

University of Washington School of Oceanography Ten Year Academic Program Review

Report of the Review Committee

10 March 2023

Joel E. Baker

Professor and Director, UW Puget Sound Institute, Center for Urban Waters
University of Washington Tacoma (Committee Chair)

Jennifer Ruesink

Professor, Department of Biology
University of Washington Seattle

Richard W. Murray

Deputy Director and Vice President for Science and Engineering
Woods Hole Oceanographic Institution

Courtney Harris

Professor and Department Chair, Department of Physical Sciences
Virginia Institute of Marine Science, College of William & Mary

Overview of Committee's Findings

The review committee began our work well aware of the strong and justified reputation of the UW School of Oceanography. During our visit, our initial impressions were reinforced through our thoughtful and open conversations with leadership, faculty, students, and staff. While we did not discover any urgent systemic problems, we gained the sense that an opportunity exists now to rethink and refresh the School in ways that both reflects the evolution of the discipline of oceanography globally and positions UW to be the #1 ranked Oceanography program for the next 50 years.

Since its inception, the UW Oceanography program has thrived following a classical academic research structure, with strong laboratories led by single (often internationally renowned) professors working within the four classic subdisciplines of marine geology and geophysics, chemical oceanography, biological oceanography, and physical oceanography. For decades, this model has attracted the talent and funding to enable UW to play a leading role in oceanography, not least through training oceanographers to be PIs heading laboratories in similarly structured academic departments.

Driven by the highly complex nature of climate change, the discipline of oceanography is evolving to include more interdisciplinary approaches that leverage approaches and technologies often adopted from other fields. An increasing number of undergraduate and graduate students are interested in substantive non-academic careers to address some of the greatest geoscience challenges facing society. Interdisciplinary graduate training programs such as the NSF

Research Traineeship program and adoption of on-line collaboration tools has accelerated early career oceanographers adept in (and expecting to) work in dynamic and diverse teams that tackle multifaceted global issues. An opportunity exists to adapt the successful UW Oceanography program to lead this evolution.

As detailed below, the Review Committee concludes:

1. The UW School of Oceanography's well-earned reputation provides an outstanding opportunity to be a leader as the global oceanographic community grows to meet the critical needs inherent in climate change. UW Oceanography needs to quickly evolve to lead the rapidly changing field of oceanography or risk becoming marginalized in the coming 5-10 years.
2. The Review Committee supports Oceanography's self-study conclusion that the curriculum at the undergraduate level does not need significant redesign. However, specific challenges identified in implementing this curriculum, including practical issues of sequencing classes and coordinating with the large marine biology major, should be addressed immediately.
3. Significant opportunities exist to realign and reimagine the graduate program to reflect the evolution of oceanography and to take advantage of other UW and regional strengths in earth and atmospheric sciences, data sciences, etc. Re-orientating the graduate experience by offering courses and building a community that focus on the theme of global challenges rather than disciplinary specialization should be considered.
4. The School's infrastructure includes some important highly specialized spaces, but clearly suffers from the lack of a clear capital plan that amplifies UW's ongoing excellence in oceanography while anticipating growth and evolution of teaching, research, and public outreach. The committee recommends that the parcel of campus between the Ocean Sciences Building and the Marine Science Building be dedicated to the School of Oceanography, with substantial investment in upgrading and replacing aging infrastructure. We note that several other U.S. oceanographic institutes with whom UW directly competes (specifically, Scripps, Woods Hole, University of Rhode Island, and the University of Alaska) are currently making large capital investments.
5. SOO exhibited substantial grassroots activity and reflection around diversity and inclusion over the past three years, with some notable change in process and demographics (particularly in faculty hires), but the committee heard concerns about the pace at which those efforts are being considered and implemented.
6. Finally, the committee notes that the School of Oceanography is at a critical time with changes in academic leadership and the retirement of their very experienced administrator and many senior faculty. SOO has successfully recruited a strong and diverse cohort of Assistant Professors who must be nurtured during this transition period.

While many of our recommendations should be addressed soon, we recommend that the degree programs offered by the School of Oceanography be reviewed again after 10 years, barring any exceptional developments that would require more immediate attention.

Background

Established in 1951, University of Washington's School of Oceanography (SOO) occupies a unique position within the US higher educational landscape. Located in a vibrant and diverse city, directly on a major waterway, and as an integral part of a large public university campus, it provides undergraduates and graduate students with unparalleled access to an ocean science education. The school houses facilities for research vessels directly adjacent to the Marine Sciences Building, giving students a front - row view of ship operations for the school's two research vessels and visiting research vessels. These marine facilities are well known throughout the national community, and are equally known for being in need of updating. The undergraduate majors number about 110, while there are ~ 65 graduate students. The school currently houses 29 voting faculty, 50% of which are female. Note that the numbers of faculty and graduate students are lower now than they were in previous decades. In addition to SOO faculty, the school benefits from close relationships with the Applied Physics Lab (APL) and nearby NOAA labs. Research scientists and engineers at APL and these NOAA labs can serve as Affiliate Faculty, advise graduate students, and in some cases teach classes. These partnerships bolster SOO research and education, particularly in physical oceanography.

The University of Washington School of Oceanography is an outstanding enterprise built on decades of global leadership in the four core subdisciplines of physical, chemical, and biological oceanography, and marine geology and geophysics. The program has been ranked #1 or #2 in the world for the past five years among degree granting institutions and is widely recognized for the global impact resulting from its research. The School of Oceanography has produced an impressive number of graduates who play influential roles in many of the top tier academic oceanographic programs around the world. The School of Oceanography has been the cornerstone of a highly productive and impactful research collaboration with the Applied Physics Laboratory, the Cooperative Institute for Climate, Ocean and Ecosystem Studies, the NOAA Pacific Marine Environmental Laboratory, and others that attracts considerable talent and funding to the Seattle metropolitan region. The School of Oceanography is the fourth largest research unit at UW, successfully competing for \$30-60M of external funding annually and employing more than 200 faculty, students, and staff. Since the last review the School of Oceanography has expanded their impact by growing undergraduate enrollments and enhanced their degree programs by leveraging UW's growing prowess in data science.

Committee Findings

The review committee carefully considered each of the questions contained in the charge letter and in the School of Oceanography self study (see end of report) in our discussions and deliberations. In this section, we detail our findings organized around (1) the undergraduate curriculum, (2) the graduate program, (3) overall community and climate, and (4) infrastructure.

Undergraduate Curriculum

UW Oceanography's undergraduate curriculum was recently redesigned and approaches oceanography with an interdisciplinary and integrative set of requirements. Some highlights of the degree include early coding and work with data, experiential learning in hands-on science throughout the degree, and a sequenced set of classes to build increasingly sophisticated learning in regards to ocean science and technology. The Review Committee supports Oceanography's self-study conclusion that the curriculum at the undergraduate level does not need significant redesign.

The committee heard some concerns in regards to implementation of the curriculum, specifically 1) overlap in content among classes, 2) inconsistency when different faculty taught the same class, 3) reconsideration of the effectiveness of co-taught integrative classes, 4) availability of courses in sequence, and 5) who gets notified about shipboard research opportunities. These concerns are compounded by increasing demand for some classes by Marine Biology majors, who may have different preparation than Oceanography majors and therefore change not just the size but also the possible scope of a class. Additionally, enrollment in required laboratory courses is limited by the size of the available laboratories (apparently renovations in the Ocean Teaching Building were only partially completed).

The Review Committee consistently heard from multiple populations that allegedly "interdisciplinary" courses are in fact not, that there is redundancy over the first several weeks of most courses as too much time has to be spent leveling the core knowledge of the students in a given course, and so on. These comments are somewhat generational, but not exclusively so. Drilling down into "interdisciplinary" courses, it was frequently pointed out (again, by several populations) that merely patching two or more professors into a class is not sufficient and, indeed, often contributes to more silo-ing (just over a fewer number of weeks in the class) than if one professor alone were teaching.

We recognize that most of these issues are already noted by Academic Affairs. Therefore, the committee chose to include the concerns only as a way to support efforts to address curriculum implementation. and they also need to engage with other faculty to better understand and coordinate what is taught in other courses. Tenured faculty may need to change what they offer and when their courses are offered in order to increase contribution to student credit hours. Faculty may be required to learn pedagogical techniques that are effective as they scale to larger class sizes. For junior faculty, however, consistent teaching is paramount, along with early mentoring that supports their ability not to exceed 15 hours/week in 10 weeks with an undergraduate class (in a 40-40-20 model). Teaching professors may contribute more to larger core classes while tenure-track faculty offer upper level electives. As teaching assignments are made and new classes considered, working with the Marine Biology major will be essential in building the credit hours contributed by Oceanography. These changes need to be implemented by leadership of SOO, and backed by leadership at the College.

Currently, activity-based budgeting (ABB) may be helpful for bottom-line accounting of the sustainable size of the unit's faculty; indeed, we don't know what other strategies for setting the optimal number of faculty would even be considered at higher administrative levels. The

committee supports increasing the number of teaching professors to four. The committee also sees potential for some upper-level classes to be offered by affiliate faculty as temporary instructors (or as WOT appointments), which could build connections among Seattle-area ocean scientists and provide unique learning opportunities for students. A challenge will be to do any accounting in a way that does not exploit teaching professors to “pay” in ABB so that tenure-track faculty can focus on research; again, comparative approaches across units in the College may be germane to setting expectations around student credit hours per tenure-track faculty member at different career stages or with different research investment.

Graduate Curriculum

The committee feels there should be little to no concern over the decline in the number of graduate students as an issue in and of itself, as the decrease instead reflects other processes that are regulating the size of this population. As shown in Appendix B of the self study, the number of graduate students has in fact been relatively steady (roughly 60 +/- 10) for more than a decade, despite a decline in the number of faculty. Prior to that, we were told the population was more on the order of ~100, but that overall change mostly is indicative of the fact that the faculty are investing more in post-doctoral researchers and technical staff, instead of graduate students. Therefore, the total number of “grad students + post-docs + techs” has remained approximately constant, but the relative populations of these three sub-groups has changed.

Oceanography as a field is in flux. Whereas the Cold War was a driver of both basic and applied research from the 1950's to the 1990's, now climate change, natural hazards, and processes reflecting human-driven perturbation of natural systems all contribute to a very real need for new and innovative approaches to ocean science, consideration of new funding models, and changes in the reward structure(s) for scholars at cutting edge institutions such as UW.

UW needs to evolve, and needs to evolve fast, or risk becoming marginalized in the coming 5-10 years. The graduate teaching curriculum, which should reflect research topics and approaches (and not vice versa), is laudable in stressing in the early years the four basic components of oceanography. Graduate students reported a strong sense of cohort-building through these early shared requirements. However, in the middle and upper levels of the graduate curriculum, the segregation into the four curricula appears to hinder UW's chances for success. The continued promulgation of the four curriculum pathways further contributes to this lack of interdisciplinary approaches. This is a fundamental issue that is not just pedagogical theory...there is a mismatch between the current approach and being truly integrated and interdisciplinarity. As such, the curriculum structure is at direct odds with modern research directions.

The committee feels there is a mismatch between the graduate course requirements (which must be taught regardless of graduate student class size) and number of faculty who teach graduate level courses, especially in biology and chemistry. Maintaining four distinct tracks with relatively few faculty who teach graduate courses is straining the system, causing concern about course availability among the students and potentially asking early career colleagues to cover too many different courses pre-tenure.

Thus, the committee recommends that the graduate curriculum change to reflect themes of study (rather than disciplinary-driven courses in physical, biological, geological, or chemical oceanography). This will help solve several challenges: (1) upper level discipline-focused courses now have too few students, and are not consistently taught, whereas were there more truly integrative theme-based courses in climate change, water quality issues, data science, or other broader scope themes, populations would rise, (2) the social currency for which UW is well-known would be revitalized, as students and faculty alike would feel less isolated and more as part of a team, (3) intellectual and social diversity would increase, as there would be a stronger sense of cohorts, and, of course, (4) students would be better prepared to enter both academic and non-academic workforces that in the modern era highly value true interdisciplinarity.

School of Oceanography Community and Climate

The review committee was particularly asked to address diversity across all communities within SOO as part of its programmatic review. Many groups mentioned the need for College-level leadership on diversity and inclusion, where that Associate Dean position has been vacant for some time.

The School's committee on diversity, equity, and inclusion was especially active over the past few years. Its strategy was to engage in a specific task each year with substantive outcomes. Specifically, we learned that holistic admission criteria increased the diversity of the pool of graduate applicants, although that may not have translated into the demographics of new cohorts; and faculty search rubrics were updated and have resulted in a demographic shift for new hires. Some concerns were expressed that DEI activities are currently stymied: for instance, the DEI plan has not been brought to faculty vote and we heard that the DEI committee has not met much recently, possibly because the next action item is not clear or due to members stretched thinly with other responsibilities. There was no discussion of diversity during our meeting with Ship Operations.

New hires will energize and diversify the faculty, and the School needs to deliberately and consistently employ best practices to retain these new faculty through mentoring for inclusion and success. We did not see a specific plan for mentoring new faculty, and we emphasize the importance of SOO leadership, including senior faculty, to provide sustained assistance to new faculty as they develop their research and teaching. Ensuring proper support of early career faculty, especially at the Assistant Professor level, is paramount for helping them flourish at UW, and maintaining strong morale among their cohort.

We heard from several groups that, despite some efforts, there is not a strong sense of community within much of the Oceanography school, with the exception perhaps being the graduate students we met with. The pandemic is an obvious possible cause of a sense of disconnection, although is not the sole cause. It is perhaps natural that as a School grows and expands into separate buildings (and very successfully creates centers such as the Ocean Observatories Initiative) it self-selects into somewhat isolated sub-disciplines. The loss of community may have the largest immediate impact on the current undergraduates who have spent so much time isolated during the pandemic. The SOO should support both academic and

social ‘mixer’ events that are school-wide (as opposed to segregated by sub-discipline) and senior faculty should be encouraged to lead by example by actively participating.

Infrastructure

World-class academic programs require world-class facilities. The School’s infrastructure includes some important highly specialized facilities, but clearly suffers from the lack of a clear capital plan that amplifies UW’s current excellence in oceanography while anticipating growth and evolution of teaching, research, and public outreach. The committee notes the critical role physical space plays in creating a welcoming sense of community and fostering energetic learning environments. With some exceptions, much of the SOO space is old, cluttered, and seemingly poorly maintained, which not only creates a poor work environment but also likely sends the wrong signals to potential students, faculty, and donors. Place matters, and the UW is in the enviable position of having an exceptional School of Oceanography located on a waterfront urban campus in a major U.S. city.

The committee recommends that the parcel of campus between the Ocean Sciences Building and the Marine Science Building be dedicated to the School of Oceanography, with substantial investment in upgrading and replacing aging infrastructure. We appreciate that such investment is at high cost, but it is entirely and completely necessary for SOO to remain a national and international leader. Other competitors, such as Scripps, Woods Hole, University of Rhode Island, and the University of Alaska either recently or are currently undergoing infrastructure investments that cost in the many tens of millions of dollars, and UW’s infrastructure is ripe for similar scale investment.

Enhancing the current UW Oceanography facilities would result in significant benefits to the University, including:

1. Oceanography is inherently a field-based, technology-intensive discipline, requiring purpose-built laboratories, specialized facilities (such as the UW pressure tank), and research vessel support buildings and docks. Having existing facilities on the water within walking distance of the campus center is a tremendous strategic advantage for UW that would be difficult or impossible for virtually any other university to replicate.
2. Developing additional undergraduate laboratory and experiential learning spaces will allow for continued growth of oceanography and related majors at UW. The committee heard that the amount of laboratory space currently available for teaching required undergraduate courses is inadequate to meet demand, causing scheduling problems and perhaps delayed progress toward degree.
3. Maintaining global leadership in oceanography requires recruiting and retaining faculty who are among the best in their field—early career scientists who are usually mobile and for whom the competition is fierce. Recruitment suffers when candidates are shown old, outdated, and poorly maintained infrastructure, not only because they know they will struggle to establish a competitive research group under those conditions but also because

it causes doubt about the institution's investment in the program.

4. Facilities that are open and welcoming, especially to students from underrepresented communities, are key elements of increasing diversity within STEM careers, including oceanography. While the Ocean Sciences Building has a lobby with some displays, the program lacks a clear 'front door' where interested students would feel welcome. Long hallways with closed doors suggest only those who 'belong' should be there. Oceanography has tremendous programs that deserve a more outward facing facility built within the current footprint between OSB and the Marine Science Building.
5. Increased visibility of the Oceanography program could benefit fund-raising efforts. A wide range of boats and other watercraft make likely tens of thousands of transits through the Montlake Cut each year, including those moored at the Seattle Yacht Club and many who 'sail gate' at UW football games. Enhanced educational signage visible from the water and innovative renovation and repurposing of the Old Oceanography Building would elevate the visibility of the world class Oceanography program among many of the UW's strongest donors and political supporters.

Infrastructure Challenges, Opportunities and Recommendations

1. Improve communication about UW capital planning. Several members of the Oceanography program expressed concern about the 2019 Seattle Campus Master Plan that indicates the removal of Old Oceanography and the Ocean Teaching Building, potentially eliminating the ocean-focused corridor between Ocean Science and Marine Science. Several expressed a sense of limbo ("waiting to hear what the Medical School will do"). There is an opportunity for Oceanography and the College to work with UW Capital Planning to develop an updated capital facility plan specifically for the School of Oceanography that reflects (1) the incredible value UW derives by taking advantage of its unique deep water urban waterfront to house a global oceanographic vessel and a world class program, (2) the growth of the undergraduate programs, and (3) needs resulting from deferred maintenance.
2. Immediately develop and communicate a capital and maintenance plan for the Marine Sciences Building and pier that reflects the reality of constraints (age, building materials, etc.) and the opportunities (waterfront).
3. Develop and promote additional active collaboration spaces within existing and planned buildings. The current undergraduate Oceanography majors we met with spoke enthusiastically about the student lounge that was recently made available. This type of 'collision space' has always been an important element of academic buildings, and its need and value has increased due to the pandemic. Because the Oceanography programs (and therefore students, staff and faculty) are spread among buildings, carving out common spaces will help to rebuild a sense of community. Several new academic buildings on the UW campus embrace this approach and should serve as models for new

Oceanography buildings.

4. Improve access to existing ‘hands-on’ oceanographic tools, such as the Puget Sound model, wave tanks, and erosion flumes, and to cutting-edge research programs. While enrolled students gain access to these classic physical models, many are located behind locked doors in the Old Oceanography Building. Similarly, the interesting work done within the Ocean Technology Center and by the Ocean Observatories Initiative (OOI) group that largely sits within the Ocean Teaching Building lacks visibility. Students and visitors on the South Campus should be able to see these excellent resources in action.
5. Consider repurposing the Old Oceanography Building to preserve and better utilize this unique corner of campus. Update the UW South Campus Master Plan to include the current and anticipated needs of SOO, including the best use of Old Oceanography.

Immediate infrastructure needs and opportunities noted by the committee.

- solidify a space plan that maintains an “ocean science” corridor from the piers at the water to the large bays and research space at the Ocean Sciences Building, incorporating ocean science teaching labs for undergraduate education
- expand undergraduate teaching lab capacity to meet the needs of the Oceanography and Marine Biology programs
- reconfigure ‘paper labs’ in the Ocean Science Building to be collaborative space organized around research themes rather than PIs.
- empower a small decisive group to triage materials stored in the Marine Science Building and elsewhere, considering possible off-campus storage options
- engage UW and/or the Washington State Archivist to scan and preserve the extensive charts currently housed in the Old Oceanography Building.

Committee Response to Graduate School Questions:

1. Are the unit's degree programs of high quality? Do they meet the university's expectations of quality and reputation?

ans. Yes, both the undergraduate and graduate programs offered by the School of Oceanography are of extremely high quality and enjoy well-earned international reputations.

2. How does the unit compare with that of peer and aspirational institutions in terms of educational programs and scholarship?

ans. The UW School of Oceanography consistently ranks #1 or #2 in the world among degree granting institutions.

3. How can the unit improve the quality of its educational programs and scholarship?

ans. As detailed in the committee's report, specific issues identified should be addressed to optimize the delivery of the well-designed undergraduate curriculum. The committee recommends that the graduate curriculum evolve away from the current four track model to one that focuses on global research themes, consistent with the evolution of the field of oceanography.

4. What does the unit need to do to increase its national prominence?

ans. The challenge for the UW School of Oceanography is not to increase its national prominence (since it is already at or near the top), but rather how they will maintain their excellence over the next 50 years. The institutional challenge is how to move away from what has worked so well in the past to anticipate (or more accurately, lead) where ocean sciences is going. UW Oceanography is well positioned to do this, but will require institutional support (especially recruiting and retaining diverse faculty), collaborative leadership (to build bridges with other UW strengths) and capital resources (i.e., infrastructure).

1. Do students, faculty and staff find the department a supportive and welcoming climate in which to pursue their degrees and careers as scholars, teachers, and administrators?

ans. As noted in the report, SOO undergraduate and graduate students develop a sense of community while enrolled in broader courses, but feel more isolated into their disciplinary track or within a specific research group later in their academic careers.

2. Are students, faculty and staff from groups that are underrepresented in higher education fully included in the intellectual life of the department?

ans. The committee notes the challenge faced by all academic units to fully include underrepresented groups, but we are impressed by the ground-up efforts to daylight structural problems and to propose solutions. Several senior faculty expressed enthusiasm about how the

changes in hiring practices and DEI awareness have resulted in recruitment of a more diverse faculty including persons of color among the most recent faculty hires. There is clearly more work to do, and this should be a priority of the next Director with strong support from the College and University leadership.

3. To what extent do the unit's current facilities and building space meet their needs?

ans. As detailed in our report, a great deal of facilities and building space occupied by the School of Oceanography are barely adequate to serve critical education and research missions. The committee questions whether UW can maintain its global leadership in oceanography without substantial investment in infrastructure that enables collaborative interdisciplinary scholarship and allows the globally important programs including the University-National Oceanographic Laboratory System (UNOLS) vessels, the Ocean Observatories Initiative Cabled Array, and the Argo Laboratory) to thrive.

4. To what extent is the unit preparing students at all levels for careers and future academic pursuits?

Overall the sense of the committee is that students graduating with B.S. degrees from SOO are well trained in the fundamentals of oceanography. Providing authentic shipboard research experience to all undergraduate students is an extremely valuable aspect of UW's program, and the committee commends SOO's commitment to maintain the required resources. A concern expressed during our meetings with students is the potential mismatch between undergraduate training and expectations of the SOO graduate program.

Graduates from the SOO doctoral program are highly sought out for positions in leading academic departments and government research groups. Many SOO graduates play senior leadership roles across the global oceanography community.

Committee Response to School of Oceanography (SOO) Questions

1. How do we maintain a robust research and teaching program in the face of budget cuts and declining faculty and graduate student populations?

ans. The committee agrees that the number of faculty has fallen to levels, especially in chemistry and biology, that impact the ability to offer a consistent and robust research and teaching program. We understand that efforts are underway to reinvigorate the use of WOT and Affiliate faculty positions, and these should continue. As detailed in the report, ironing out delivery of the undergraduate curriculum and expanding teaching laboratory space will allow more majors and larger classes and, therefore, more SOO funding through ABB.

The committee notes that the overall shift from graduate students to post docs and research technicians has allowed SOO to maintain a high level of research productivity, perhaps at the expense of a vibrant graduate student community. We encourage the faculty to carefully consider the 'right' mix of students (undergraduate and graduate), post-docs, and research technicians within their programs.

2. How can we improve our school structure, hiring practices, and graduate curriculum to maintain our disciplinary excellence, balance interdisciplinary expansion, and increase diversity across all communities within the SOO?

ans. In our report we detail our specific thoughts on how the already excellent SOO can evolve to lead the continual growth and evolution of global oceanographic science and technology. We encourage the SOO faculty, staff, and students to seize the present opportunity to collectively design and execute a 'mid-life retrofit' (to borrow from the ship ops world) for the School. You are in a great position to do this—plenty of experienced oceanographers with strong research programs at a time when a global community is increasingly looking for solutions to complex and critical environmental changes.

3. How do we deal with the reduction in usable buildings/space and the broad physical spread of our faculty over many buildings?

ans. As detailed in our report, the committee concludes that the UW Oceanography program is in danger of losing its global leadership and UW may squander a significant and distinctive asset without substantial investments in infrastructure. We recognize that this will require exceptional commitments from UW leadership, including sustained fund-raising efforts. Continuing to defer maintenance and capital planning will further degrade SOO morale and sense of community while increasing overall costs.