Summary of Process

The 10-year review of the School of Aquatic and Fishery Sciences (SAFS) began in February 2003. Prior to the site visit, members of the SAFS Review Committee received and reviewed the 2002 Self Study report, the 1996 review report, and the School of Fisheries (former name of SAFS) response to the 1996 review. Internal committee members also received a copy of the 2002 SAFS Grad Student review prior to site visit. Early internal committee meetings were held with the Associate Dean of the Graduate School, the Associate Provost for Academic Planning, the Dean of the Office of Undergraduate Education, the Dean of the College of Ocean and Fishery Science (COFS), the Director of SAFS, the SAFS administrator, and a small graduate student group. During the site visit held April 7-8 2003, the entire committee met with the Director and Associate Director of SAFS, small faculty groups sorted by interest areas, undergraduate students, graduate students, the SAFS administrator and other staff, science staff, the Recruitment, Admissions, and Scholarship Committee (RASC), assistant professors, and the curriculum committee. In our final meeting, our draft recommendations from the site visit were communicated to the Acting Provost, the Dean of COFS, the Dean of the Office of Undergraduate Education (OUE), and the Associate Dean of the Graduate School.[1] Subsequent to the site visit several emails were received by the chair of the review committee from faculty, staff and students who either could not attend the review sessions or had further thoughts; these emails were forwarded in their entirety to the review committee. In the weeks following the site visit, members of the committee drafted sections of the report, which were circulated to other committee members. The chair of the committee compiled the final report, which was reviewed and accepted by all committee members before submission to the Graduate School.

Executive Summary of Committee Findings

The School of Aquatic and Fishery Sciences (SAFS) has excellent and accessible faculty and staff, competitive and enthusiastic students, and a "small school" feel. The new building that houses SAFS is an excellent facility that supports the SAFS mission in a comfortable and professional setting. SAFS was described by one of the outside reviewers as the "brightest crown jewel in international fisheries and aquatic sciences." The changes that have occurred in SAFS over the last 10 years are remarkable and speak highly of SAFS's collaborative and collegial means of governance and administration.

The committee noted that problems identified in previous reports have been addressed. Specifically:

- PhD exam criteria have been clarified for graduate students; students now are concerned about the event (normal!) rather than an unevenly applied process.
- Morale and efficiency have increased; the school is "leaner but stronger". Optimism and collegiality have increased.

[1] In hindsight, it would have been valuable to have a meeting with research faculty as a group and perhaps outside industry/community members. Given the limited time available, this was not an option. Future site visits should be constructed around a 3 day timetable for sufficient discussion with all interest groups.

- Curricular reorganization and clarification has identified areas of strength. Research and teaching efforts now include newer fields [e.g. conservation and restoration] as well as traditional strengths [e.g. fisheries biology, stock assessment science, and aquaculture].

The review committee makes the following recommendations to the University of Washington, the College of Ocean and Fishery Sciences (COFS), and the SAFS (briefly outlined here and detailed in the report):

UW/COFS Administration

- **Commit funding for 1.0 FTE physiologist**. This position requires a senior faculty member (associate or full) to provide leadership for SAFS's 2 junior faculty members and to establish critical mass for the revised aquaculture program. This person will bring critically important expertise in organismal biology with broad application to many areas within SAFS and elsewhere on campus.
- **Commit funding for 0.5 FTE for Western Regional Aquaculture Center (WRAC) director**. The director must be a senior level scientist who can pursue outside funding and eventually make this position self-sustaining. This position will also help solidify the aquaculture program.
- **Return the Center for Quantitative Science (CQS) to an academic unit;** it has lost stature and visibility in the Office of Undergraduate Education (OUE); consider a co-director model between SAFS and the College of Forest Resources (CFR).

SAFS Administration

- **Develop a Marine Biology minor;** a minor would enhance, not drain, existing programs in the COFS. This effort should be integrated with Biology and other relevant units. The review committee heard no support from faculty, staff, or students for a marine biology major.
- **Reconfigure and require all three flagship courses**. Low enrollment in the aquaculture course deprives students both in organismal biology and in understanding how traditional aquaculture has expanded its relevance to include newer fields of research such as habitat restoration. Only two of the three flagship courses (FISH 312, 323, 324) are now required of undergraduate students. Expanding the requirement to three, with the option of not taking laboratory components in two of them, is one alternative. We recommend that SAFS institute this or a similar curricular change that will broaden the students'exposure to the diversity of disciplines in SAFS.
- **Stabilize support for Alaska Salmon program.** This program supports excellent science, has high visibility to the public and is strongly valued by both students and faculty. Creation of a board to explore funding opportunities and hire an externally-funded director might be an appropriate start. Furthermore, the UW and COFS needs to make a strong commitment to seek and secure funds for this important research and teaching resource.
- **Increase communications** with all staff, faculty and students; quarterly meetings followed by a social event to allow all of SAFS to interact professionally and socially.

- **Brainstorm creative ways to deal with isolation** of students and faculty housed outside the SAFS building.
- **Hold a retreat to develop a 10 year strategic plan** regarding new hires, programmatic direction, increased outreach opportunities. Previous strategic planning was perhaps more organizational planning and tactical actions; in other words, it focused on "what do we need to do now" as opposed to "who do we want to be in the future."
- **Increase outreach opportunities with greater UW campus, community members, and industry.**
- **Coordinate curriculum with other university units**, especially in the areas of conservation and restoration. Programs in CFR and Biology would be logical partners.

The Review Committee unanimously and enthusiastically recommends the continuance of the BS, MS, and PhD programs in the School of Aquatic and Fishery Sciences.

Detailed Committee Findings

Introduction

This panel was asked by the Graduate School at the University of Washington (UW) to conduct a review of programs administered through the School of Aquatic and Fisheries Sciences (SAFS). Members of the panel included 3 UW faculty; Linda Scott-Chalker (Environmental Horticulture) who served as Chair, John Ferguson (Civil Engineering) and Merrill Hille (Biology) plus external reviewers Edward Houde (University of Maryland) and James Kitchell (University of Wisconsin). Our evaluation is based on two primary sets of documents: those provided as Review Committee Materials assembled by the Graduate School and those presented as the December 2002 Self-Study Report prepared by SAFS. During 7-8 April, 2003, we conducted interviews of SAFS faculty, undergraduate and graduate students, plus administrative staff. Additional materials were provided during and following the interview process.

Our clear consensus is that the SAFS has recovered from some difficult times and is now engaged in a vigorous program of teaching, research and service. SAFS is justifiably regarded as the most prominent institution of its kind in the country. The undergraduate program is strong and held in high regard by an enthusiastic, growing group of students. The graduate program continues to be among the very best and includes an exceptionally high rate of professional placement. Faculty research programs are very productive and of international acclaim. Faculty service is substantial, diverse and important at local, regional, national and international scales. Administrative support is operating at a high level of efficiency and effectiveness. In sum, SAFS is a very strong unit and richly deserving of future investment by the UW administration.

Review of individual program components are detailed in the following pages.

Marine Fisheries at UW

The University of Washington enjoys a global reputation as a premier institution of education and research in the marine fisheries sciences. From its inception as the College of Fisheries in 1919 until the present, the potential to obtain a quality education with emphasis on marine fisheries at the undergraduate and graduate levels has singled out the UW among peer institutions. Its research programs, initially focused heavily on salmons and halibut, and responsive to technical and fundamental needs of fishing industries, has expanded and broadened in recent years to include a wide range of organisms (fish and shellfish) and strong emphasis on ecological, environmental, and conservation issues. Interests of the faculty in climate change and ocean regime shifts in recent years have fostered development of a strong and highly visible area of research in marine fisheries oceanography that is a strength in SAFS. Research programs conducted jointly with government agencies (e.g., National Oceanic and Atmospheric Administration/National Marine Fisheries Service [NOAA/NMFS]) in the Northwest Pacific are strong contributors to a new understanding of marine ecosystems and fundamental knowledge to undertake multi-species and ecosystem-based fisheries management.

Many leading fishery scientists have contributed to and built the reputation of UW, beginning with W. F. Thompson's tenure as head of the Department and later the School of Fisheries in the 1930's. The strengths that continue to the present in stock assessment research and modeling, and an emphasis on the quantitative nature of marine fisheries science, were instilled early in the UW history. It is this reputation and legacy that best describe the school in the eyes of prospective students and its peer institutions. Not only has UW been home to leaders in the field of quantitative fisheries science (e.g., Thompson, Paulik, W. Chapman, D. Chapman), but it has had the 'critical mass' in numbers of such expert faculty to offer diversity of expertise within the discipline. From the 1960's through the 1980's, UW was viewed by many peers as the 'training ground' for PhDs in marine fisheries. It was a particularly attractive institution for degree-seeking government scientists (e.g., NMFS) who sought quantitative training in fisheries that could be applied to expanding stock assessment demands. Armed with graduate degrees, many of these UW alumni returned to their agencies (in the USA and internationally) to become leaders, rising to the top in many instances.

The Review Committee notes that SAFS maintains traditional strengths in marine fisheries, while having diversified its capabilities with recent faculty hires. Recent additions have bolstered capabilities in stock assessment science (e.g., Punt) or in hydroacoustics assessments and applications (e.g., Horne), while others have disciplinary expertise that expands SAFS potentials and complement the historically prominent sub-disciplines (e.g., Hauser, Parrish, even Naish, and probably Essington). Diversification in marine fisheries disciplinary strengths represents a healthy trend in SAFS. It is responsive to teaching needs and research emphases that now include conservation, ecology, genetics, molecular, and ecosystem science. Close linkages between SAFS faculty and NOAA/NMFS scientists in the areas of stock assessment and multi-species/ecosystem-based fisheries science also are effective in promoting the UW and in educating a new wave of students for the agency.

Nationwide and globally, there is a strong and increasing demand for marine fisheries scientists with expertise in stock assessment modeling and quantitative evaluation of fish populations. The National Research Council[2] discussed the great need for such experts, especially in fisheries management agencies, and the notable lack of institutions and faculty to develop and train students. The UW, and SAFS faculty, is one of a few institutions with the capability to contribute substantively to fill this gap in marine fisheries science. SAFS should strive to maintain its excellence and prominence in stock assessment science, even while diversifying and expanding its role within the broader realm of aquatic sciences.

The Alaska Salmon Program

Established more that 50 years ago, the Alaska Salmon Program flourished for decades and has developed a series of long-term data sets rivaled by few in the world of aquatic ecology, salmon management and fisheries research. Based in southwestern Alaska, research stations in support of UW programs have included a substantial financial contribution from a consortium of salmon-based industries, a sustained commitment of collaboration with the Alaska Department

[2] NRC. 2001. Recruiting fishery scientists: workshop on stock assessment and social science careers. National Research Council, Ocean Studies Board. National Academy Press, Washington, D.C

of Fish and Game, and support from several federal agencies. Major economic and ecological forces now challenge the future of this important program.

Climate and ecological change in the North Pacific Ocean, expressed as oceanic regime shifts, caused major reductions in recent salmon runs. Those coincide with a diminishing commercial value of wild salmon products owing to the globalization of salmon aquaculture. The ecological responses are uniquely documented in the long-term records of the UW program and represent a critical source of information for salmon management in Alaska and the Pacific Northwest. A long and well-recognized program of graduate training has accompanied the extensive scientific accomplishments of this program. The field sites have also been used by a host of international scientists for pursuing basic scientific questions in ecosystems that are still relatively pristine.

Of greater immediate significance are the current economic constraints on the Alaska salmon industry. The program is now maintained by a bare-bones support (approximately 20% of former funding) from the salmon industry coupled with newly-established NSF-sponsored programs that improved the field station facilities and support new research ventures. In addition, a summer course for undergraduates has been developed as a recent addition to the UW curriculum. Both of those owe to productive collaboration between SAFS faculty (Hilborn and Quinn) and Biology faculty (Schindler). In other words, the UW's Alaska Salmon Program has grown from a single focus on salmon research to a vital, multi-dimensional effort that blends interdisciplinary research, graduate training and undergraduate instruction.

As in the past, Alaska salmon resources and revenues eventually will recover. Unfortunately, the UW program is at risk in the interim. While extramural research funding can provide periodic and focused aid, the viability of the undergraduate course and the graduate program need support in the form of sustained commitment from UW. The research accomplishments and teaching opportunities provided by this program are unique to the UW. No other university has a comparable program. **Stable, long-term support of the infrastructure and staff are needed to maintain the integrity of this program and continue its vital role as a productive vehicle for education and research**.

The Center for Quantitative Science

The Center for Quantitative Science in Forestry, Fisheries, and Wildlife (CQS) was established in 1968 and was jointly administered by the Colleges of Fisheries and Forest Resources (CFR). In 1996, CQS became an element of the Office of Undergraduate Education (OUE). In its early years, under the direction of D. Chapman, CQS was a notable strength, which enhanced the national and international reputation of fisheries science at UW. There has been a clear evolution and expansion of interests in fisheries and aquatic sciences during the past 20 years at UW, but the broad need for rigorous training in quantitative methods and applied mathematics for SAFS students has expanded as well. The CQS remains an important resource for SAFS that should be nurtured and promoted.

The Review Committee did not examine the history of circumstances that led to CQS being transferred into OUE, but comments from faculty and students indicated that it is advisable to re-establish a departmental affiliation for CQS. This will insure its future viability and promote

excellence in quantitative education that has been a hallmark of fisheries and allied sciences at UW. Many SAFS faculty (and students) indicated the QSCI 200-300 level courses are more focused on application to life sciences than similar classes in math and statistics. As such, QSCI courses are absolutely essential for students in biological disciplines to prepare them for professional employment in natural resource science and resource management.

We recommend that UW explore the potential to re-establish an academic home for CQS, possibly within SAFS or jointly with other departmental units (notably CFR). Several SAFS faculty already teach QS courses, or jointly offer FISH courses listed with CQS. Placing CQS within SAFS would offer incentive for faculty involvement, not only in teaching, but also in development and administration of CQS. An affiliation of CQS with SAFS may be especially important to promote excellence in the QS 200-300-level courses in which undergraduate students are introduced to quantitative principles and methods in mathematics and statistics. Re-instituting CQS within the invigorated SAFS also will benefit CQS, which may be languishing in its present affiliation in OUE. We believe that an affiliation of CQS with SAFS will highlight the considerable reputation in quantitative science that SAFS already holds.

The Freshwater Program

Formerly known as the School of Fisheries and best known for its work in marine systems, SAFS emerged from reorganization with a stronger emphasis on diversity in its research and teaching programs. Accordingly, the role of freshwater science grew as one important hallmark of change. Although faculty had never been limited to a focus on marine or freshwater environments, growth in the emphasis on streams, rivers and lakes expresses recognition that an ecosystem and landscape perspective is more appropriate to the holistic view essential to understanding and managing aquatic resources. Faculty associated with this group emphasized that it is "now stronger than ever before" and poised to continue a growth trajectory important to the future of SAFS. Perceived needs and opportunities include a greater support to outreach activities as a logical interface with growing public interests in water quality and riparian (water's edge) issues.

This program has high public visibility. Seattle and the region will continue to look to UW for leadership in developing programs focused on its lakes and rivers. The faculty (Wissmar, Naiman, Beauchamp, and Quinn) participating in these efforts are both interested and effective in presenting the importance of SAFS projects as an expression of UW's commitment to outreach and relevance in ongoing research efforts.

Two of the four faculty in this group are relatively senior**. Replacement commitments may be essential to sustain this group.** In addition, support of collaboration between SAFS faculty and those in Biology (e.g., Daniel Schindler) and/or Forestry can maintain and enhance a strong, growing and highly visible program of teaching and research.

Physiology in SAFS

Across the UW campus, and indeed throughout academia in the US, there is a disturbing trend to eliminate courses that focus on the whole organism. As faculty members retire, courses and expertise in areas such as taxonomy, morphology, and physiology are not being replaced. Instead, resources are diverted to more reductionist fields (e.g. molecular biology and genetics) or holistic studies (e.g. ecology and GIS). The dearth of courses devoted to the study whole organisms on the UW campus should serve as a wake-up call to life science departments and to upper administration: we are producing students whose view of the world is shaped by *Arabidopsis* and *Drosophila* and have little understanding of how organisms function in their environment.

With this warning, **the review committee strongly recommends appointment of a fish physiologist in the SAFS**. This should be a senior person (i.e. not at the assistant level) who can broadly apply his/her training to all areas within aquatic and fisheries science and will serve as the administrative cornerstone for the revitalized aquaculture program. In addition to filling an obvious hole within the SAFS faculty expertise, a physiologist will undoubtedly attract biology students into his/her courses given the paucity of physiology courses offered in that department. This person will relieve the administrative burden from the two new assistant professors in the aquaculture program and possibly could expand the outreach capabilities of this highly public field of study. With increased visibility for the aquaculture program, SAFS may successfully find increased public support (i.e. dollars) for the hatchery.

The Graduate Program

Problems in the graduate program had been identified in both the 1991 and 1996 reviews of SAFS, so it was gratifying to find that issues had been addressed successfully and that the graduate student experience is viewed positively by both faculty and students. Major changes in graduate student admissions, the curriculum and the general exam are noted in the Self-Study Report and were described by the faculty. In turn the graduate students are highly qualified, well satisfied with their graduate experience, notably with the quality of the faculty and their accessibility, and seem to have a high degree of camaraderie. They are a diverse group, representing several different countries, who have enjoyed integrating education with research and have shown leadership in curricular development.

Our interview findings closely match the information collected by the UW Graduate School.[3] Though not significantly different, SAFS PhD graduate satisfaction ratings are higher than COFS in most areas. 100% of the PhD's publish papers, which is significantly greater than UW average. All those employed received their first choice; many graduates find employment in Washington (more than twice the overall UW percentage), insuring that retention of aquatic and fisheries sciences expertise remains in state. The % satisfaction among PhDs is much higher than 10 years ago; this is mirrored in MS student satisfaction as well. SAFS is producing highly employable, publishing scientists who are more satisfied with their education than 10 years ago, when SAFS consistently rated lower than the COFS average in all areas.

[3] SAFS Self Study Dec. 2002 Appendix A2

In response to issues identified in the 1996 review, the Ph.D. Qualifying and General Exam procedures have been modified, and the process is now clearly defined and described. The Qualifying Exam format involves answering six open book questions over a period of a week. The exam is described as an intense learning experience, exhausting and rewarding. Student services to graduate students were also identified in 1996 as not being equal to those offered undergraduates. Reorganization of student services into one office serving all students has resulted in a high level of satisfaction among graduate (and undergraduate) students with staff support.

Graduate admissions are now managed by a faculty committee that ranks qualified applicants into Tier 1 and Tier 2 groups for a single admissions cycle each year. Currently this Recruitment, Admissions, and Scholarship Committee (RASC) is chaired by the associate director of SAFS and has faculty representation from all program groups. (Though this broad representation was not deliberate, it would be a good policy to ensure equal participation in future). All accepted students are offered 2-year support from SAFS endowments, graduate research assistantships, agency support and outside fellowships. The students in the program often described SAFS as their first, best or only choice for graduate work. Several cited the strength of quantitative approaches to resource management at SAFS, while others spoke of the unique opportunities afforded by the Alaska Salmon Program and others described the opportunities to work in labs of agencies with their research scientists. Graduate students were unanimous in their support for and appreciation of the required funding packages, as it decreases their competition with each other and increases collegiality and stability.

Graduate students were asked about their TA experience. The responses generally indicated that teaching assistant assignments were available if and when the graduate students wanted them, that TA support was sometimes used to bridge funding gaps when research support wasn't available, and that TA experience was generally a valuable part of their graduate studies. There was a mixed response to the question on whether TA experience should be required; while faculty felt it was very important for PhD students to have this experience, it has variable importance among graduate students, though most seemed to feel that PhD students needed teaching experience. Given the generally recognized importance of the TA experience, **we recommend that SAFS consider increasing TA support for CQS/QSCI courses, a crucial need noted by both undergraduate and graduate students**.

A few concerns were mentioned by students that should be addressed:

- Two of the five 2-hour current topics courses (510-514) are required for MS students, but the courses aren't scheduled sufficiently in advance for students to make informed decisions about which ones to take. **The SAFS needs to organize these courses, determining topics, instructors and time schedules at least a year in advance**.
- There is a perception among graduate students that some faculty avoid teaching, leading to disparate teaching loads and narrower curricular choices. Teaching load discrepancies should be minimized by the SAFS administration. **The review committee agrees with the SAFS administration that all state-line faculty members should carry a yearly teaching load of one large (>30), one medium (15-30), and one small course (<20)**.[4]

[4] Numerical ranges supplied by David Armstrong, Director, SAFS

- Graduate students want a broad-based education (more marketable), integrating science with policy, economics, and other disciplines. Though the students are unsure how to get this broader education, the review committee suggests consideration of **required competency areas rather than specific classes.** This broad-based education would also be enhanced by increased interaction with other programs, including Biology, CFR, Evans School of Public Affairs, PoE, etc.
- In the past, statistical consulting for graduate student research projects was offered, supported by one or more TA positions. This consulting apparently has been used by most graduate students and would be again, if the service were restored (see recommendation in previous paragraph).

The Undergraduate Program

The undergraduate program in the School of Fisheries and Aquatic Sciences has been under revision since 1992. There are four distinct curricular areas – marine biology/ecology, freshwater ecology, conservation and management, aquaculture – with which the students closely identify. Currently there are 102 majors (5 freshman, 12 sophomores, 37 juniors, 41 seniors, and 7 fifth year students). The major structural changes include the development and showcasing of the Flagship Courses and the Capstone Experiences. The review committee was very impressed by the program structure and relevance, the quality and diversity of undergraduates, and the admirable staff advising and program coordination.

SAFS students*:* Undergraduate SAFS students are remarkably professional in their approach to their degrees and have great enthusiasm for their educational programs. Students feel that the faculty and advising staff are accessible and supportive. Both honors students, as well as students who could not find a home or an academic interest in other majors, have become enthusiastic students in this program. The undergraduate program, through Lin Murdock, has worked hard to achieve and maintain diversity. Appropriately, two Native Americans will be graduating this year.

Flagship Courses: The undergraduate curriculum includes three "flagship" courses (FISH 312 [the ecology course], 323 [the conservation and management course] and 324 [the aquaculture course]) in the major program areas of SAFS. One course is required, although many students take two or three. Formerly, all courses were required. During the course of the interviews, the status of these classes was discussed several times. Specifically, relatively low enrollment in one of the courses was seen as a problem in recruiting students to that program area. The advantage of again requiring all three courses was identified as developing breadth of exposure to the range of SAFS program areas—a breadth that some students may need more than they realize. The main disadvantage is the reduction in electives and the reduction in a student's ability to focus as strongly with their elective courses as they might like. There were several opinions expressed and one option that we believe should be considered. All three courses are comprised of a two-credit lab and a three-credit lecture. **We recommend that SAFS consider requiring one course with lab for 5 credits and either encouraging or requiring registration in the other two courses without the lab for 3 credits each**.

***Capstone Experience**:* The gem of the undergraduate program is the capstone experience, which is required for all undergraduates. Students enter their capstone experience prepared by coursework in critical thinking, quantitative sciences, scientific literacy, field skills, scientific methodology, and oral and written communications. The undergraduate students eagerly look forward to doing an independent project under the guidance of a faculty member or in an off-campus internship, such as the National Marine Fisheries and the Friday Harbor Laboratories. Six students have the exceptional experience of entering the Alaska Salmon Program. All students are required to give an oral presentation and write a scientific paper as the culmination of their capstone experience. Faculty report that these projects have increased in quality in the past ten years.

One question raised was whether some proportion of the endowment fund could be set aside for these capstone experiences. While most of the endowment fund should, and does, go to graduate students, undergraduates only receive 3-4% of the total endowment. Since undergraduates tend to create smaller projects, **increased financing of undergraduate research (perhaps 10-20% of the total endowment) would certainly enhance the capstone program and benefit faculty who are willing to advise the students**.

Marine Biology Minor: The marine biology courses offered by the SAFS are attracting consider numbers of interdepartmental students. We were asked to comment on the possibility of having a Marine Biology Major in this school or any of the Schools on campus. Our response after looking at the existing undergraduate program and from our knowledge of marine biology expertise campus-wide is that any marine biology courses and programs should remain interdisciplinary. In addition, due to the breadth and depth of the current undergraduate program in the SAFS, we feel that a marine biology major would be too narrow in scope and not offer appropriate training for the current job market. It would also not be significantly different from other degrees and would probably drain majors from other areas within COFS. However, given the success SAFS has shown with its Honors Program in Marine Biology, **we recommend that the SAFS develop a Marine Biology Minor in conjunction with other relevant UW departments (such as Biology)**.

Further Curricular Development and Programmatic Needs

- There is an alarming paucity of physiology courses in COFS and UW in general. Recent emphasis has been on tools courses (molecular, genetic, etc.) at the expense of fundamentals. **There is a critical need for a physiologist and increased physiology courses in SAFS**.
- In addition to the need for physiology, faculty and students specifically would like to see new courses in marine mammal ecology, marine bird ecology, aquatic entomology, aquatic/marine invertebrate biology, and managed freshwater systems.
- **SAFS should actively seek interdisciplinary coordination with other relevant units on campus for delivering broad-based education and marketable skills**. In particular, there should be more formalized coordination between the restoration curriculum and other university programs, especially the 3 campus Restoration Ecology Network (REN). Additional marriages among science, policy, and law should be considered.
- It was suggested that FISH 210 should be retooled to become more of an overview of all three focus areas (ecology, conservation, and aquaculture) as well as increasing the four

skill sets (writing, data analysis, oral presentation and field skills). This redesigned course would also appeal to premajors and non-majors.

- **Ensure TA support for flagship courses** (this was an area of concern especially among younger faculty) and consider additional support for those faculty who carry high supervisory loads.
- **Maintain current flexibility in the undergraduate core by permitting BIOL 101-102 sequence**; this allows transfer students (a large segment of the SAFS student population) to enter the program without penalty.
- Students have requested a reduction in overlap among required classes, and a more equal distribution of courses throughout the day;
- Students expressed a desire for upgraded computers (it was pointed out by the review committee that student groups could apply for computer upgrades paid through the technology fee). The review committee encourages students to pursue this avenue of funding for computer resources.
- Students have requested copy-card abilities for a SAFS Xerox machine.

Outreach Activities

Many of the faculty and staff mentioned their interest in increasing outreach activities, a refreshing viewpoint given the de-emphasis liberal arts universities normally place on this activity. Increased outreach will not only allow faculty and staff to convey new information to industry and the public (much like extension agents in land-grant universities), but will also improve the visibility of the program to external constituencies who may be interested in financially supporting some of the high cost programs in SAFS, a viewpoint shared by the SAFS administrator.

Some programs and facilities within SAFS already attract significant public interest and could be vehicles for increased outreach opportunities; examples would include the hatchery and the Alaska Salmon program. Indeed, a story in UW *Columns* attracted several undergraduate students to the SAFS program. Public schools, environmentalists, private fishing groups, and industrial fishing have interests in the issues studied in this school. Coordination with the Alumni Association's Science Forum or with CFR's Outreach program might increase outreach opportunities. **We recommend that outreach service be encouraged and appropriately recognized by the SAFS, COFS, and UW**.

Research Scientists

The department had done an excellent job in incorporating their research faculty in their teaching program by offering them two months' salary for teaching. The research faculty are extremely valuable assets and their involvement and interest in the teaching program should be encouraged and maintained. One question raised was why salary compensation was set at two months rather then the three months required to teach a course. Apparently, Oceanography provides their WOT faculty three months' salary per year. **We recommend that the SAFS and COFS apply a uniform compensation policy to WOT faculty**.

Another issue raised was by research scientists who supervise graduate students and obtain grants that support them, yet are not members of the graduate faculty and thus cannot officially serve as mentors. **We recommend that the policy of appointing such advisors to appropriate positions be reviewed**. There were expressions by some research scientists and faculty that they felt like second class citizens. Although they all agree that the situation is much better than 10 years ago, they believe that eliminating the class differences between research and teaching faculty will yield additional improvements in the school.

SAFS Communications

Though SAFS communications were reported by all constituent groups to be good, many thought they still could be improved. While key faculty, staff and students are well informed, many respondents requested more all-inclusive communications. **The review committee recommends quarterly all-SAFS meetings** rather than only when there are "emergencies." Increasing face-time through all-SAFS events – seminars, social get-togethers – would also reduce anxieties. Such regular meetings and events would also help overcome feelings of isolation mentioned primarily by students but also by some faculty.

Concluding Comments

The Review Committee thoroughly enjoyed this effort; it was exciting and professionally satisfying to see an academic unit so completely transform itself in a relatively short time. Compared to 10 years ago, the School of Aquatic and Fisheries Sciences (SAFS) has fewer UW supported staff and is down by 10 faculty lines, but is a more cohesive, coherent, and unified faculty. One faculty member stated that the "progress made on every front has been exceptional." Eliminating the divisional structure is recognized as key for improving the climate within the school, and the SAFS should be recognized for its successful reorganization. The committee understands that reorganization continues to evolve in SAFS, with perhaps 75% of the effort completed at this time.

Though laboratory and field courses will always limit the number of majors possible in SAFS, the faculty compensate for this by boosting student credit hours (SCHs) through participation in Biology and Quantitative Science (QSCI) courses. This is reflected in the data which show small undergrad numbers compared to peer institutions, but more SCHs generated per faculty member.[5] Other notable comparisons occur in the graduate program, where a smaller faculty mentors a larger number of graduate students, finishes them in a reasonable amount of time, and supports nearly all of them through RAs or TAs[6].

One of the ongoing challenges for the college will be increasing diversity within the faculty; even with the most recent hires there are only 4 women in a faculty of 27 and presently no minorities. Given the high proportion of female undergraduate and graduate students and growing minority population, SAFS should continue to recruit highly qualified women and minority faculty. Fortunately, it appears that women faculty (perhaps new faculty in general) are treated well and not overloaded with committee work. With new hires, the outreach, teaching, and administrative loads experienced by the two assistant professors should be somewhat relieved. Mentoring of new faculty should be a primary goal of **all** SAFS faculty.

The vision statement of SAFS[7] recognizes the importance of aquaculture and public education, while the mission statement[8] specifies collaboration with other units and strengthening aquatic organismal biology as desirable goals. Furthermore, in the words of one faculty member, "good, healthy and productive visions may incorporate ideas from other disciplines (anthropology, policy, history, art)." The committee believes that the vision and mission of SAFS can continue to be realized through acceptance and implementation of our recommendations by the SAFS, the College of Ocean and Fishery Sciences (COFS), and the UW:

[5] SAFS Self Study Dec. 2002: Appendix I2
[6] SAFS Self Study Dec. 2002: Appendix I2
[7] SAFS Self Study Dec. 2002: Appendix F
[8] SAFS Self Study Dec. 2002: Appendix F

UW/COFS Administration

- **Commit funding for 1.0 FTE physiologist**. This position requires a senior faculty member (associate or full) to provide leadership for SAFS's two junior faculty members in the aquaculture disciplines and to establish critical mass for the revised aquaculture program. This person will bring critically important expertise in organismal biology with broad application to many areas within SAFS and elsewhere on campus. Furthermore, leadership in the transformation of the aquaculture program from its historical production focus to restoration and conservation will decrease the stress on the new faculty who are expected to redevelop the program. This person could also help develop a community college aquaculture program for fish production, which could serve as a feeder institution for future transfer students.
- **Commit funding for 0.5 FTE for Western Regional Aquaculture Center (WRAC) director**. The director must be a senior level scientist who can pursue outside funding and eventually make this position self-sustaining. This person would pursue outside (industry) endowment to reduce UWs costs and would help solidify the aquaculture program as well. Research area needs to be in basic science and could be a biochemist/nutritionist, given that the new chemistry curriculum no longer includes biochemistry.
- **Return the Center for Quantitative Science (CQS) to an academic unit; it has lost stature and visibility in the Office of Undergraduate Education (OUE); consider a co-director model between SAFS and the College of Forest Resources (CFR)**. While 400 level courses are well supported, many of the 200-300 level courses do not have faculty to teach them any longer. These courses are more focused on application to biological sciences than similar classes in math and statistics and are preferred by students. Several faculty in CFR have experience in quantitative science and might be part of a new teaching contingent for CQS. A possible solution might be co-directors of CQS through SAFS and CFR, with two months' summer salary. TA's associated with QSCI are recommended and could also hold help sessions for undergraduate and graduate students who expressed this need.

SAFS Administration

- **Develop a Marine Biology minor;** a minor would enhance, not drain, existing programs in the COFS. The existing marine biology course is a good SCH generator and obviously popular among a diverse student population. The review committee heard no support from faculty, staff, or students for a marine biology major, and it was suggested that little demand for such majors exists among employers. This effort should be integrated with Biology and other relevant units.
- **Reconfigure and require all three flagship courses**. Low enrollment in the aquaculture course deprives students both in organismal biology and in understanding how traditional aquaculture has expanded its relevance to include newer fields of research such as habitat restoration. Only two of the three flagship courses (FISH 312, 323, 324) are now required of graduate students. Expanding the requirement to three, with the option of not taking laboratory components in two of them, is recommended; this increases the opportunity to experience diversity in a flexible manner. Furthermore, enrollments in all

three lecture sections will probably increase as a result of non-major interest in a 3 hour NW course. TA support for these 3 laboratory courses is critical.

- **Stabilize support for Alaska Salmon program.** This program supports excellent science, has high visibility to the public and is strongly valued by both students and faculty. Like most field stations, there is a critical need to support the basic infrastructure (cabins, docks, boats, etc.) and operations. While historical support has come from the commercial fishing industry, the industry itself is in dire financial straits. Program funding needs to be redirected to non-industry sources; the creation of a board consisting of SAFS and the Alaska group to explore funding opportunities and hire an externally-funded director might be an appropriate start. Another expensive field resource – the hatchery – has recently been upgraded and is utilized by new faculty. The hatchery has a significant outreach potential and enjoys enthusiastic support of the faculty. In contrast, the committee did not hear much about Big Beef Creek; perhaps the costs and benefits of this field resource should be analyzed.
- **Increase communications** with all staff, faculty and students; quarterly meetings followed by a social event to allow all of SAFS to interact professionally and socially.
- **Brainstorm creative ways to deal with isolation** of students and faculty housed outside the SAFS building.
- **Hold a retreat to develop a 10 year strategic plan** regarding new hires, programmatic direction, increased outreach opportunities. Previous strategic planning was perhaps more organizational planning and tactical actions; in other words, it focused on "what do we need to do now" as opposed to "who do we want to be in the future."
- **Increase outreach opportunities with greater UW campus, community members, and industry.**
- **Coordinate curriculum with other university units**, especially in the areas of conservation and restoration. Programs in CFR and Biology would be logical partners.

The Review Committee unanimously and enthusiastically recommends the continuance of the BS, MS, and PhD programs in the School of Aquatic and Fishery Sciences. We fully expect to see SAFS continue to flourish given the continued shared leadership of administration, faculty, staff, and students, and the necessary support and resources from the COFS and UW.