active courses due to a lack of professors. Therefore, the DMS personnel committee is working to solve this issue at least temporally, by reviewing the CVs of several candidates to be appointed as Adjunct professors. Adjunct professors can teach and advise graduate students, write proposals and develop research projects with DMS faculty. It could increase and complement our academic offerings for new students.

D.2- New courses

Two new courses that were submitted for approval to complement our curriculum, course # CMOQ-6008 “Open Data Science in Chemical Oceanography” and CIMA-6007 “Professional Ethics in the Oceanic Sciences” were recently approved (certification # 23-22 and 23-13 respectively).

New and regular faculty have developed new courses at the 5000 and 6000 level to attract upper-level undergraduate students and motivate them to apply to our graduate program These courses also add diversity and opportunity for our students to complement their academic programs given the low number of courses currently available due to lack of professors.

Biological oceanography is the area in the most demand receiving the bulk of the new applications. Other specialization areas within the program such as physical, geological and chemical oceanography are receiving very few, or none, new students, which pose a problem for professors not been able to complete their 12 credits of academic load on at least one semester. Moreover, these areas do not have enough specialization courses (electives) due to a lack of professors (one professor in each area).

D.3- New academic programs

The Department is working with the administration to finish the process of implementing a new program, ***the Professional Master's in Marine Sciences***, with Plan II and Plan III. The program was offered one semester and attracted several new students to the Department, furthermore, several of the current students enrolled in the master's program (Plan I) switched to this new program. However, a procedural confusion with the application to create the program, forced the DMS to stop offering it, and re-start the application process anew. We expect this program to be active and running for the second semester of 2023-24.

D.4- Recognition of teaching staff

Professors Aurelio Mercado Irizarry was honored with rank of Doctor Honoris Causa by the University in a ceremony at the Mayagüez Campus (RUM) of the University of Puerto Rico (UPR). Dr. Mercado Irizarry was highlighted for having been a pioneer in Physical Oceanography issues in Puerto Rico, in addition to contributing significantly to the Curricular Sequence of Atmospheric Sciences and Meteorology of the Campus. His prolific scientific production has served as the basis for the development of public policy with a view to reducing the vulnerability of coastal communities and residents of flood-prone areas during extreme events such as hurricanes, torrential rains, and tsunamis within a climate change scenario.

A leading academic platform for researchers (Research.com), in its 2023 Edition, ranked Dr. Ernesto Weil, director of the DMS, in position # 1146 of Best Scientists in the field of Ecology and Evolution in the United States and #3093 in the World. The ranking is based on D-index (Discipline H-index) metric, which only includes papers and citation values for an examined discipline. The ranking includes only leading scientists with D-index of at least 30 for academic publications made in the area of Ecology and Evolution.

E.- Initiatives to strengthen teaching - Collaborative Agreements

The most important initiative to strengthen teaching and the quality of the graduate program is with hiring new professor to fill the gaps of important topics that previously provided a comprehensive academic program and are now missing.

All Faculty have taken the CTI course for remote teaching. This tool provides flexibility to teach courses in three different formats to facilitate the access of students and the possibility of teaching when access to a classroom is not granted for any particular reason. It also opens the possibility of collaborative teaching with professors and researchers from other local and/or foreign institutions, and that students from other programs and faculties could take some of the DMS graduate courses.

Use of technology in the classroom – Both Classrooms at Magueyes, and the one in the Physics building have been updated technologically to provide support for "in class", hybrid and remote teaching. Professors have been using these systems for over a year now.

The DMS has no program for training professors, most of whom have achieved the highest academic degree (Ph. D). New training activities include specialized workshops in different topics. Dr. W.Schmidt participated in a workshop for the region of the South Atlantic (between the African and American coasts) and the Wider Caribbean area on the United Nations Regular Process – World Ocean Assessment in 2023. Dr. Weil participated in a couple of workshops dealing with the treatment of a new coral disease (SCTLD) and the restoration of coral communities.

E.1- Infrastructure and equipment support

The upgrade of classrooms and Conference rooms is done. State of the art equipment (Camera, projector, computer, modem, TV screens, fast fiber optics internet) and support for remote teaching has been available this last year in all DMS classrooms (one in Mayaguez one in Magueyes) and the CCRI conference room (Magueyes). The next step is to extend the fiber-optic network and bandwidth to all the facilities (areas) of the Magueyes Marine lab. This will allow students, professors and visitors to access fast internet connection from any area of Magueyes. It also will allow the installation of sophisticated measuring and recording equipment for monitoring and video recordings.

The upgrade and refitting of the fleet of small boats (new outboard engines, central consoles, cables and electrical system, and the re-arrangement of the distribution of sitting and working space inside the boats was finished during this year. Boats are now safer and more efficient (gas consumption has been reduced significantly by the four strokes engines saving money to the DMS.

Maintenance of the air compressor and nitrox facilities was done and spare parts and materials purchase for the year allowed the continuous diving support for the DMS students professors and research visitors. The DMS has enough dive tanks to support the current activities, however, if the demand for air and nitrox continues to increase, a second compressor might be needed.

The physical plant personnel continue to provide support to the students, professors and visitors helping with many different tasks (wood and steel work, rebar cutting, keeping the sea water system working, the boats in good working conditions, and the general maintenance of the infrastructure in Magueyes.

The replacement of all the old air conditioning units with new inverter untis is continuing. During this year the larger units of the main building (20 Ton unit), one of the two 7 ton units of the student lounge, and two of the four 5 ton units of research labs were replaced. All units of the dormitories and most of the essential units were replaced. We are waiting for the rest of the units to be replaced this coming semester.

Physical Plant in Mayaguez has the list and quotations to purchase and install the rest of the units. This is another way by which the DMS is trying to save money reducing the electrical bill.

The dissemination of academic achievements was reduced to informing the faculty and students of the list of masters and doctorate graduates for the year. The DMS web page is being revised and reorganized to serve not only as a much better information platform of the DMS, its academic program, the faculty members, research projects, productivity, student body and activities (AECIMA), but also to have sections of interactive new information, events, students' status, publications, and up-to-date dissemination of important news related to the marine environment etc.

F.- To increase and diversify the Institution's sources of revenue

Faculty members are constantly encouraged to write and submit as many proposals as they can to bring funds to the DMS to support our students and infrastructure. They are also looking for new sources of funding, including private foundations, private companies, and joining as Co-PIs with local NGOs to increase potential sources of research and academic funding.

F.1- External funding, internal revenues, proposals and active projects

Even though the DMS has only eight active, full-time professors Ten (10) research proposals submitted to Federal agencies (EPA-DNRA, NASA), institutions (Purdue University, Schmidt Institution) and foundations (Wenner Green Foundation) for a total of $ 3,747,556 in research funding were approved during this year, and several projects started during 2022-23. See appendix 4a, and 4b, for a summary of the funding sources and active projects in the DMS during 2022-23. Some of these projects have funding up to 2026, and a couple are in a "no cost extension" phase until 2024.

Two other proposals in which the DMS (Dr. E.Weil) is a collaborator (co-PI), that were submitted to NOAA by ISER (Institute for Socio-Ecological Research, an NGO) with other collaborators, and another collaborative research with the DNRA (for a total of $ 11,189,000 in research funds), were approved during 2022-23. The projects are now in the process of starting. The largest one ($ 10,500,000) is entitled "*multi-strategic approaches to scaling-up ecosystem-based restoration to improve coral reef recovery and resilience around Puerto Rico*", will allow the expansion and improvement of the current on-land coral-, and sea-urchins cultures, and expanding the out-planting protocols to increase survivorship of the bleaching and disease resistant cultured fragments, to aid in the restoration of impacted coral reefs around Puerto Rico.

ISER will be the official administrator, with the other collaborators, including the DMS, as subcontractors or participants, for four years (2023-2027). The DMS will benefit by several infrastructural improvements, including a new, more efficient sea-water system with enough seawater pumping and storage capacity to last several days feeding the culture tanks if there is a power failure. Twelve research assistantships/ hourly wage contracts will be available (> $ 120,000 per year for 3 years) for DMS graduate- and BIO undergraduate students, and funds to pay for use of space, boats and dive facilities, and equipment isalso included. The new water system will help other aquaculture projects on Magueyes such as the fish and mangrove cultures that are mostly for academic and outreach purposes. These projects will also provide opportunities for the DMA students to develop research thesis projects.

During the fiscal year of 2022-23, the DMS received a total of $ 103,623 from the use of lab space, boats, dive tanks, and dormitories from CARICOOS, Ecoelectrica, federal agencies, visitors, students and faculty members' grants. These funds are used for the maintenance and improving of our facilities and equipment, and the purchase of new equipment such as dive tanks, outboard engines, spare parts, new air conditioners to replace old units, etc.

Institutional funds for maintenance of the Magueyes lab facilities in La Parguera were used for gasoline, diesel, motor oil, cleaning, spare parts, laboratory equipment and the update of our three (3) classrooms, one in Mayagüez and two Magueyes ($62,973). The Faculty of Arts and Sciences provided $32,716.32 for updating equipment for non-teaching staff. Through this, several pieces of equipment were acquired with the purpose of improving technological resources. The "Center of Technology Information (CTI)" provided $31,176.58 to improve the teaching laboratories and classroom to be able to provide local and distance teaching and conferences.

F.2- Recurrent accounts – intended use

During the fiscal year 2022-2023 the Department received $6,250.00 for the use of the big boats, $16,770.51 for the use of small boats, and $5,328.00 for the use of diving equipment. For 2022-23 the use of classrooms, conference room, wetlab space, and laboratory/office space produced $74,576.40. The use of the dormitories brought in $626.75. The use of a photocopier at Isla Magueyes produced $71.50.

Use of dormitories is increasing slowly to the levels of the pre-pandemic times when the DMS had many visiting groups of students and researchers. These funds are deposited in the rotative accouns and are mainly used for the maintenance of the boats and the diving facilities, including the air/nitrox compressor.

The support columns of the dormitories suffered some damage due to the 2020 earthquakes, so they were closed for visitors for a few months until the UPRM engineers checked the structures. They recommended install of additional metal supports while they decided what to do to reinforce the columns. The air conditioners of the five rooms needed to be replaced by new units after the blackout of April 2022.

The total income for this year was $103,623.16, which was deposited in the DMS rotative accounts (tables 1a, b). These accounts are used to support the continuous functioning of the Magueyes marine laboratory, the upgrade and purchase of basic equipment (ACs, out-board engines, gardening equipment, electrical supplies, the maintenance and renovation of infrastructure, workshop areas, piers, classrooms, sea-water pumps, and research labs and external wetlabs, etc. Funds from the "time purchase" (compra de tiempo) account will be used to increase (by $14,000) the start-up award ($8,000) provided by the Chancellors office to newly hired faculty members. Some funds from this account were used for student support (hourly wages) during the past year. Some extra funds might be used to purchase some basic equipment that the new professor would need to start her research as soon as possible.

Table 1a – Recurrent account DMS-balance 2022-23

Accounts DMS	FSR #	Balance 08/2022	Expenses 2022-23	Balance 06/2023
Fish	3-50840	$ 28,580.29	$ 11,375.00	$ 17,205.29
Indirect costs	3-90293			$ 17,819.29
Time purchase	2-78273			$ 128,156.70
Total				$ 163,181.28

During 2022-23 the DMS had to use funds from the Fish account to purchase essential equipment/materials for Magueyes because of the hurricane Fiona and continuous power failures of the LUMA network in Parguera. Two 10.5 KW portable generators ($ 4179.00) and extension cords to supply electricity to the ultra freezers and refrigerators with students and professor samples in the areas without energy due to the broken generator since April 2022, so half the island has no emergency power; other electrical materials and tools ($ 805.05); a battery for one of our trucks ($ 277.04); six inverter air conditioning units to replace non-functioning old units in labs and offices ($3,855), and three APC units ($908.00) for a total of $ 11,375.00. Four thousand dollars ($ 4,000) from this account are obligated for the purchase of an utility vehicle (Kawasaky) for Magueyes. The station needs a medium-size digger for the inhouse projects and to move heavy equipment around the island. Funding to purchase a digger (KUBOTA or CATERPILLAR) is being seek for 2023-24.

Table 1b – Recurrent accounts DMS – Balances 2022-23

Account	**FSR #**	**Balance 08/22**	**Expenditures 2022-23**	**Deposits**	Balance 06/23
Medium boats					
Sultana					
Small boats					
Facilities					
Diving					
Donations					
Total					

G- To implement efficient and expedient administrative procedures.

Administrative staff has been working to simplify the flow of information and run administrative tasks more efficiently across employees, faculty, and students. A Spreadsheet summarizing information related to the different steps of the purchase process has been created, for example. It includes all information needed to follow the process form the company quote to the date the merchandise or service is received; company and quote date, number and date of requisition, number and date of purchase order, cheque, and date the merchandize or service was received. This table is in onedrive for easy access to everyone. The administrative staff continues to keep important internal statistics up to date. These include employees' attendance, illness leave, vacations, accumulated balances, extra hours, other leave, etc. Balances are then prepared every month. This information together with the individual requests are used to prepare the projection of excesses, vacation planning without affecting work, and the vacation dates for all employees.

The department continues to be understaffed with regards to the Magueyes guards, who not only provide security but more importantly, the daily transportation service from the mainland to Magueyes (24/7 - 365 days a year). This is a major problem to cover all daily turns and is a security risk. At the moment, Magueyes has no guard on duty from 12:00 m to 7:00 a.m. The transit boat is left tide-up to the mainland dock and the island has no guard. This very risky given the expensive equipment (i.e. all the new outboard engines) and research equipment in the labs. A security camera system is being purchased and will be installed soon. This no replacement for a guard however. La Parguera has become a high magnet for local and foreign tourism, so the number of people in the area has increased significantly. On the other hand, because of an incomplete guard staff, Guards keep accumulating extra hours for filling up the turn for which there is no guard I the roster, which cost the university more money than an new hire.

Administrative personnel attended most of the training workshops related to the improvement of the different academic (registration) administrative (sign-request, use of programs, etc.) processes that were provided by the administration during 2022-23.

The process of tracking fuel use (Diesel and gasoline) in Magueyes has been optimized using Google Forms to evaluate consumption and have an efficient plan to avoid running out of fuel for the boats and diesel for the generators during normal use, and in case of an emergency. This record, in conjunction with calendar reminders, has improved the purchasing and sourcing process.

The major issue with purchasing is the low number of personnel in the main offices in Mayaguez, including purchasing. For example, it took the DMS almost three year to replace broken AC units that fed tha main building and the student lounge at Magueyes. Currently, it's being almost 15 months that one of our emergency generators in Magueyes broke down, and the administration has not been able to either repair it, or replace it with a new one. The LUMA service is getting worse and every time there is an grid problem in La Parguera, and Magueyes has no electrical energy, half of our facilities do not get it for the duration of the problem, this could take up to 6-7 days, and is happening more frequently. We are seriously concerned with what will happen to our projects and activities during the summer if a hurricane hits the island.

H.- To strengthen research and competitive creative endeavors

Most of this section has already been covered above in sections C – F. Faculty members submitted ten (10) research proposals (Pi and Co-PI) to Federal agencies (EPA-DNRA, NASA), institutions (Purdue University, Schmidt Institution) and foundations (Wenner Green Foundation). Most of these were approved during this year for a total of $ 3,747,556 in research funding. Most projects are now on the way and a few are starting. See appendixes 4a, 4b for a summary of active funded projects, funding sources, duration, etc.

H.1- Collaborations for research and development (Appendix 7)

Collaboration agreements were discussed between the DMS and the California State University, NothRidge Campus (Dr. Peter Edmunds) and SCRIPS Institute of Oceanography, University of California, San Diego (Dr. Dahiana Arcilla and Dra. Isabel Collazo). An MOU is being developed to officialize the verbal agreement with CSU, which includes student exchange, remote teaching of courses, and research collaborations. Similarly, two MOU's are being developed between the DMS and two Departments at the

SCRIPPS Institution, University of California, San Diego. One with the Department of Anthropology (Dra. Isabel Collazo), and one with the department of biology (Dr. Dahiana Arcilla). A summer course in fish biology and evolution was organized by the DMS and Dr. Dahiana Arcila to be offered for the first summer session of 2023. Unfortunately, there were no applications because of the high cost of the course. We are seeking alternatives to provide financial support for next year.

Drs. T. Courtney and E. Weil collaborated with the Schmidt Ocean Institute, a private NGO, with an agreement to collaborate with a mesophotic project and to secure the participation of DMS students in the planed cruise for the project. The project was entitled "Corals and Sponges as Biological Hotspots of Reactive Oxygen Species in the Mesophotic to Deep Sea Habitats" . The PI of the project, Dr. Colleen Hansel, from Woods Hole Oceanographic Institution, was the person of contact for a science research cruise scheduled for April - May 2023 aboard SOI's research vessel Falkor. Five students from the DMS participated in this unique experience.

Collaboration agreement with the University of Southern Mississippi (USM) and the Marine Consortium of the University of Louisiana (LUMCON). This link opens collaboration doors in aspects related to oceanography, possibilities to interact with other institutions and the opportunity for all UPR students.

The Sea Grant College Program has formalized a collaboration agreement with the DMS, through which we will join efforts to increase the impact of both programs in the community with a perspective of education, applied research and marine extension.

CoHemis Consortium Framework Agreement, between the UPR-Mayagüez and the University of Málaga, the purpose of which is to expand hemispheric collaboration by facilitating institutional and professional relations and faculty and student exchanges. In addition to supporting various investigations and information transfer through conferences and workshops.

Cooperative Agreement between the Woods Hole Oceanographic Institute and the UPR-Mayagüez for the purpose of promoting education and research through the establishment of academic exchange programs Academic exchange, visits by professors, research staff and students, particularly in association with joint research, workshops. Exchange of publications, scientific materials, academic articles, and research information resulting from joint activities, etc.

The DMS is a participating member of the Gulf of Mexico University Research Collaborative (GOMURC) which allows us to expand our collaboration ties in oceanographic activities (Letter of Support).

An MOU was signed between the DMS and the CARICOOS program. It establishes cooperation with infrastructure and logistical support, and an agreement for use of space in Magueyes, and use of DMS boats and diving support for the projects sponsored by the organization. CARICOOS provides several research assistantships for DMS students, and has helped with some equipment and upgrading of infrastructure.

An understanding agreement is maintained with the University of Rhode Island with which a migratory bird monitoring station was established that will allow the development of studies related to seabirds (Validity: 2019). In the Marine Sciences facilities on Isla Magueyes, the NOAA tide station with older data in this area of the Caribbean is maintained (https://tidesandcurrents.noaa.gov/stationhome.htmlid=9759110) (Undefined)

A collaborative agreement is in force under the East Coast Oceanographic Consortium (ECOC) agency to guide and supervise the utilization, operation and administration of a currently active UNOLS research vessel, the R/V Endeavor; to promote cooperation and collaboration in marine science and education.

The financial aid to our graduate students improved significantly due to external funding linked to new research projects awarded to DMS faculty, and collaborative projects between the DMS and NGOs and other institutions. Fifteen (15) teaching assistantships were funded with institutional funds distributed between the Departments of Biology (11) and Geology (4). Two (2) research assistantships were funded by EcoElectrica (MOU). The total amount of funding for these 17 assistantships was $66,306.74 (appendix 2).

Fifty four (54) research assistantships were funded with external funds provided by research grants awarded to DMS faculty members and other sources (appendix 1). The total amount of funding from was $174,101.60. A NASA funded project to Dr. R. Armstrong supported ($11,632.5) nine (9) undergraduate students working in different projects in Magueyes. Fourteen graduate students receive hourly wages (jornal) to assist in different tasks, including research projects and maintenance of the invertebrate collection. The total amount was ($27,253)**.**

Productivity in terms of peer-reviewed publications was high again. A total of twenty-two (22) peer-reviewed manuscripts were published in recognized journals, four (4) technical reports were submitted to agencies, and eleven (11) manuscripts (for a total of 41) are under review in recognized journals. Students are listed as senior/co-authors authors in 19 of all the published/submitted manuscripts, which represents a 57% participation (appendix 2).

I.- To impact our Puerto Rican society

The department has increased its outreach and community service activities thanks to the help and assistance of professors and administrative personnel, and the initiatives of AECIMA, the student organization and our local collaborators. One major accomplishment was the involvement of the DMS in the development of a high school marine science “program” for the new Montesori School Alejandro Tapia Rivera in the community of La Parguera. The DMS, the school principal, the San Juan headquarters and Mr. Efrain Figueroa and the Sea Grant program and CARICOOS are collaborating with this project. The DMS has provided information, materials, talks and logistical support for several visits of the students to our lab facilities. This is an important collaboration because we are training and motivating the future graduate students of the department, and the community leaders to protect our marine natural resources. Recently, DMS collaborated with a series of workshops on coastal marine ecosystems and environmental and scientific photo-journalism for the school during June of 2023 lead by Mr. E. Figueroa.

The Department has been contacted many times in the last year to give local and international TV and journalist interviews about the current problems facing the coastal marine communities of Puerto Rico. This is part of our outreach activities and the one that reaches the most people.

The DMS has strengthened the collaboration with the Department of Natural Resources. During the last year we have had meetings and discussion about the critical situation of the La Parguera Natural Reserve (LPNR) due to the combination of stressful conditions linked to climate change (high temperatures, storms, diseases and bleaching) and the direct impact of human activities. The LPNR has become a tourist

nightmare due to the lack of law reinforcement and the ignorance of the users. The DNRA and the DMS are now working closely to establish usage regulations to ameliorate the human impact (Noise control, speed limits in manati areas, night lighting, carrying capacity in some highly visited localities, etc.) while we finish the Zonification and Management plan for the reserve.

The DMS has a couple of projects dealing with the influx of the floating seaweed Sargassum, which has increased significantly every year since 2016. The idea is to use the results of these studies to forecast the arrival of the big floating rafts and plan how to prevent the accumulation of the seaweed in areas where it can produce extensive mortalities due to the lack of oxygen during decomposition.

A new course at level 5000 (CIMA-6007 "Professional Ethics in the Oceanic Sciences") was recently approved (certification #23-13). This course deals with all ethical aspects involved in a scientific career, a very important addition to our list of courses for our graduate program. The course is designed to promote the values of ethics, justice, and honesty in our students and future professionals.

J.- To strengthen school spirit, pride, and identity

The DMS is compiling information to develop courses that will help our graduate students to write research proposals and scientific publications. We have one administrative official who takes care of all official student academic issues. The revision of the student's manual (2021) and the updating of the DMS web page are two sources of information for our students.

The DMS has one student organization, AECIMA, which has been doing excellent work with community services and training, tours of our facilities, talks, symposia, and workshops, and organizing open houses in the department, music nights and beach cleaning activities. They need to promote their activities more through collective emails. Also, AECIMA participates in the promoting activities of the DMS in other institutions around Puerto Rico.

No active efforts have been made to contact Alumni and request them to give seminars and talks to our new graduate about their experience in looking for jobs after graduating, their actual jobs and how the graduate studies helped them to be a successful professional.

The Department has been contacted many times in the last year to give local and international TV and journalist interviews about the current problems facing the coastal marine communities of Puerto Rico. This is part of our outreach activities and the one that actually reaches the most people.

The DMS does not receive any recurrent donations from Alumni. However, we were just informed this year that in the year 2012, The Rita Walsh MD Scholarship was established to aid graduate students from the department of marine sciences and the school of medicine in Ponce. The agreement was signed by the then President of the University Dr. Miguel Munoz and Mrs. Carmen Walsh Rivera. The funds come from the dividends of Mrs. Walsh investments and the only information we could get from the Central administration is two deposits into the endowment for $ 452,838.79, which we assume are from two years. We have not been able to find out what the deposits for the other ten years are and how much is the total endowment for assistantships in the scholarship fund.

Collaboration agreements with government agencies, the private sector, and various entities were discussed above (section H).

Improvements to infrastructure and buildings were presented above in section E and F.

K.- International activity

During the academic year 2022-23 The DMS had few international students. Only seven (7) or 12 % of the students were from foreign countries, mostly from central and south America. Two masters (one male one female) and one Ph.D (female) students were from Colombia, two male Ph.D students were from Mexico, one female Ph.D student was from Ecuador and one from Costa rica. one male and one female.

All faculty members of the DMS are males. Three of the faculty members are originally from foreign countries, two from Venezuela and one from Greece. In our last hiring call and evaluation process, we has several female applicants, of which two made it to the interview process and one of them, a female from Czechoslovakia was selected and offered the assistant professor position to substitute Dr. G. Nadathur.

Most of the faculty have collaborations with researchers from other institutions, some from foreign countries, and have published joint manuscripts with them. Last year publication list (appendix 2) at least 22 of the 41 (53%) manuscripts published and in revision in peer-reviewed journal av at least one international coauthor.

The participation in international conferences was totally halted with the pandemic, and many of these events are slowly coming back with researchers still reluctant to attend. One professor attended the International Coral Reef Symposium in Germany and was infected with COVID. Another professor presented a poster as a co-author but did not attend the meeting.

The DMS has no courses in collaboration with international colleagues.