

PROGRAM REVIEW

BS in Fish Health

2016 – 2017

1. Contribution to the LSSU Mission/Vision - A narrative introduction to the overall School, its programs and history. Review the evidence supporting the essentiality of this program to the institution, and the importance of the program with respect to achieving the LSSU Mission and/or strategic plan/goals.
 - a. Narrative relating program goals to advancing LSSU's vision, mission and strategic goals, describe how the program complies with Assumed Practice A.7.a.

The Bachelor of Science degree in Fish Health was first offered in academic year 2008-2009. The idea for the degree emerged when the Michigan Department of Natural Resources (MDNR) approached LSSU about establishing a Fish Disease Lab at LSSU. Their rationale was that LSSU was in a unique geographic position between the Fish Disease Lab at Michigan State University and the eastern extent of the Upper Peninsula. We had been doing thiaminase testing related to Early Mortality Syndrome in Atlantic salmon, and it was noted that 11 recent senior thesis projects had focused on various aspects of fish health. During discussion at the annual meeting between the Michigan DNR and LSSU's Aquatic Research Lab (ARL), concern was voiced about the increase in fish disease and the lack of any training programs to provide skilled fish health personnel in the Great Lakes region. We determined we had the expertise to offer a BS Fish Health curriculum as a hybrid between two existing programs, the Fisheries concentration of the BS in Fisheries and Wildlife Management and the BS in Clinical Laboratory Science (now Medical Laboratory Science). The academic requirements for certification as a Fish Pathologist through the American Fisheries Society (AFS) were used as a guideline for developing the curriculum. (There currently are less than 30 certified fish pathologists in the whole of the US). Only three new classes needed to be created to allow our graduates to meet certification requirements. The fish health curriculum is a rigorous one, comparable to classes taken at a college of veterinary medicine. In addition, the program has a focus on practical, applied, hands on learning, that prepares students for employment in the fisheries agencies and in aquaculture. At the time of its inception, our degree was the only undergraduate fish health degree in the world, outside of China. There are a few US graduate programs in fish health, and aquatic animal health, but to our knowledge we are unique in offering these skills at the undergraduate level.

- b. Program can demonstrate a direct link to advancing LSSU's vision, mission and strategic goals.

The Fish Health program embodies the mission and vision of the University. Faculty are dedicated to ensuring that each of our students leaves fully prepared to become a contributing member of their profession and of society as a whole. Our graduates are highly marketable and employed by the aquaculture industry that values biologists with a fish health mind set. For example, Jason Sauve was hired by Stoney Creek Fisheries & Equipment Inc. in Grant Mi; Lucas Bradburn was hired at Indian Brook Trout Farm in Jackson Mi.

The foundation of the Fish Health program is hands-on, applied course work, which capitalizes on our location. Students are able to take part in disease testing through the ARL Fish Disease lab, and gain real world experience with diseases of concern to the state agencies.

The proposed Center for Freshwater Research and Education will incorporate a Fish Disease Laboratory, and our future students will have a state of the art facility to acquire techniques for addressing fish disease in the wild and in aquaculture settings.

- c. Program is unique in state or region, evidence of two or more significant distinguishing factors identified

To our knowledge, LSSU has the only undergraduate Fish Health program in the United States, and possibly in the world outside China. China has recently established several Fish Health degrees to complement their rapid growth in aquaculture. We currently have a signed agreement with the Shanghai Ocean University to help them develop their Fish Health degree program. Further collaborations with other institutions for undergraduate exchange with LSSU on the Fish Health program are under discussion. Our Fish Health curriculum includes the Biology core curriculum, including the freshman through senior seminar series. All graduates are required to complete a senior thesis research project focused on fish disease diagnosis. A chemistry minor is also embedded, as well as all courses needed to satisfy the academic requirements for certification as an AFS Fish Pathologist. With addition of a year of physics, this curriculum meets the Michigan State University pre-vet requirements

2. Productivity - An analysis and presentation of relevant metrics including, but not limited to, credit hours taught (majors, general education, other service courses), degrees granted, student retention, time-to-degree, number of majors, minors, enrollments (and various metrics per faculty FTE); student faculty ratio; faculty advising within and outside of program; ratio of credit hours offered to majors versus non-majors. Other indices may include operational expenditures compared to comparable institutions; unit efficiency; investment in facilities and equipment; potential economies of scale, proportion of administrative to total costs; self-sustaining and revenue generating activity.
- a. Narrative provides analysis of metrics that support program continuation, enhancement of institutional support or changes in staffing.

Enrollment in the degree program has been low, but steady with an average of 4.33 students between Fall 2010 and 2015. Direction of the program is handled by a single faculty member. Fish Health required courses are used by students enrolled in various programs (see Appendix B). Although enrollment is low, this is a cost effective degree, as the classes are attended by students in the biology, fisheries and wildlife management, and pre-professional programs. We also see that there is marketing value in the Fish Health degree, as several students have told us they became interested in LSSU after reading about the Fish Health option. They admitted they did not enroll in the Fish Health degree as they felt it was a highly rigorous course load, and they wanted to keep high grades for application to veterinary school.

- b. Analysis of metrics presented supports case for program growth and investment. Evidence of program quality at or above peers and like units at LSSU.

The Fish Health program is an area of potential growth for LSSU, but it is not a well known option, given it is the only undergraduate program of its kind in the United States. We have examined the options for attracting students from China, and so far we have had two exchange students enrolled in the Fish Health program; however, most prospective

Chinese students are looking for graduate programs. A limiting factor for attracting US students is the slow growth of the US aquaculture industry, which will require personnel skilled in fish health. Once this industry grows as projected, we envision high demand for fish health expertise.

- c. Program generates more revenue than expense.

Specific data regarding the revenue: expense ratio of the program has not been made available. However, the data previously presented suggests that the Fish Health program is extremely cost efficient. One faculty member is responsible for teaching the fish health courses in the program and has the primary responsibility for advising. Note that these classes are also taken by students in many other programs. This faculty member also oversees the fish disease lab and performs fish disease testing for the MDNR and tribal agencies.

- d. Program has favorable operating expense comparison with peers and comparable units at nationally recognized institutions.

To our knowledge, no other undergraduate fish health program exists in the US (see Appendix A). There are graduate programs in fish health at Auburn University and in fish disease at Kentucky State University with the rest of the training occurring at veterinary colleges as part of the AquaVet and Aquatic Animal Medicine programs. There are a number of aquaculture programs, but most do not have any classes in fish health or disease. Auburn University's undergraduate aquaculture degree has one class in fish health. Eastern Wyoming College offers a certificate program in aquaculture with one class in fish health. The only program with several courses related to fish health is an Associate Degree in Aquaculture at Hillsborough Community College. Given that we are able to offer this program as a hybrid undergraduate program where our peer programs are in graduate schools and veterinary colleges suggests we are able to offer this training at a significantly lower cost than at other institutions.

- e. Program offers courses unique to its majors and provides service courses in support of numerous other academic units.

Several of the courses unique to the Fish Health program in the past have become required or designated as electives in other programs. The three new classes (Virology, Histopathology and Ecology of Animal Disease, are well subscribed by students from all degrees in our department as Biology electives. We have added a class in Animal Nutrition to replace the nursing nutrition class in the originally proposed degree. This class is also required by several veterinary schools. We have also offered a special topics class in Microbial Ecology, which we plan to add to the Fish Health curriculum. This class will also be beneficial to the students from Fish & Wildlife Management, Conservation Biology and Environmental Health programs. Dr. Wright, chair of Physical Sciences has indicated plans to add Microbial Ecology to the Environmental Health and Environmental Science degree programs.

3. A narrative to analyze and summarize student interest, recruitment and placement in the context of both external and internal demand. *External Demand* - Present and anticipated future demand for this program as measured by market demand for graduates, economic/scientific/social; partnerships

with external stakeholders; the uniqueness of the program. *Internal Demand* – Provide evidence of student demand and the degree to which other units rely on this program for instruction or support.

- a. External Demand - Evidence must be cited from at least one of the following sources: U.S. Department of Labor, the National Association of Colleges and Employers or the Michigan Department of Labor, other sources may also be cited such as a professional society relevant to your program field. Review evidence of recent program graduate employment, and recent graduate program acceptance/ persistence/ completion data. Differentiate between options in consolidated programs to provide evidence for each option. Relate the program to the same or similar programs, within the state or region. Narrative provides multiple sources of evidence related to gainful employment in the field, demand for graduates in the field, student interest, and successful employment.

The growth potential for aquaculture is very high, and is touted as one of the fastest growing sectors of the food industry. As the US aquaculture industry grows, as observed in China, there will be an increased demand for the fish health expertise. Most aquaculture facilities will not require graduate trained personnel, and the needed expertise can be provided by the LSSU BS Fish Health degree.

Aquaculture is most commonly thought of as "fish farming" – the theory and practice of cultivating marine and freshwater algae and animals for food. According to the Food and Agriculture Organization of the United Nations, aquaculture continues to be one of the world's fastest growing industries, with an average growth rate of over 8% per year for the past ten years, as demand for aquatic food products continues to increase. The aquaculture industry will face many challenges over the next few years to be economically, socially and environmentally sustainable. The industry will require highly educated, trained and experienced staff to address successfully these key issues and to meet further anticipated future growth.

Fish Disease poses serious obstacles to long term sustainability of aquaculture (FAO, 1994). Infectious diseases caused by bacteria, viruses and parasites are a primary concern in aquaculture. Indeed, effective control of infectious diseases is one of the most critical elements in successful aquaculture (Bruce L. Nicholson, Professor of Biochemistry, Microbiology and Molecular Biology, the University of Maine). Disease may challenge the ability of fish farming to feed the growing human population even as wild fish stocks decline and climate change hampers food production from other sources. As a result, the need for aquaculture experts also continues to increase.

We now have a global perspective on the dynamics of infectious diseases in aquaculture, and disease may turn out to ultimately be the limiting constraint on growth of this industry. Disease monitoring and training must be improved. (Martin Krkosek, assistant ecology and evolutionary biology professor at the University of Toronto, Canada)

Although not growing to the same extent in the US as in Asia, there is considerable effort occurring in Michigan to promote the aquaculture industry. The rationale is echoed by Missouri entrepreneurs who are seeking opportunities in the aquaculture area for the follow reasons: Aquaculture is the fastest growing segment of the United States agricultural industry. Missouri is one of the leading aquaculture states in the Midwest. An increasing job market is developing in this area. Wild fisheries are declining and becoming contaminated while demand for aquaculture products are

increasing. Per capita consumption of seafood in the U.S. has risen to 16.3 lbs per person. Seafood demand is met currently by importing aquaculture products from other countries. The US seafood trade deficit is \$14 billion, third only to oil and natural gas.

The significant increase in demand for fish health expertise has been evidenced by the recent establishment of 5 Fish Health undergraduate programs in several universities in China. This is in direct response to the rapid growth of the aquaculture industry and emergence of fish diseases in that country. At least 3 additional programs are in the proposal stage. In the US there is limited access to fish health training. Current students at Veterinary Medicine Schools lack knowledge of fish biology. On the other hand students from Fisheries and Wildlife programs have very limited understanding about microbial pathogens and fish infectious diseases. Therefore, LSSU's BS Fish Health hybrid degree between fisheries science and veterinary medicine fits the future demand for fish health in fish farms and hatcheries and governmental fishery management. Our ability to provide this expertise at the undergraduate level is unique in the United States.

- b. Analysis and evidence provided that graduates of this program are successfully employed in their field of study or a related field, or successfully pursuing graduate study.

Although we have had few graduates, they are quickly employed by the aquaculture industry, typically before graduation, as in the above mentioned fish health students Jason Sauve and Lucas Bradburn. Fish health senior student Conner Workentine was also offered a position from the Indian Brook Trout Fish Farm after he completed a Sea Grant awarded 2016 summer internship with this company.

- c. Evidence provided of current trends indicates that demand for this program will remain strong into the foreseeable future. Analysis provides action plan to continue growth.

Over the last few years, as total LSSU enrollment has declined, the Fish Health program's enrollment has stayed steady. The key for growth then is to increase awareness of the Fish Health program among prospective students from the US and Canada to support the projected growth of aquaculture in these countries. Several universities from China (like Qingdao Agriculture University and Shanghai Ocean University) are seeking collaborations with our fish health program for undergraduate education, and we are actively pursuing these opportunities. State and Nationwide job projections for aquaculture indicate a steady increase in demand and the breadth of employment trajectories gives graduates wide variety in job offerings.

- d. Other evidence, e.g., this is the only program of its kind in the state, with growing demand from students. Evidence of program uniqueness provided.

As mentioned previously, the Fish Health program remains a unique program in the United States. The unique course offerings and laboratories provide hands-on experiences, which distinguish LSSU's program.

- e. Internal Demand – Include courses required by majors in other units, service courses, and general education offerings. Provide any additional information relevant to internal demand,

differentiate between any options. Narrative addresses overlap of the program with other degree programs, and delivery of service courses to make effective case for continuation.

As mentioned above, the Fish Health includes the Biology core curriculum, and the other classes are available to students in other programs as Biology electives. A chemistry minor is also embedded in the BS Fish Health degree.

- f. Evidence of enrollment in the program and demand for the program's courses is strong and/or growing. Enrollment is in the top 25% of all programs.

Fish Health is a small, but highly specialized program. We can sustain program growth with current staffing.

- g. Graduation requirements needed by other units are offered by this program, courses are not duplicated by other units. Analysis presents case for major in addition to service courses.

As stated above (3e), the close affiliation in programs and coursework of the Fish Health program encourages use of program-specific courses by other majors. Outside of the affiliated programs, no other unit within the University offers courses in any way similar to those required for the Fish Health degree.

- h. Program is as large as or larger than peer programs at other regional institutions, program is current and relevant.

The lack of comparable programs precludes the collection of data regarding enrollment of regional peers.

The faculty responsible for the Fish Health program keep abreast of professional and educational trends by actively participating in professional organizations and activities. These professional interactions inform our deliberations with respect to curricular and pedagogical changes.

- i. Evidence provided that required and elective courses are regularly scheduled and have strong enrollment and that the School balances course offerings to meet institutional needs.

Most required and (departmentally-taught) elective courses are taught every year, with some taught every other year. See Appendix B for course-specific enrollment data over the past 5 academic years.

4. Analyze and discuss the quality factors of this academic program. Review this program's incorporation of high-impact educational practices promoting student learning and engagement.
- Provide evidence, including but not limited to, the program's ability to attract and retain high quality students and faculty, the reputation of the program, regional/national recognition; faculty recognition; comparisons with peers; student experiences; faculty achievements in teaching, success in establishing and meeting learning goals. Review the use of effective pedagogy, and of curriculum alignment, as well as effective use of the LSSU physical environment for out-of-classroom learning experiences. Additional evidence of quality may include national program accreditation, specialized facilities or equipment. For programs with

multiple options or concentrations, provide evidence of quality for each option. Narrative effectively addresses program quality and provides multiple sources of evidence.

Fish Health faculty are respected among their colleagues as educators and scientists. Fish Health faculty attend and present at national and international scientific conferences and have received awards acknowledging their effectiveness in the classroom (see 4c). Faculty also serve as PhD committee members for MSU's graduate specialization in Fish and Wildlife Disease.

- b. The program is accredited for the full time period by its disciplinary accrediting body. (where applicable) Narrative addresses accreditation and summarizes last review.

Not applicable, there is no accrediting body for Fish Health programs.

- c. Faculty in this program have received national, regional or state-level awards and recognition for their outstanding teaching and engagement with students. Narrative provides context and relevance of award(s).

Faculty teaching in the Fish Health program have received the following awards: LSSU Distinguished Teaching Award (2 faculty), Michigan Professor of the Year Award, and Excellence in Academic Advising Award. These awards recognize the programs ability to attract and retain high quality faculty that are recognized at the university and state levels.

- d. Evaluations of courses taught by the program's faculty are consistently high.

Faculty access to this data is restricted by contract language.

- e. The program offers extensive opportunities for students to engage in practical application of knowledge, cutting edge study, research or career ready training.

The Fish Health program, as do all programs within the School of Biological Sciences, places a premium on hands-on field and laboratory experiences. While many institutions are moving away from laboratory components of courses and even toward on-line instruction, the School of Biological Sciences has maintained and, whenever possible, expanded opportunities for students to engage in the practical application of their chosen profession. The Fish Health faculty fully support this aspect of the program even though these activities typically require more time and effort to prepare while being valued less (in terms of faculty load) than lecture instruction.

- f. Evidence provided that all graduates engage in interdisciplinary study and research.

The broad nature of the Fish Health coursework is shown by the variety of job areas graduates are qualified for biomedical/clinical diseases diagnostic analysts, fish health manager, fish biologist etc. Depending on the path selected graduates in BS programs are responsible for developing, designing, and conducting their own original research project. All students are also required to present their findings in multiple formats (poster, paper, and oral presentation) to the School faculty and students as part of an end-of-semester symposium. We strongly encourage students to also present their

findings to fish health professionals and fish farm managers in the regional/national conferences.

- g. Percentage of the programs' undergraduates participating in research, service learning, international or other experiential learning experiences is above average for peers and like units at LSSU.

All (100%) of students in associated BS programs engage in such activities (see 4f above).

- h. External reviews, where applicable, indicate that this instructional program is of the highest quality.

There is no external accrediting or review body for Fish Health programs.

- i. Evidence provided that graduates of the program are systematically and effectively engaged in an array of experiential learning, or other High Impact Practices. Most or all graduates participate.

See 4e – 4g above

- 5. Assessment - a narrative to summarize the program's effectiveness in the use of assessment data to strengthen the program and improve student learning consistent with the Criterion for Accreditation. Review the nature, quality and level of the program outcomes. Evaluate the strength of the program outcome measures and the course-program mapping. Review the progress in course assessment: course outcomes, measures and findings. Summarize assessment feedback from all stakeholders.
 - a. Narrative addresses HLC Criterion, outcomes are clearly defined, lead to actionable data, evidence of the use of assessment data to make changes and evidence of the impact of those changes. Narrative provides evidence of progress in assessment and timeline for the assessment cycle leading to HLC reporting in April 2016.

This process is ongoing. The BS programs are developing a coordinated assessment plan within the School of Biological Sciences.

To date, two program level outcomes have been identified.

1. Will meet academic requirements for certification as Aquatic Animal Health Inspectors and/or Fish Pathologists by the American Fisheries Society.

2. Will possess the necessary skills/knowledge and ethical standards to conduct, endorse and/or oversee aquatic animal health inspections.

Our next step for the Fish Health program, beginning in the fall 2016 semester, will be to select specific assessment activities to measure student learning outcomes.

- b. All course and program outcomes are student focused, measurable, and rely on both direct and indirect measures. Administrative outcomes clearly identified. Implementation plan provides methodology for the assessment of all student learning outcomes within a 4-year rotation.

Student learning outcomes have been established and means of assessment have been identified for Virology, Ecology of Animal Diseases; required courses for Fish Health.

Measures of course-specific outcomes for Virology and Ecology of Animal Diseases of Fish Health courses have been determined and were entered into Trac Dat in the spring of 2016. All program and course-level outcomes are student focused and measurable.

- c. The program has established and implemented an assessment plan and accountability metrics, and has used the process to make improvements in their program. A detailed action plan summarizes program direction for the future responsible parties are identified and timelines included for all actions.

See 5a above.

- d. A program-level curriculum map (matrix) has been developed and reviewed by faculty to define how and where each program outcome will be addressed (i.e., introduced, reinforced, and assessed).

This process is on-going. We will develop a curriculum map in 2016-17.

- e. Evidence provided of school-level review of course and program findings, and the substantial participation of faculty in processes and methodologies leading to assessment of student learning.

See 5a & 5b above.

6. Opportunity Analysis - Summarize the program's long-term goals (5-10 years). Define and report on opportunities for advancing the program. Define, quantitatively and qualitatively, the obstacles to moving the program towards its long-term goals.

- a. Report on the current status of equipment/lab and other resources. Has the program kept facilities current? How will future equipment needs be met (external funding or LSSU funding)? Describe any options for continuation of the program in another format (as an emphasis, minor associate degree, etc.). Are there any duplicated efforts on campus relative to this program? Where can efficiency be increased through collaboration? Describe the curriculum or staffing changes required or resulting from these changes. Is the program currently at or below capacity, what steps can be taken to increase program effectiveness? Narrative provides overview of the program potential.

The Fish Health program long-term goals are to focus on streamlining the BS degree. Over the years, changes in the Biology core curriculum have added credits to the degree, making it somewhat credit heavy. We are looking to evaluate the program to emphasize those courses with Fish Health content (including a course in Microbial Ecology), and remove those where content may be duplicated. We also plan to change the chemistry requirements to coincide with recent changes made in the chemistry minor.

Any changes to the program would not result in staffing changes.

Obstacles for continued growth and expansion in the Fish Health program are mainly the lack of awareness that a program of this nature exists in the US. At recent professional meeting we discussed our program with universities and agencies specializing in fish disease. Most were amazed, but encouraged to hear that such a program existed at the undergraduate level. We need to increase our efforts to market this program through the country.

- b. Program has very high potential for growth; action plan to achieve this growth is clear and well defined.

The Fish Health program at LSSU continues to produce well-trained and successful graduates. The potential for growth of the program is apparent.

- c. Program facilities and equipment are current and plans in place for maintenance or replacement on regular schedule. Facilities are self-funded or have external funding sources.

Thanks largely to external funding, the equipment used in the Fish Health program is in excellent condition, but it must be stressed that this has been accomplished without institutional support. The faculty have been conscientious stewards and subsequently, the equipment in the Fish Health program has enjoyed a long life span and has been able to be replaced and maintained as needed.

- d. The evidence given shows strong potential for the program to maintain or improve quality and capacity, and adapt well to changes in budgetary constraints or program demand.

See items 6a – 6c above.

APPENDIX A – FISH HEALTH AND AQUACULTURE PROGRAMS/COURSES

Fish Health Programs/Courses		
Location	Type	Description
UW Madison	Veterinary Medicine	Basic Fish Health Medicine
USFWS/NCTC Training	Agency personnel	Intro to Fish Health
Kentucky State University	Graduate school	Fish Diseases
Cornell University	Veterinary Medicine	AquaVet program
University of Florida	Veterinary Medicine	Aquatic Animal Medicine
Auburn University	Graduate school	Fish Health
Michigan State University	Graduate school	Specialty in Fish and Wildlife Disease
Aquaculture Programs		
Location	Type	Description
Hillsborough Community College	AD Aquaculture	Aquaculture; some disease classes
Carteret Community College	Diploma	aquaculture no fish health
Florida Institute of Technology	BS Aquaculture	no classes on disease
Clemson University	BS Aquaculture	no classes on disease
Auburn University	BS Aquaculture	1 class in fish health
Eastern Wyoming University	certificate	1 class in fish health
University of New England	BS Aquaculture	no classes on disease

AS • Aquaculture

AS.AQUA (60 Credit Hours)

This program will provide students with the knowledge and skills for an entry-level job in the aquaculture industry as a field/farm assistant or a laboratory technician. When students graduate they may also find employment in state agencies such as the Fresh Water Fish and Wildlife Commission that oversee environment and wildlife.

Program Required Courses

YEAR I – First Semester

†CGS	1107	Introduction to Computers	1 cr.
†ENC	1101	English Composition I	3 cr.
FAS	1012C	Aquacultural Organisms	3 cr.
ZOO	1450	Icthyology	3 cr.
ZOO	1450L	Icthyology Laboratory	1 cr.
		Mathematics General Education	3 cr.

YEAR I – Second Semester

CHM	1025	Introductory Chemistry	3 cr.
CHM	1025L	Introductory Chemistry Laboratory	1 cr.
†ESC	1000	Earth Science <i>and</i> †ESC 1000L, Earth Science Laboratory <i>or</i> OCB 2000, Marine Biology <i>and</i> OCB 2000L, Marine Biology Laboratory	4 cr.
FAS	1401L	Aquacultural Laboratory Techniques	3 cr.
FAS	2263C	Aquacultural Reproductive Techniques	3 cr.

YEAR I – Third Semester

†EVR	1001C	Introduction to Environmental Science	3 cr.
FAS	2941L	Aquacultural Field Experience I	3 cr.

YEAR II – First Semester

FAS	2240C	Aquacultural Nutritional Techniques	3 cr.
FAS	2253	Aquacultural Disease Processes	3 cr.
FAS	2253L	Aquacultural Disease Processes Laboratory	1 cr.
FAS	2942L	Aquacultural Field Experience II	3 cr.
		Humanities General Education	3 cr.

YEAR II – Second Semester

†ANT	2000	Introduction to Anthropology <i>or</i> †PSY 2012, General Psychology <i>or</i> †SYG 2000, Introduction to Sociology	3 cr.
FAS	1404C	Aquacultural Field Techniques	3 cr.
FAS	2353C	Aquacultural Management Practices	3 cr.
FAS	2943L	Aquacultural Field Experience III	3 cr.
†SPC	1006	Speech Improvement	1 cr.

APPENDIX B – Fish Health COURSE ENROLLMENTS BY SEMESTER

	11S	11F	12S	12F	13S	13F	14S	14U	14F	15S	15F	16S	16U	16F	Total
Virology		12			11		9			9				10	51
Histopathology				5					6					3	14
Ecology of Animal Disease	6			13			8	1				3			31
Animal Nutrition	17	9					7					7			40
Senior Project		1							2	1		2		2	13
Microbial Ecology						11				10					21