



UNIVERSITY
of ALASKA

Many Traditions One Alaska

Fisheries Team Report

UA Strategic Pathways

December 15, 2016



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Charge

Develop and review options for organizational restructuring that strengthen fisheries programs at the certificate, associate, and baccalaureate degree levels.

Scope

Certificate, associate, and baccalaureate fisheries programs.

Goal

Meet 90% of projected labor market demand by 2025.

Key Stakeholders

- ▶ Students and Prospective Students (Alaska middle and high school students and non-traditional students)
- ▶ Faculty
- ▶ Staff
- ▶ Executive Leadership
- ▶ Communities (coastal and rural, and hubs)
- ▶ Alumni
- ▶ Industry/Non-Government Organization/Consumers
- ▶ Alaska Native Organizations (e.g., Regional Corporations, Native Associations, Tribes, and Villages)
- ▶ Employers
- ▶ Parents
- ▶ Legislators

Team Members

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Process Overview

The Fisheries team is one of eight teams in Phase 2 of Strategic Pathways. Phase 2 began in early October when the teams met for the first time. During that first meeting, Session 1, there was a thorough orientation to the overall effort, and the charge, scope, and goal were refined. Most teams also identified the first iteration of potential Options. In the weeks between Session 1 and the second meeting, Session 2, the Fisheries Team continued to define the options with weekly teleconferences and virtual collaboration. The Pros and Cons for each Option were developed in Session 2 on November 8th. Since then the Fisheries Team has been continually refining the Options, Opportunities, Pros and Cons and writing them into the following document. These Reports served as the main source of information for the Presentations that will be presented to the Summit Team on January 18th.

Existing Degree Programs for Fisheries

Programs	No. Full-Time Faculty	No. Staff	No. Students ¹
UAF Fisheries	4 - Fairbanks 5 - Juneau 2 - Kodiak 1 - Anchorage ²	2 - Juneau 4 - Fairbanks 0.75 - Kodiak 0 - Anchorage ³	52 - Fairbanks 3 - Juneau 1 - Anchorage
UAS (Juneau) faculty teaching fish courses	1 term faculty 1 tenure track faculty	0	0 (new program)
UAA Fisheries	0	0	0
UAS (Sitka) Fish Tech	1	0.5	29 ⁴

Comments on UA Strategic Pathways Process

- ▶ The rapid review process required in Strategic Pathways Phase II has allowed for the initial development of options. More time and research would provide key stakeholders more fully-informed and deliberate decision making capabilities and would allow for a more in depth analysis of structural options, requiring less speculation.

Assumptions for All Options

- ▶ Not considering implications of the budget.
 - Reality is that resource and funding are at risk in the current fiscal environment.
- ▶ External factors do not override program improvements.
- ▶ Strong undergraduate program benefits a graduate program and strong graduate programs benefits an undergraduate program – applied education.
- ▶ Strong community and industry partnerships co-located make more opportunities available to students.

¹ Fall 2016 Enrollment

² In Juneau there are 2 full-time faculty that support the Biology and Marine Biology program and who are able to contribute to Fisheries Curriculum. There are currently no students enrolled in Fisheries specific courses; in Fairbanks, there are 4 staff members that contribute some part of their time broadly in support of CFOS academic programs, which includes the undergraduate fisheries program; there is 1 staff member at 0.75 FTE in Kodiak in support of the faculty in Kodiak.

³ The number of fisheries faculty listed by location each teach at least one course in support of the undergraduate fisheries program. There are 4 additional UAF fisheries tenure-track faculty in Juneau that do not teach UG classes; all UAF fisheries faculty also teach graduate-level courses.

⁴ The majority of Fish Tech students are distance.



Further Analysis Needed for All Options

- ▶ Reassess how the programs will be reviewed (i.e., the criteria used for evaluation).
- ▶ More research and information is needed to assess if the option chosen meets the charge and goal.

Option 1 – Status Quo (does not include the joint Fisheries initiative)

Narrative Description

One Consolidated Fisheries Baccalaureate Degree at UAF (BA and BS available at UAF, and Certificate and Associate available at UAS).

Key Change Elements

- ▶ No change to any elements.

Pros and Cons

- | Pros | Cons |
|--|---|
| <ul style="list-style-type: none">▶ Least cost and no disruption to fisheries undergraduate programs▶ Maintains valuable connection between the graduate and undergraduate program▶ Does not disrupt graduate program▶ Established identity with existing programs▶ Maintaining baccalaureate degree at UAF allows connections to other natural resources related disciplines▶ Immediate implementation (Done)▶ No required duplication of programmatic content | <ul style="list-style-type: none">▶ Dissatisfaction among key stakeholders▶ Perception that UAS and UAF are resistant to change▶ Will not meet the charge▶ May not meet the goal▶ Public confusion about the existing established programs▶ Progression from AAS and certificate programs, to the baccalaureate programs is difficult/inefficient▶ Not considering continued reductions in budget▶ No increased savings |

Further Analysis Needed

- ▶ What are the potential impact of reduced budgets on the programs?

Option 2 – Strengthening UAF/UAS Fisheries existing program structures (does not include the joint Fisheries initiative)

Narrative Description

One Consolidated Fisheries Baccalaureate Degree at UAF with increased investment in recruitment, retention, and marketing (BA and BS available at UAF, and Certificate and Associate available at UAS). Strengthening Status Quo.

Specific Strengthening Opportunities

- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Alignment of common technological platform for course delivery to expand course delivery locations.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - Increased distance courses available off campus.
- ▶ Staffing Changes - Increase resources and staff for recruitment and retention of students.
- ▶ Use of Facilities/Technology - Increased use of facilities to handle more students and technology.
- ▶ Access for Students - Improved and wider access at off campus locations.
- ▶ Administration - No change.
- ▶ Front-End Investment - Increased for recruiting, marketing, staff and scholarships. Invest in distance delivery technology.
- ▶ Community (external) Engagement - Increased through marketing and engaging additional locations.
- ▶ Marketing - Increased.

Option 2 continued – Strengthening UAF/UAS Fisheries existing program structures (does not include the joint Fisheries initiative)

Pros and Cons

Pros

- ▶ **Minimal investment in up-front costs; one of the least expensive ways to strengthen the programs (i.e., no additional facilities or infrastructure needed)**
- ▶ **Potential to increase student recruitment, retention, engagement, graduation, and job placement**
- ▶ Minimal disruption to the programs
- ▶ **Maintains valuable connection between the graduate and undergraduate program**
- ▶ Does not disrupt graduate program
- ▶ Established identity with existing programs
- ▶ Maintaining baccalaureate degree at UAF allows connections to other natural resources related disciplines
- ▶ May meet the charge and goal
- ▶ May reduce public confusion about the existing established programs
- ▶ Ability to recruit underrepresented groups more effectively
- ▶ Rapid implementation
- ▶ Proven effectiveness of strengthening tactics (from previous Rasmuson support)
- ▶ **No required duplication of programmatic content**

Cons

- ▶ Minimal investment in up-front costs
- ▶ In comparison to joint options, less opportunity for collaboration, less community engagement, and less student recruitment (see Options 2 and 3)
- ▶ **Dissatisfaction among key stakeholders**
- ▶ **Perception that UAS and UAF are resistant to change**
- ▶ **May not meet the charge and goal**
- ▶ Public confusion about the existing established programs
- ▶ Progression from AAS and certificate programs, to the baccalaureate programs is difficult/inefficient
- ▶ Not considering continued reductions in budget
- ▶ No increased savings

Further Analysis Needed

- ▶ Determine how external factors may override recruitment efforts and program improvements.

Option 3 – Jointly Offered Programs with Stronger Integration between UAF and UAS (certificate, associate, and baccalaureate degrees)

Narrative Description

This option would entail jointly Offered Programs between UAF and UAS (certificate, associate and baccalaureate degrees). Programs offerings would be strengthened by a joint BS degree with students at both locations, as well as the development of an Associate Science degree that is a seamless transition to either the BS or BA in Fisheries.

Specific Strengthening Opportunities

- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Alignment of undergraduate programs.
- ▶ Alignment of common technological platform for course delivery to expand course delivery locations.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - Joint BS degree with students at both locations (UAS and UAF). Development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.
- ▶ Staffing Changes - Increase resources and staff for recruitment and retention of students.
- ▶ Use of Facilities/Technology - Explicit requirement to deliver fisheries courses to UAS and UAF. Increased demand for technological support for video delivery.
- ▶ Access for Students - Improved clarity of pathway for students. Improved access for UAS.
- ▶ Administration - No change in Administrators. Increased load for existing faculty for program review and assessment to be completed.
- ▶ Front-End Investment - Minimal. Training on communication equipment for UAS and/or UAF. Increased funding for marketing and recruitment.
- ▶ Community (external) Engagement - Need to communicate program changes, and strengthen or develop additional community/industry partnerships.
- ▶ Marketing - Improved and streamlined with collaborative efforts.

Option 3 continued – Jointly Offered Programs with Stronger Integration between UAF and UAS (certificate, associate, and baccalaureate degrees)

Pros and Cons

Pros

- ▶ Limited need for increased front-end investment
- ▶ **Potential to increase student recruitment, retention, engagement, graduation, and job placement**
- ▶ **Increased and improved collaboration between UAS and UAF**
- ▶ Decreased overlap between programs (cost savings and efficiencies)
- ▶ Positive impact on legislative support
- ▶ Improved potential for private and industry fundraising
- ▶ **Increased efficiency for students to navigate between programs (AS and BS/BA)**
- ▶ Decreased public confusion about the existing established programs
- ▶ Increased undergraduate research opportunities (UAS undergraduate students to work with UAF graduate students)
- ▶ Framework developed for implementation
- ▶ Strengthen already strong ties between UAS and UAF faculty
- ▶ **Maintains valuable connection between the graduate and undergraduate program**
- ▶ Does not disrupt graduate program
- ▶ Maintaining baccalaureate degree at UAF allows connections to other natural resources related disciplines
- ▶ Provides increased diversity of course offering for other programs

Cons

- ▶ **Difficulty in coordinating upper division undergraduate degree course offerings and program assessment**
- ▶ Implementation will take time (Fall of 2017)
- ▶ **Need for front-end investment**
- ▶ Increased workload for existing faculty
- ▶ **Challenges in recruiting fisheries students to new joint programs at UA**
- ▶ **Potential for low program enrollments and completion at UAS may be seen as a failure of the program**
- ▶ Potential competition between or within existing programs at UAS and/or UAF
- ▶ Some duplication of programmatic content

Option 3 continued – Jointly Offered Programs with Stronger Integration between UAF and UAS (certificate, associate, and baccalaureate degrees)

Pros, continued

- ▶ Ability to recruit underrepresented groups more effectively
- ▶ Demonstrates flexibility to respond to stakeholder needs
- ▶ Improved public perception of the program and University
- ▶ **Long term sustainability and stability of the program would be enhanced**
- ▶ Provides increased diversity of delivery options for students
- ▶ Increased recruitment of students and program exposure to communities/industry across the state
- ▶ Minimal disruption to the programs

Further Analysis Needed

- ▶ Is this investment taking away from current strong programs at UAS (dilution of faculty focus)?

Option 4 – Jointly Offered Programs with Stronger Integration between UAF, UAS, and UAA (certificate, associate, and baccalaureate degrees)

Narrative Description

This option would entail jointly Offered Programs between UAF, UAS and UAA (certificate, associate and baccalaureate degrees). Programs offerings would be strengthened by a joint BS degree with students at all locations, as well as the development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.

Specific Strengthening Opportunities

- ▶ Improved community and industry engagement in Anchorage.
- ▶ Alignment of undergraduate programs.
- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Alignment of common technological platform for course delivery to expand course delivery locations.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - Joint BS degrees with students at all locations (UAS, UAF, and UAA). Development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.
- ▶ Staffing Changes - Increase resources and staff for recruitment and retention of students. UAA fisheries faculty and staff positions would need to be created and filled. Increased faculty or staff time devoted to advising at UAS and UAA.
- ▶ Use of Facilities/Technology - Explicit requirement to deliver fisheries courses to UAS, UAF, and UAA. Increased demand for technological support for video delivery. Additional office space and equipment to accommodate additional faculty at UAA.
- ▶ Access for Students - Improved clarity of pathway for students. Improved access for students statewide (especially UAS and UAA). Increased coordination of programs and classes for students at all three campuses (for example: fisheries course timing would now have to consider conflicts among courses at three campuses).

Option 4 continued – Jointly Offered Programs with Stronger Integration between UAF, UAS, and UAA (certificate, associate, and baccalaureate degrees)

Key Change Elements, continued

- ▶ Front-End Investment - Significant for UAA in hiring faculty and staff. Training on communication equipment for UAS, UAA and/or UAF. Increased funding for marketing and recruitment. Additional resources needed for distance delivery technology, classroom, lab space.
- ▶ Community (external) Engagement - Need to communicate program changes, and strengthen or develop additional community/industry partnerships.
- ▶ Marketing - Improved and streamlined with collaborative efforts.

Pros and Cons

Pros

- ▶ **Increased and improved collaboration between UAS, UAA, and UAF**
- ▶ **Improved access to students in the Anchorage and Juneau area resulting in exposure to a larger population base and increased enrollment potential**
- ▶ Framework at UAS is developed for implementation
- ▶ Some framework for implementation at UAA has been identified/developed
- ▶ Decreased overlap between programs (cost savings and efficiencies)
- ▶ Positive impact on legislative support
- ▶ Improved potential for private and industry fundraising
- ▶ Increased efficiency for students to navigate between programs (AS and BS/BA)
- ▶ Decreased public confusion about the existing established programs
- ▶ Increased undergraduate research opportunities (UAS undergraduate students to work with UAF graduate students)

Cons

- ▶ **Significant front-end investment for UAA (increased new faculty, office and lab space, etc.)**
- ▶ **Existing UAA faculty and administration “buy-in” to support implementation could be challenging as sparse resources from other programs would likely have to be reallocated to support a jointly offered Fisheries program**
- ▶ **Difficulty in coordinating upper division undergraduate degree course offerings and program assessment**
- ▶ Implementation will take more time and be more complex
- ▶ Increased workload for existing faculty
- ▶ Challenges in recruiting fisheries students to new joint programs at UAS and UAA
- ▶ Potential for low program enrollments and completion at UAS and UAA may be seen as a failure of the program

Option 4 continued – Jointly Offered Programs with Stronger Integration between UAF, UAS, and UAA (certificate, associate, and baccalaureate degrees)

Pros, continued

- ▶ Strengthen already strong ties between UAS and UAF faculty
- ▶ Building ties between UAS, UAA, and UAF
- ▶ **Maintains valuable connection between the graduate and undergraduate program**
- ▶ Does not disrupt graduate program
- ▶ Maintaining baccalaureate degree at UAF allows connections to other natural resources related disciplines
- ▶ Provides increased diversity of course offering for other programs
- ▶ Ability to recruit underrepresented groups more effectively
- ▶ Demonstrates flexibility to respond to stakeholder needs
- ▶ Improved public perception of the program and University
- ▶ Long term sustainability and stability of the program would be enhanced
- ▶ Provides increased diversity of delivery options for students
- ▶ Increased recruitment of students and program exposure to communities/industry across the state
- ▶ Increased research opportunities statewide
- ▶ **Increased potential to develop and strengthen community partnerships in the Anchorage area**

Cons, continued

- ▶ Potential competition between or within existing programs at UAS, UAA and/or UAF
- ▶ **Fisheries students at UAA will not have a direct access to opportunities with fisheries graduate students**
- ▶ Potential challenge with morale at Anchorage due to small isolated fisheries faculty
- ▶ **Duplication of programmatic content at UAS and UAA**

Further Analysis Needed

- ▶ Is this investment taking away from current strong programs (dilution of faculty focus)?

Option 5 – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAS (with courses available within the other Universities)

Narrative Description

This option includes significant changes at both UAS and UAF, including eliminating the BA and BS at UAF and re-creating both at UAS. The BA of Fisheries would require substantial changes due to the connection to the Rural Development and Economics departments at UAF. These departments currently do not exist at UAS. This option would further require the development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.

Assumptions

- ▶ UAS would be the lead university for Fisheries programs (administering the programs at UAS), and courses would be delivered face-to-face at UAS with distance delivery available elsewhere.

Specific Strengthening Opportunities

- ▶ Improved community and industry engagement in Southeast Alaska.
- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - Significant changes at both UAS and UAF, including eliminating BA and BS at UAF and re-creating both at UAS. BA of Fisheries would have substantial changes due to the connection to Rural Development and Economics at UAF, areas that currently do not exist at UAS. Development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.
- ▶ Staffing Changes - Staffing increased at UAS to cover additional program offerings. Duties may change at UAF. Potential transition from UAF to UAS for some and potential sharing of staff.

Option 5 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAS (with courses available within the other Universities)

Key Change Elements, continued

- ▶ Use of Facilities/Technology - UAS would need additional distance delivery technology, office space, and lab space.
- ▶ Access for Students - UAS student access would increase with coordinated courses. Students at other locations (MAUs) would have decreased access due to lack of coordination of classes and conflicting course schedules. Navigating the programs would be easier for students (one pathway).
- ▶ Administration - Minimal change.
- ▶ Front-End Investment - Substantial to build program offerings and qualified fisheries faculty at UAS. Utilize Auke Bay lab. Cost of hiring and/or relocating staff. Investment necessary to promote a sustainable fisheries program over time. Substantial funding for marketing and recruitment.
- ▶ Community (external) Engagement - Need to communicate program changes. Maintain community/industry partnerships in SE. Reduce community/industry partnerships in the Interior.
- ▶ Marketing - Need to develop a sustainable marketing plan to recruit a robust student body.

Pros and Cons

- | Pros | Cons |
|--|---|
| <ul style="list-style-type: none">▶ Increase the capacity to deliver Fisheries related programs out of UAS▶ Increase the access of SE Alaska residents, particularly Juneau residents, to Fisheries degrees▶ Increase the diversity of undergraduate courses for other programs in the UAS Natural Sciences Department▶ Clear navigation of the BS and BA program at UAS▶ UAS faculty currently teach marine related courses so that some of the program requirements could be met with existing faculty | <ul style="list-style-type: none">▶ Few current undergraduates at UAF might choose to transfer to UAS; some will desire to finish their degree at UAF and some will instead choose a different course of study at UAF▶ Transition costs at UAF to support existing BA and BS students who choose not to transfer - staff support, faculty course offerings required for several years▶ Decrease in the total number of students receiving a BS or BA in Fisheries if UAS not as attractive as UAF has been |

Option 5 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAS (with courses available within the other Universities)

Pros, continued

- ▶ Juneau provides great access to internships at NOAA, ADF&G, USFWS, NPS
- ▶ **Increased efficiency for students to navigate between certificate, AAS, BS and BA programs since all at one location**
- ▶ **Decreased public confusion about the existing established programs**

Cons, continued

- ▶ **UAF Fisheries faculty most heavily involved in undergraduate program have deep ties to Fairbanks, and likely would opt to shift their effort towards the graduate program internships, etc.**
- ▶ **Substantial transition time for UAS program to be fully developed - full faculty, full complement of courses, substantial number of students**
- ▶ **Housing undergraduate and graduate fisheries programs at two different campuses would likely require duplication of faculty expertise because UAS doesn't have the capacity or accreditation status to house the Fisheries graduate program**
- ▶ **Degradation of the connection between the undergraduate fisheries program and the UAF graduate Fisheries Program (faculty and students), which provides substantial opportunities for undergraduate research experience**
- ▶ Substantial transition costs for UAS to develop curriculum, recruit faculty and administrative support staff, publicize new program and recruit students, pursue accreditation, and replace the existing strong network of employers
- ▶ Risk of competing with existing strong UAS Marine Biology and Biology programs for a limited pool of students rather than increasing the total enrollment at UAS

Option 5 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAS (with courses available within the other Universities)

Cons, continued

- ▶ Decrease the capacity to deliver Fisheries undergraduate programs out of UAF
- ▶ No space for new faculty (office and laboratory) at UAS
- ▶ Local agencies in Interior Alaska would have a reduced connection with UAF undergraduates for internships
- ▶ Deterioration of the strong relationship between UAF and UAS faculty
- ▶ Some disruption to productive graduate program (faculty efforts disrupted, less TA opportunities, less access to undergraduate interns), more if faculty transferred to new program
- ▶ It may be confusing for students to find classes and have an undergraduate fisheries program not housed within the UAF College of Fisheries and Ocean Sciences

Further Analysis Needed

- ▶ Even with great recruitment investment, will numbers of students in Fisheries programs increase or even match the existing UAF program?
- ▶ Must be approved by the regional accreditation body (NWCCU) and Board of Regents.

Option 6 – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAF (with courses available within the other Universities)

Narrative Description

This option would entail eliminating the Associate and Certificate Programs, which are currently in Sitka through UAS, and re-creating both at UAF. This option would also require the development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.

Assumptions

- ▶ UAF would be the lead university for Fisheries programs (administering the programs at UAF), and courses would be delivered face-to-face at UAF with distance delivery available elsewhere.

Specific Strengthening Opportunities

- ▶ Improved community and industry engagement in Interior and Northern Alaska.
- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - The Associate and Certificate Program which is currently in Sitka through UAS would have to relocate to UAF. Development of an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.
- ▶ Staffing Changes - UAF would need to hire or relocate faculty to deliver the Associate and Certificate Programs. There would be an increased advising load that would need to be filled.
- ▶ Use of Facilities/Technology - There would be no change in facilities for the undergraduate program, but UAF would need to increase faculty and therefore offices to deliver the Associates and the Certificate Programs.
- ▶ Administration - The administration of the Associate and the Certificate Programs would move to Fairbanks so there would be an increased administration load.

Option 6 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAF (with courses available within the other Universities)

Key Change Elements, continued

- ▶ Access for Students - With respect to the undergraduate degree, there would be no difference between this option and the status quo option since UAF already delivers the undergraduate Fisheries degree. Would need to improve navigation for other MAUs. If the Associate and Certificate Programs are distance delivered, then there would be similar access for students as is currently available. Negatively affect student access.
- ▶ Front-End Investment - Moving the Associate and Certificate Programs to UAF would require investment in new faculty/or relocation of UAS faculty and technology. Since the undergraduate program already uses the distance technology to deliver the BS and BA in Fisheries, there would be an increased need to deliver more lower division courses.
- ▶ Community (external) Engagement - Less community engagement since there may be much less interest in marine fisheries (more in freshwater fisheries) in Fairbanks. SE Alaska and other Fishing Communities would have more interest in the AAS and Certificate. Could improve engagement with the fishing community in Fairbanks.
- ▶ Marketing - In order for the delivery of all programs to be successful, there would need to be an increased marketing effort and targeting recruitment of students nationally.

Pros and Cons

Pros

- ▶ Limited need for increased front-end investment
- ▶ Potential to increase student recruitment, retention, engagement, graduation, and job placement
- ▶ Increased efficiency for students to navigate between programs since all at one location
- ▶ Decreased public confusion about the existing established programs
- ▶ Maintains valuable connection between the graduate and undergraduate program
- ▶ Does not disrupt graduate program

Cons

- ▶ Implementation will take time (Fall of 2018 or 2019)
- ▶ Need for front-end investment - recruitment/retention, faculty, staff
- ▶ Increased workload for existing faculty
- ▶ Challenges in recruiting fisheries students to one location (Fairbanks); students located in SE or ANC/Mat-Su/Kenai Peninsula may not want to come to Fairbanks
- ▶ Lower morale for UAS faculty and staff, particularly in Sitka, because they would lose their certificate and AAS programs

Option 6 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAF (with courses available within the other Universities)

Pros, continued

- ▶ Maintaining baccalaureate degree at UAF allows connections to other natural resources related disciplines
- ▶ Long term sustainability and stability of the program could be enhanced (administered out of one campus)
- ▶ All fisheries program in the UA system would be consolidated in one administrative location, which would be the College of Fisheries and Ocean Sciences
- ▶ Stronger campus “feel” at UAF
- ▶ May lead to cost reductions
- ▶ Potentially easier for students to navigate from one degree to the next

Cons, continued

- ▶ Could lose close relationship between UAF and UAS
- ▶ Dissatisfaction among key stakeholders, particularly in SE Alaska
- ▶ Could lose enrollment in Southeast Alaska where the AAS and Certificate programs have most of their student base
- ▶ Broken connections with industries in Southeast Alaska
- ▶ Decreased university presence in Sitka specifically as well as throughout SE Alaska
- ▶ Could be confusion for students if the fisheries program is administered out of UAF but faculty/classes are located also at UAA and/or UAS

Further Analysis Needed

- ▶ Must be approved by the regional accreditation body (NWCCU) and Board of Regents.
- ▶ Will recruitment into Fisheries programs increase if it is only located in Fairbanks?

Option 7 – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAA (with courses available within the other Universities)

Narrative Description

This option would require eliminating the baccalaureate programs at UAF and certificate/associate programs at UAS, and re-creating both at UAA, where no related programs exist. All degrees would have to be recredited at UAA. Supporting programs would need to be developed, including an Associate of Science degree that is a seamless transition to either the BS or BA in Fisheries.

Assumptions

- ▶ UAA would be the lead university for Fisheries programs (administering the programs at UAA), and courses would be delivered face-to-face at UAA with distance delivery available elsewhere.

Specific Strengthening Opportunities

- ▶ Improved community and industry engagement in Southcentral Alaska.
- ▶ Increased scholarship money.
- ▶ Increased staff and resources for additional student recruitment and marketing.
- ▶ Increased staff and resources for student retention, engagement, graduation, and job placement.
- ▶ Strengthen or build additional community/industry partnerships.

Key Change Elements

- ▶ Program/Offering Changes - Significant. Would require moving baccalaureate programs from UAF and certificate/associate programs from UAS to UAA where no related programs exist.
- ▶ Staffing Changes - Significant. Currently no fisheries faculty or support staff or students at UAA. Would require either moving faculty/staff/students from UAF and UAS or hiring new faculty/staff at UAA. In addition, outreach programs to inform student body of availability of program would be important to implement.
- ▶ Use of Facilities/Technology - UAA would either need to develop or reallocate teaching classrooms and labs, research space, distance delivery technology, etc., to accommodate new fisheries programs which do not currently exist.

Option 7 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAA (with courses available within the other Universities)

Key Change Elements, continued

- ▶ Access for Students - A strong advising program would need to be developed and implemented to ensure students enroll in the appropriate courses offered by the various campuses, and to promote retention and program completion.
- ▶ Administration - Significant change as currently no fisheries administrative support at UAA.
- ▶ Front-End Investment - Significant as the necessary senior administrator, faculty, support staff, and infrastructure (e.g., fisheries laboratories, increased distance learning capacity, offices, equipment, etc.) needed to deliver a fisheries program at UAA are currently not available. In addition, a well-designed marketing and recruitment plan would need to be developed and implemented.
- ▶ Community (external) Engagement - Unclear if there is interest/demand for this program in Anchorage. Negative in both Juneau, Sitka, and Fairbanks. As noted above, access to the North Pacific Fishery Management Council (NPFMC) offices (and associated meetings) would be positive. Access to Alaska Department of Fish and Game (ADF&G) offices in Anchorage are similar to access in Fairbanks and Juneau.
- ▶ Marketing - Since Anchorage is a larger population base, then recruitment/marketing would potentially reach more people. Would likely not attract students from SE (which want to go to UAS) or interior/northern Alaska (which want to go to UAF).

Pros and Cons

Pros

- ▶ Develop capacity to deliver Fisheries related programs out of UAA
- ▶ Potential to increase access for residents statewide to Fisheries degrees
- ▶ Increase the access for Southcentral Alaska residents to Fisheries degrees
- ▶ Increase the diversity of undergraduate courses through the offering of Fisheries programs at UAA

Cons

- ▶ Significant front-end investment for UAA (increased new faculty, office and lab space, develop curriculum, recruit faculty and administrative support staff, publicize new program and recruit students, pursue accreditation, etc.)
- ▶ Existing UAA faculty and administration “buy-in” to support implementation could be challenging

Option 7 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAA (with courses available within the other Universities)

Pros, continued

- ▶ Once developed, clear navigation between certificate, AAS, BS and BA programs since all at one location
- ▶ UAA provides expanded access to internships at NOAA, ADF&G, USFWS, NPS, NPFMC, and variety of industry/AK Native organization stakeholders
- ▶ Potential improvement of regional legislative support
- ▶ Largest population region in the state
- ▶ Potential for new Fish Tech AS program to be added to established Alaska Middle Collage program
- ▶ Housing undergraduate and graduate fisheries programs at two different campuses has potential to expand learning opportunities through various faculty at another UA university

Cons, continued

- ▶ Increased public confusion about the existing established programs being moved to UAA as UAA has never had Fisheries certificate or degree programs
- ▶ Undergraduate fisheries students at UAA will not have a direct access to opportunities with fisheries graduate students and faculty at the same location (UAA) because most fisheries graduate students and faculty are at UAF
- ▶ Potential competition between or within existing programs at UAS, UAA and/or UAF
- ▶ Current undergraduates at UAF and UAS might choose not to transfer to UAA; some will desire to finish their degree at UAF and UAS and some will instead choose a different course of study at UAF and UAS
- ▶ Transition costs to support existing Fisheries students who choose not to transfer - staff support, faculty course offerings required for several years
- ▶ UAF Fisheries faculty most heavily involved in undergraduate program have deep ties to Fairbanks, and likely would opt to shift their effort towards the graduate program rather than transfer to Anchorage
- ▶ Substantial transition time for UAA program to be fully developed - full faculty, full complement of courses, substantial number of students

Option 7 continued – One Consolidated Fisheries Program (includes the certificate, associate, and baccalaureate degrees) administered and located at UAA (with courses available within the other Universities)

Cons, continued

- ▶ Disrupt developed relationships between UAF and UAS faculty, and require development of relationships with UAA faculty
- ▶ The rapid review process required in Strategic Pathways Phase II has not allowed for a fully-informed and thoughtful deliberation process by key stakeholders within UAA
- ▶ Too much speculation is involved and the quick moving process does not allow time for in depth research of the UAA option
- ▶ It may be confusing for students to find classes and have an undergraduate fisheries program not housed within the UAF College of Fisheries and Ocean Sciences

Further Analysis Needed

- ▶ Must be approved by the regional accreditation body (NWCCU) and Board of Regents.
- ▶ Even with great recruitment investment, will numbers of students in Fisheries programs increase or even match the existing UAF program?
- ▶ UAA must choose what department/college would house the Fisheries program.

Other Opportunities for Change

Key Definitions:

A fisheries program is any degree program that focuses on a subject that makes responsible commercial fishing, subsistence fishing, sport fishing, or aquatic resource management possible. These include, but are not limited to, fishery biology, fishery science, fishery ecology, fishery economics, fishery oceanography, fishery stock assessment, conservation engineering (as applied to bycatch mitigation), seafood processing and product development, and refrigeration (as applied to marine vessels, marine policy).

Fishery support programs include hydraulics, welding, diesel mechanics and business, and could also include statistics, ecosystem modeling, computer science, socio-economics, etc. In short, a fishery support program is any program that makes responsible fisheries management sustainable.

Introduction:

The charge of the strategic pathways working teams is to create and develop options for high-level structural changes that have a potential of reaching the goal of meeting 90% or more of the state's projected labor market need in fishery related jobs. The team identified numerous opportunities that would help meet the goal that would be useful whether structural changes were implemented or not. For the purposes of this report, an opportunity is any action that the university could take that would contribute to the University meeting the above stated goal regarding fisheries. An opportunity may be complementary to the options we have developed.

1. Expand current efforts to develop strong relationships with high school and middle school extra-curricular programs with ties to fisheries, or other natural resources (i.e., Tsunami Bowl, Envirothon, FFA, or 4H as well as others not listed). This would:
 - Make the university a more familiar organization to HS, and MS students.
 - Require a modest investment in money and staff time for those participating.
 - Potentially increase enrolment in natural resource degree programs.
 - Attract high quality students to UA.
 - Provide a platform for recruitment.
2. Improve existing capacity regarding distance delivery of classroom material across all UA campuses:
 - All campuses will use the same delivery platform (i.e., Blackboard Collaborate or Adobe Connect).
 - Programs will be strengthened with a consistent distance-delivery platform.

Other Opportunities for Change, continued

3. Mandate common course numbering across UA:
 - Consider use of Montana University system's model or similar programs.
 - This would require BOR approval.
 - The required hardware, software, and maintenance costs would be relatively high, as would the upfront costs.
4. Develop a statewide fisheries council to advise UA regarding ways to improve its fishery related offerings to existing and potential students:
 - Would be relatively time consuming.
 - Would require limited support for travel, venue support, and possible honorariums.
 - Would contribute to community engagement in UA's fishery enterprise.
 - Would improve existing communications between the university and industry.
5. Standardize delivery methods where possible:
 - Would limit to some extent the training requirements for new faculty and staff.
 - Would be relatively time consuming initially, but once accomplished would only require routine updates.
 - Has the potential to save money/ reduce costs of licensing multiple distance delivery platforms.
 - May require the modification of courses, at least initially.
6. Improve delivery of online courses across all campuses in terms of ease of access, speed of access, and cost to access:
 - Would be conducive to student success.
 - Would make UA more competitive with lower-48 schools.
 - Would require significant investment.
 - Is already being done at the individual MAU's to compete amongst themselves.
7. Redefine degree requirements and evaluation metrics to foster coordination between programs from different MAUs:
 - Would be difficult and require considerable leadership to achieve.
 - Would require considerable lead time to accomplish.
8. Develop a transfer program for the AAS fish tech program at UAS to the bachelor's program at UAF:
 - Would create an obvious path for students interested in careers in fisheries.
 - Would require modest amount of time to achieve.
 - Would require restructuring of either the AAS or the BS/ BA programs.
 - Would assist transition of students between UAF and UAS.
 - Would foster collaboration between UAF and UAS.

Other Opportunities for Change, continued

9. Make the AAS program more available at community campuses:
 - Would open up a new pool of prospective fisheries students.
 - Would require faculty or a program representatives at select campuses.
 - Would allow a more community centric approach to the fisheries program.
 - Would require initial investment (e.g., distant-learning capacity).

10. Increase financial aid for fisheries program students:
 - Would require investment.
 - Would require some effort to determine how those funds should be disbursed.
 - Would create an incentive for students who might otherwise not be able to participate in a fisheries program at UA.
 - Could be supplemented with funds from industry.

11. Develop articulation agreements with lower-48 community and technical colleges, and other colleges/universities (i.e., Tribal Colleges):
 - Community and technical colleges, and Tribal colleges typically award two-year degrees. In addition, some universities have two-year programs. Such agreements potentially could allow students from applicable two-year programs to enter a four-year degree program at UA.
 - Would require significant research.
 - May attract new students to the UA system.
 - Would require lengthy negotiations.
 - May be expensive.

12. Develop marketing initiatives/campaigns:
 - “Get Hooked on Fisheries”.
 - Improve publicity regarding course offerings through distance delivery.
 - Would require some resources in the Anchorage area.
 - Use Marine Advisory Program for marketing and recruitment.
 - Would increase community awareness.
 - Would require investment.

Other Opportunities for Change, continued

13. Lobby Legislators:

- Coordinate and maximize efforts with the UA professionals who currently lobby on behalf of UA.
- Would require considerable background research to initiate.
- Could be expensive.
- Would have to compete with other lobbying interests in an already crowded field.
- May have significant benefits, if successful.

14. Have shared Student Learning Outcomes (SLOs) for:

- Courses with common course numbers.
- Unique SLOs that allow for unique character.

15. Consider offering different types of courses (e.g., different format):

- E.g., a type of course offering similar to ones offered at University of Montana – Western ((Experience One (X1)) is a block scheduling program where students take courses one at a time in 18 day sessions).
- Would require administrative accommodation.
- Would change the UA college experience to some extent.
- Would require changes in course delivery.
- Would have a relatively large initial cost for set up.

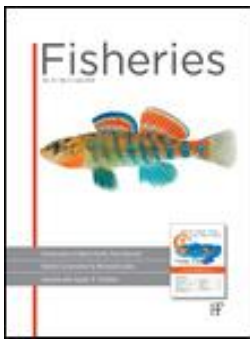
16. Expand ANSEP program in Juneau, and integrate UAA and UAF.

- Would provide for a larger and more diverse pool of students at UA fishery programs.
- Would encourage High School students with interest in marine science to consider careers in fisheries.
- Cost-effective initiative in terms of public outreach and communication.
- Excellent way to communicate with community the importance of higher education.
- Encouraging students interested in biological sciences to pursue further education and/or career in fisheries.

17. Expand 2-year associate program to provide qualification for application for NOAA's groundfish observer program.

Addendums

- ▶ Are We Preparing the Next Generation of Fisheries Professionals to Succeed in Their Careers?
- ▶ UA Maritime Education and Training Inventory, Fiscal Year 2015
- ▶ Alaska Maritime Workforce Development Plan
https://www.alaska.edu/fsmi/AKMaritimeWFDPlan_HighRes_5-22-14.pdf
- ▶ Alaska Economic Trends, Forecast for Industries and Occupations
<http://labor.alaska.gov/trends/oct16.pdf>
- ▶ McDowell Report on Industry Workforce Development Priorities
<http://apicc.org/wp-content/uploads/2016/07/McDowell-Cross-Industry-Workforce-Final-Formatted-4.28.16.pdf>



Are We Preparing the Next Generation of Fisheries Professionals to Succeed in their Careers?: A Survey of AFS Members

Steve L. McMullin, Vic DiCenzo, Ron Essig, Craig Bonds, Robin L. DeBruyne, Mark A. Kaemingk, Martha E. Mather, Christopher Myrick, Quinton E. Phelps, Trent M. Sutton & James R. Triplett

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ARE WE PREPARING THE NEXT GENERATION OF FISHERIES PROFESSIONALS TO SUCCEED IN THEIR CAREERS?

A SURVEY OF AFS MEMBERS



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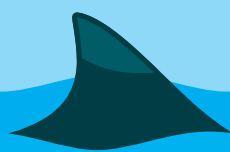
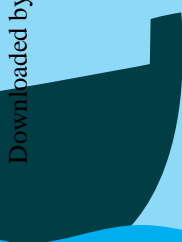
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Natural resource professionals have frequently criticized universities for poorly preparing graduates to succeed in their jobs. We surveyed members of the American Fisheries Society to determine which job skills and knowledge of academic topics employers, students, and university faculty members deemed most important to early-career success of fisheries professionals. Respondents also rated proficiency of recently hired, entry-level professionals (employers) on how well their programs prepared them for career success (students and faculty) in those same job skills and academic topics. Critical thinking and written and oral communication skills topped the list of important skills and academic topics. Employers perceived recent entry-level hires to be less well-prepared to succeed in their careers than either university faculty or students. Entry-level hires with post-graduate degrees rated higher in proficiency for highly important skills and knowledge than those with bachelor's degrees. We conclude that although universities have the primary responsibility for developing critical thinking and basic communication skills of students, employers have equal or greater responsibility for enhancing skills of employees in teamwork, field techniques, and communicating with stakeholders. The American Fisheries Society can significantly contribute to the preparation of young fisheries professionals by providing opportunities for continuing education and networking with peers at professional conferences.

¿Estamos preparando a la siguiente generación de profesionales en pesquerías para que tengan éxito en sus carreras?: una encuesta a miembros de la AFS

Los profesionales de los recursos naturales, con frecuencia, han criticado a las universidades por la preparación deficiente de los graduados para tener éxito en sus trabajos. En este trabajo se encuestaron a miembros de la Sociedad Americana de Pesquerías para determinar qué conocimiento de tópicos académicos y habilidades laborales consideran los empleadores, estudiantes y miembros de facultades universitarias como las más importantes en los profesionales de las pesquerías para tener éxito al inicio de sus carreras. Los encuestados también reconocieron las habilidades de los profesionistas regresados y contratados (empleados) o qué tan bien sus programas académicos los preparaban para tener éxito en sus carreras (estudiantes y facultad) en las mismas habilidades laborales y tópicos académicos. El pensamiento crítico y las habilidades de comunicación oral y escrita encabezaron la lista de habilidades y tópicos académicos importantes. Los empleadores percibieron a las contrataciones recientes como menos preparadas para tener éxito en sus carreras que los miembros de la facultad o los propios estudiantes. Los individuos recién contratados con posgrado fueron mejor calificados en cuanto a poseer el conocimiento y las habilidades más importantes que los titulados de licenciatura. Concluimos que si bien las universidades tienen la responsabilidad primordial de desarrollar el pensamiento crítico y las habilidades de comunicación en los estudiantes, los empleadores tienen la misma o mayor responsabilidad para fomentar las habilidades de sus trabajadores en lo referente a trabajo en equipo, técnicas de trabajo en campo, y comunicación con los involucrados en las pesquerías. La Sociedad Americana de Pesquerías puede contribuir significativamente a preparar a los jóvenes profesionistas de las pesquerías mediante el otorgamiento de oportunidades para continuar con su educación y el establecimiento de redes de contactos, durante conferencias, con pares y profesionales.

Préparons-nous la prochaine génération de professionnels de la pêche à réussir leur carrière?: Un sondage auprès des membres AFS

Les professionnels des ressources naturelles ont fréquemment critiqué les universités, car elles préparent mal les diplômés à réussir leur carrière. Nous avons interrogé les membres de l'American Fisheries Society pour déterminer quelles compétences professionnelles et quelles connaissances académiques les employeurs, étudiants et membres du corps professoral des universités jugent les plus importantes pour le succès des professionnels de la pêche au début de leur carrière. Les répondants ont également évalué l'aptitude des professionnels récemment entrés sur le marché du travail (employeurs) ou dans quelle mesure les programmes les ont préparés à réussir leur carrière (étudiants et professeurs) dans ces mêmes compétences professionnelles et sujets académiques. La pensée critique, les compétences en communication écrite et orale étaient en tête de la liste des compétences et des sujets académiques importants. Les employeurs ont perçu les professionnels récemment entrés sur le marché du travail moins bien préparés pour réussir leur carrière que les professeurs d'université ou les étudiants. Les employés au niveau d'entrée possédant des diplômes postuniversitaires étaient mieux notés dans la maîtrise des compétences et des connaissances très importantes que ceux ne possédant que des diplômes de baccalauréat. Nous concluons que, bien que les universités aient la responsabilité principale de développer la pensée critique et les compétences en communication de base des étudiants, les employeurs ont la responsabilité égale ou supérieure d'améliorer ces compétences dans le travail d'équipe, les techniques de terrain et la communication avec les parties prenantes. L'American Fisheries Society peut contribuer de manière significative à la préparation des jeunes professionnels de la pêche en offrant des possibilités de formation continue et de réseautage avec des pairs lors de conférences professionnelles.

INTRODUCTION

University programs that prepare students to enter the fisheries profession face a difficult task due to the complex and diverse nature of the field. Classmates in a single university program may become fisheries professionals but go into jobs with primary responsibilities in areas as diverse as fish ecology, population dynamics, population or habitat manipulation, water quality, human dimensions, economics, aquaculture, or numerous other specialty areas. Due to the complexity of the field, fisheries professionals (as well as other natural resource professionals) have debated the content of the "ideal" university

curriculum for almost as long as the professions have existed (Leopold 1939).

Numerous symposia at professional conferences and publications in natural resource journals over the past 40 years have addressed the issue of how best to prepare students to become successful natural resource professionals. Several common themes that emerged from those symposia included discussions of the merits of broad and general undergraduate curricula versus more specialized curricula and frequent calls for more emphasis on communication skills. These themes are described in more detail below.

First, the complexity and diversity of fisheries (and other natural resource fields) makes it impossible to adequately prepare students in basic sciences, humanities, communications, specific topics related to fisheries science and management, and critical job skills (e.g., ability to communicate effectively in writing and speaking, working in teams) during a four-year undergraduate program (Chapman 1979; Oglesby and Krueger 1989; Applegate 2009). Furthermore, employers frequently criticized universities for producing students they perceived as too narrowly focused on research questions and poorly prepared in basic skills needed by management-oriented employers (Donaldson 1979; Olmsted 1979; Cutler 1982).

Second, numerous authors suggested that undergraduate curricula should have a broad, interdisciplinary focus rather than a narrow, specialized focus (Hester 1979; Oglesby and Krueger 1989; Hard 1995), and that broad undergraduate programs should focus on developing critical thinking and problem-solving skills of students (Eastmond and Kadlec 1977; Donaldson 1979; Oglesby and Krueger 1989). Specialization should be left to graduate studies (Eipper 1973; Hester 1979). Bleich and Oehler (2000) suggested that more specialized undergraduate education leads to weaker, basic knowledge that hinders professional success of wildlife professionals.

Third, universal recognition of the importance of good written and oral communication skills in contributing to career success (for example, see Royce 1973; Stauffer and McMullin 2009; Blickley et al. 2012) has not resulted in desired proficiency in communication skills of students. Employers frequently cite communication skills of newly hired employees as their greatest deficiency (Cannon et al. 1996; Machnik et al. 2008; CNRS 2011; Sundberg et al. 2011; Sample et al. 2015).

Fourth, the broad category of people skills (e.g., interpersonal communication skills, working in teams, project management, human dimensions, policy processes) received almost as much attention as written and oral communication skills and, as with communication skills, nearly all authors believed that young professionals lacked well-developed people skills (Eastmond and Kadlec 1977; Hester 1979; Kelso and Murphy 1988; Crawford et al. 2011).

Fifth, authors frequently cited the lack of practical field skills among newly hired employees. Lack of experience in the field came up less frequently than the deficiencies in communication skills (Chapman 1979; Applegate 2009; Miller et al. 2009). Nevertheless, complaints about college graduates lacking field skills go back as far as Leopold's (1939:156) lament that "too few schools offer good instruction in the field operations of wildlife management and administration; too many offer indifferent training in wildlife science and research."

Finally, numerous authors suggested that employers should share in the responsibility of developing skills critical to career success of young professionals. Employers' contributions should focus on on-the-job training and support for continuing education (e.g., see Hester 1979; Kelso and Murphy 1988; McMullin et al. 2009).

As the first decade of the 21st century gave way to the second decade, this suite of concerns for the adequacy of university programs in preparing future natural resource professionals took on greater urgency as employers paid increasing attention to generational change in the workplace and workforce planning (McMullin 2005; Millenbah et al. 2011). Workforce planning involves more than supplying enough workers to replace those who retire; it also involves recruiting talented new employees and developing skills of existing

employees so that they may move into positions of leadership vacated by retiring senior employees (Pynes 2004). Bieda (2011) attributed some of the persistently high unemployment in the United States workforce to a deficiency in the number of qualified workers to fill existing job openings.

Three major natural resource professional societies have addressed the adequacy of academic preparation of the next generation of natural resource professionals. A special committee of The Wildlife Society (TWS) assessed forces affecting university programs (McDonald et al. 2009) and reviewed university websites to determine that more than 400 universities in the United States offered wildlife, natural resource, or environmental science/management degrees (Wallace and Baydack 2009). The special committee also surveyed TWS members to assess perceptions of employers in the governmental, nongovernmental, and private sectors regarding the importance of various topics to the career success of entry-level hires, including how well-prepared recent entry-level hires were in those same topic areas (Stauffer and McMullin 2009). A few years later, the American Fisheries Society (AFS) followed a similar path when President John Boreman appointed the Special Committee on Educational Requirements and charged it with similar tasks, including assembling a list of North American colleges and universities offering degrees in fisheries and fisheries-related disciplines, conducting a survey of employers to determine what university coursework expectations they have for newly hired employees, and comparing university curricula with employer expectations for expertise of newly hired employees and with the U. S. Office of Personnel Management standards for entry into the federal 480 job series (Essig, this issue). In 2015, the Society of American Foresters devoted an entire issue of the *Journal of Forestry* to forestry education and employer expectations (Bullard 2015).

In this article, we present the results of a survey of AFS members conducted in response to the charge by AFS President Boreman and designed to address the following research questions:

1. What knowledge and job skills do students, university faculty members, and employers deem most important in contributing to early career success of entry-level hires?
2. Are students adequately prepared to succeed as fisheries professionals, and do students, faculty, and employers agree on how well students are prepared?
3. Does postgraduate education contribute significantly to perceptions of how well prepared students are to succeed as fisheries professionals?
4. What should be done to better prepare future fisheries professionals to succeed in their careers, and who should take primary responsibility to improve their preparation?

METHODS

During summer 2013, we invited all 9,214 members of the AFS listserv to participate in an online survey. Sampling from the AFS listserv membership allowed us to secure a broadly representative sample of employers, students, and university faculty in the fisheries profession, including adequate samples of employers in the federal, state, and nongovernmental organization (NGO) sectors, as well as private-sector employers (e.g., utility companies, consulting firms), university faculty, and students. We also hoped to receive enough responses from tribal/First Nation representatives to enable valid analyses.

We could not assign individual passwords, so two follow-up reminders were sent to all listserv members. Because we could not distinguish between respondents and nonrespondents in the listserv population, we relied upon comparison of key demographic characteristics of respondents and all AFS members to assess representativeness of the sample.

The first question of the survey asked the respondents to identify their employers (state/provincial agency, federal agency, tribal/First Nation entity, NGO, private-sector employer, university, student). University faculty members' and students' responses to the first question led them to unique sections of the survey that asked them to rate the importance to career success of 14 topics related to AFS academic requirements for certification as an Associate Fisheries Professional. Six topics in the survey related specifically to fisheries, four topics related to other biological sciences, and single items addressed each of the physical sciences, mathematics/statistics, communications, and human dimensions categories of the AFS professional certification framework. In addition to the certification-related academic topics, we asked respondents to rate the importance of seven other job-related skills to career success: written communication, oral communication, communicating to nontechnical audiences, critical thinking, working in teams, practical field skills, and a general assessment of technical knowledge of fisheries/aquatic sciences. We also asked students and university faculty to rate how well they thought their academic programs prepared them to succeed as fisheries professionals. We asked students to respond with respect to the degree sought (B.A./B.S., M.A./M.S., Ph.D.). University faculty at institutions with graduate programs answered two identical sets of questions: one for their undergraduate program and one for their graduate program. All nonacademic respondents answered a similar set of questions designed for employers. However, we asked employers to rate the perceived proficiency of recently hired entry-level employees (with the degree most commonly required of entry-level hires by their organization) in each of the certification topics and job-related skills. We compared perceptions of proficiency of recently hired B.S.-level graduates to perceived proficiency of M.S.-level graduates for state agency and NGO employers using a *t*-test. We compared perceived proficiency of recently hired B.S.-, M.S.-, and Ph.D.-level graduates in federal agencies and private-sector employers

using analysis of variance, followed by a post-hoc Duncan's multiple range test.

All respondents answered questions near the end of the survey designed to assess the level of responsibility of universities, employers, and professional societies in developing knowledge and job skills of fisheries professionals. We also asked all respondents to rate perceived effectiveness of various strategies for developing knowledge and job skills (e.g., revising university curricula, continuing education, participating in AFS, revising the AFS Professional Certification Program).

RESULTS AND DISCUSSION

Response Rate and Respondent Characteristics

Sixteen percent of all listserv members ($n = 1,490$) responded to the survey. Although the low response rate raises the possibility of nonresponse bias, both the geographic distribution of respondents (Figure 1; χ^2 test, $df = 1$, $P = 0.32$), and the mix of students and working professionals in our sample closely matched the overall AFS membership. Students comprise 16.1% of AFS members and made up 15.5% ($n = 231$) of our sample. These comparisons suggest that our sample reasonably represented the members of AFS.

State, federal, and NGO employers hired entry-level professionals predominately at the master's degree level (Figure 2). Tribal/First Nation employers hired mostly at the bachelor's degree level. Only federal and private-sector employers hired a significant number of entry-level employees at the Ph.D. level. Although we report responses of NGO and tribal/First Nation employers, the reader should exercise caution in drawing conclusions about those employer groups due to small sample sizes.

Graduate students provided 87% of the student responses, and 70% of students responding attended public land grant universities. Seventy-four percent of students were enrolled in fisheries programs, combined fisheries and/or wildlife programs, or marine biology programs. The other 26% of students were enrolled in biology/zoology, environmental science, or conservation biology programs. University faculty responses closely resembled those of students, with 61% employed by public land grant universities and 56% housed in fisheries and/or wildlife departments.

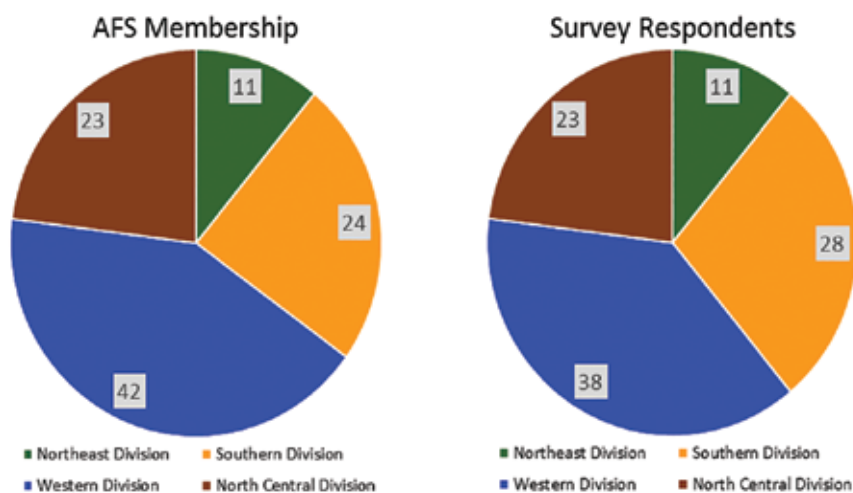


Figure 1. Percentage of AFS members in each of the four geographic Society-level Divisions and percentage of survey respondents in each of those Divisions.

Table 1. Mean ratings of the importance of job skills (A) and knowledge of academic topics addressed by the AFS certification program (B) in contributing to successful careers for entry-level professionals (biologists/scientists/managers) in the fisheries profession by undergraduate (UG), master's (MS), and Ph.D. students; university faculty (Faculty); and employers in state/provincial agencies (State), federal agencies (Fed), tribal/first nation organizations (Tribe), nongovernmental organizations (NGO), and the private sector (Private). Rating scale was 1 = not at all important to 10 = very important.

	Universities				Employers				
	UG n = 30	MS n = 105	Ph.D. n = 88	Faculty n = 184	State n = 472	Fed n = 227	Tribe n = 27	NGO n = 55	Private n = 192
A. Skill/knowledge area									
Effective written communication skills	9.1	9.2	9.0	9.2	9.0	9.2	8.4	9.3	9.1
Effective oral communication skills	9.4	9.3	9.0	9.2	9.0	9.1	8.6	9.2	9.0
Ability to communicate effectively with nontechnical audiences	9.2	9.1	8.8	8.9	8.9	8.5	8.1	9.1	8.4
Critical thinking skills	9.5	9.3	9.2	9.3	9.0	9.0	8.8	9.3	9.0
Working in teams	8.8	8.9	9.0	9.0	8.7	9.0	8.4	9.1	8.8
Practical field skills	9.1	9.0	8.5	8.6	8.5	8.1	8.4	7.4	8.5
Technical knowledge of fisheries/aquatic sciences	8.8	8.9	8.8	8.7	8.5	8.6	8.6	7.9	8.4
B. AFS certification area									
Fisheries management	8.5	8.9	8.6	8.5	8.6	7.6	7.4	7.4	6.2
Fish ecology	8.8	8.9	8.9	8.8	8.1	8.3	8.3	7.8	7.7
Fisheries techniques	8.3	8.6	8.4	8.3	8.5	7.8	8.2	5.9	8.1
Aquaculture	7.0	5.9	5.8	5.4	5.1	4.4	5.7	4.5	3.7
Limnology/aquatic/marine ecology	8.0	7.5	7.9	7.8	6.6	6.8	6.0	5.9	6.9
Population dynamics	8.6	8.2	8.6	8.2	7.8	7.4	7.1	6.2	6.2
Conservation biology	8.4	7.6	8.0	7.6	6.6	7.8	6.8	7.8	6.3
Ichthyology	8.5	7.5	7.2	7.9	7.0	6.5	5.8	6.1	6.7
Aquatic entomology/invertebrate zoology	7.5	6.2	6.2	6.7	5.2	5.7	5.1	5.3	5.8
Other biological sciences	8.4	7.6	8.2	8.2	6.9	7.3	6.0	7.4	7.1
Physical sciences	7.2	6.6	7.0	7.2	5.7	6.2	5.5	5.5	6.1
Mathematics/statistics	8.2	8.5	8.6	8.4	7.5	7.3	6.6	6.5	7.2
Communications courses	8.4	8.6	8.9	9.0	8.7	8.4	7.5	8.3	8.6
Human dimensions/policy	7.5	7.5	7.9	7.5	7.5	7.0	5.8	7.4	6.6

Research Questions 1 and 2: What knowledge and skills contribute most to early career success, and how well prepared are students to succeed?

Overall, employers rated critical thinking skills and oral and written communication skills as the most important contributors to career success of entry-level employees. Communication courses and fisheries-specific topics rated highest in importance among academic topics, whereas aquaculture, aquatic entomology/invertebrate zoology, and physical sciences rated lowest in importance (Figure 3). Overall mean importance ratings for all job skills and academic topics, with the exception of aquaculture, exceeded the midpoint (5.5) of the 1–10 scale, suggesting that respondents considered all of those topics as at least moderately important. Differences in importance rankings of job skills and academic topics among students at every degree level, faculty members, and employers in every category were minor and generally consistent with the missions of employers (Table 1). For example, whereas all employers included communication courses and fish ecology among their five highest-rated academic topics, state agency employers rated fisheries management among their top five academic topics. Federal agency employers, which frequently deal with conservation of imperiled species, rated conservation biology among their five most important topics. Nongovernmental organizations ranked conservation biology and human dimensions/policy among their five most important topics.

Regardless of the level of education at which employers hire entry-level employees, what employers desire most includes the ability to think critically and to communicate effectively in

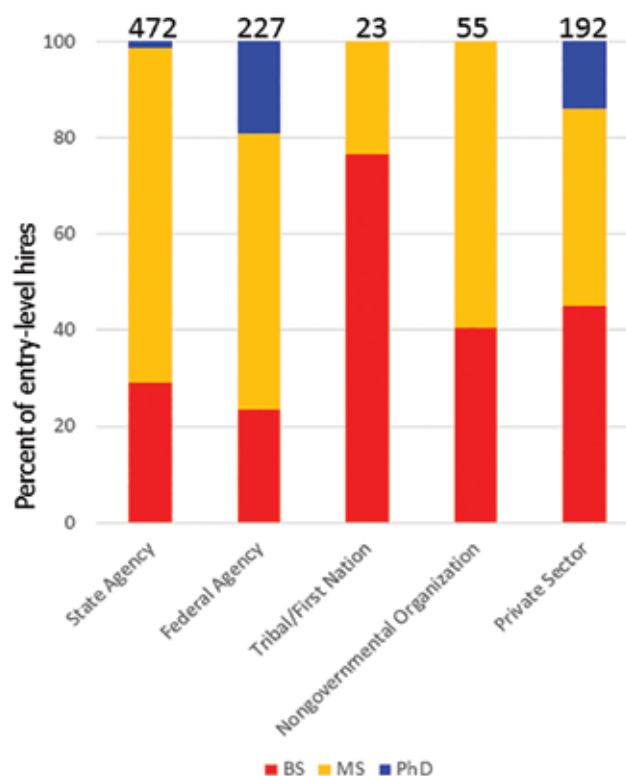


Figure 2. Percentage of entry-level hires with B.S., M.S., and Ph.D. degrees by employer. Numbers at the top of the bars are sample sizes for each employer type.

Table 2. Mean ratings by undergraduate students (UG) and university faculty (Faculty) of how well university undergraduate curricula prepare students in job skills (A) and academic topics addressed by the AFS certification program (B) and perceptions of employers in state/provincial agencies (State), federal agencies (Fed), tribal/first nation organizations (Tribe), nongovernmental organizations (NGO), and the private sector (Private) who hire primarily B.S.-level graduates of the proficiency of B.S. graduates as entry-level professionals (biologists/scientists/managers) in the fisheries profession. Rating scales were 1 = very poorly to 10 = very well (for students and faculty) and 1 = not at all proficient to 10 = very proficient (for employers).

	Universities		Employers				
	UG n = 30	Faculty n = 184	State n = 472	Fed n = 227	Tribe n = 27	NGO n = 55	Private n = 192
A. Skill/knowledge area							
Effective written communication skills	8.2	6.8	5.6	5.4	5.6	6.1	6.2
Effective oral communication skills	7.8	6.9	5.7	5.5	5.7	5.8	5.9
Ability to communicate effectively with nontechnical audiences	6.7	6.1	5.8	5.7	6.6	6.2	5.7
Critical thinking skills	8.2	6.8	5.7	5.4	6.1	6.2	6.2
Working in teams	7.4	7.2	7.1	6.5	6.4	7.2	7.0
Practical field skills	7.9	6.9	6.6	6.2	6.3	5.2	6.4
Technical knowledge of fisheries/aquatic sciences	8.1	7.1	6.3	6.4	5.6	4.9	6.3
B. AFS certification area							
Universities							
Employers							
	UG n = 30	Faculty n = 184	State n = 472	Fed n = 227	Tribe n = 27	NGO n = 55	Private n = 192
Fisheries management	7.6	6.9	5.4	5.2	4.8	4.1	4.6
Fish ecology	7.8	7.3	5.8	6.0	6.2	5.5	5.5
Fisheries techniques	7.1	6.6	5.9	6.2	6.0	4.3	5.1
Aquaculture	5.2	4.4	3.9	3.3	4.4	3.4	3.2
Limnology/aquatic/marine ecology	7.7	7.2	4.9	4.7	4.8	4.2	5.0
Population dynamics	7.8	7.0	4.5	4.5	5.0	3.4	4.0
Conservation biology	7.6	7.0	5.6	5.0	5.4	4.6	4.9
Ichthyology	8.5	7.0	5.5	5.2	4.7	4.3	4.8
Aquatic entomology/invertebrate zoology	7.3	6.0	3.8	4.5	4.6	4.1	4.5
Other biological sciences	9.0	8.0	6.2	5.6	5.7	5.4	6.3
Physical sciences	7.6	7.1	5.2	4.9	5.0	4.4	5.4
Mathematics/statistics	7.8	6.9	4.9	4.8	4.9	4.4	5.3
Communications courses	7.8	6.6	4.9	5.1	5.2	5.0	5.1
Human dimensions/policy	6.4	6.2	4.4	4.5	4.1	4.8	4.7

In addition to the desire for greater quantitative skills, employers desire graduates who understand and appreciate the social science, policy, and administrative aspects of fisheries conservation.

both writing and speaking. Although employers, university faculty, and students also identified fisheries-specific courses and quantitative courses as highly important, all employers rated all of the 14 academic topics and seven basic job skills (with few minor exceptions) as at least somewhat important. These findings are consistent with several of the themes found throughout the literature for at least 40 years, including the need for a broad, interdisciplinary undergraduate education that stresses critical thinking, problem-solving, and communication skills (e.g., Royce 1973; Donaldson 1979; Oglesby and Krueger 1989; Hard 1995; Stauffer and McMullin 2009).

Undergraduate students generally believed that their university curricula prepared them well to succeed in entry-level positions for all job skills and academic topics except aquaculture (Table 2). University faculty members also tended to rate their programs' undergraduate curricula as preparing students well to succeed in entry-level positions, with only aquaculture receiving a preparation rating less than 6.0 on the

10-point scale (4.4). However, faculty members rated every item lower than undergraduate students. Undergraduate students and faculty members differed most in perceptions of how well their curricula prepared students to succeed in entry-level jobs for ichthyology, critical thinking skills, and effective written communication skills.

Employers who hired entry-level employees primarily at the bachelor's degree level rated the proficiency of recently hired graduates substantially lower compared to both undergraduate students' and faculty members' ratings of how well their undergraduate programs prepared them to succeed in all job skills and academic topics (Table 2). Nongovernmental organization employers rated proficiency on all 14 academic topics below the midpoint of the 10-point scale and private-sector employers rated all but one of the items below the midpoint. All employer groups rated proficiency of recent entry-level hires below the midpoint on more than half of the 14 academic topics. Employers rated recent entry-level hires approximately two to three points lower than undergraduate students and one to two points lower than faculty members for critical thinking skills, effective written communication skills, effective oral communication skills, and technical knowledge of fisheries/aquatic sciences. Although job skills and academic topics that rated highest and lowest in importance tended to follow similar patterns for proficiency, the difference between importance and proficiency ratings differed notably for population dynamics, mathematics/statistics, and human dimensions/policy (Figure 4).

Respondents consistently rated proficiency (or in the case of

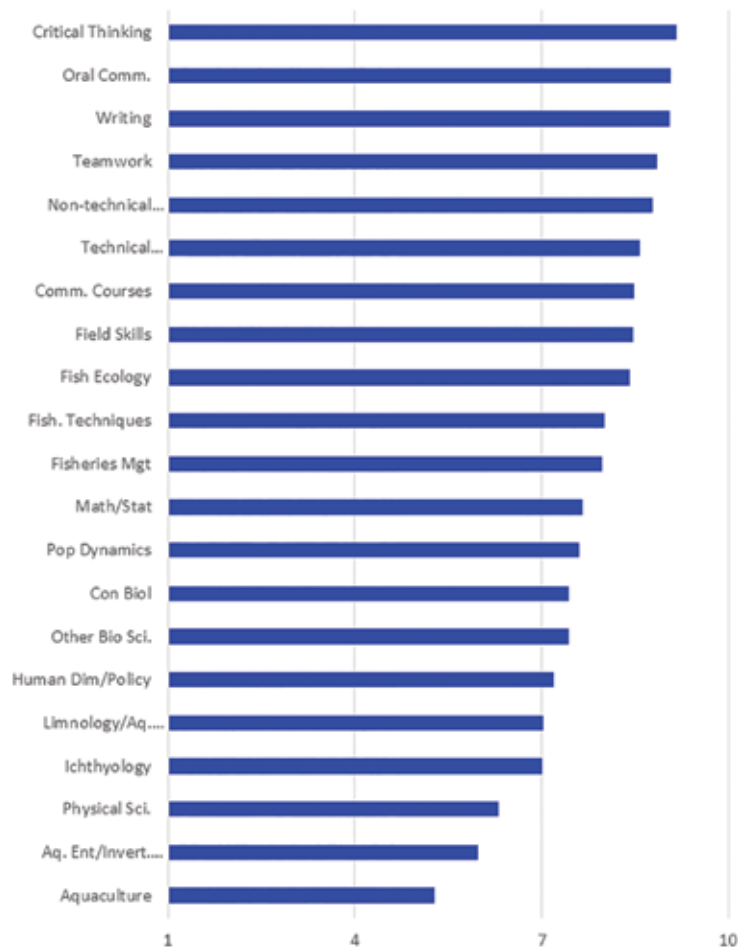


Figure 3. Overall ratings by all employers of the importance of job skills and academic topics to career success of entry-level hires.

faculty and students, preparation) lower on a 10-point scale than they did importance (also on a 10-point scale) of job skills and academic topics. Although the response scales are similar, they do not provide exact matches for comparisons. Nevertheless, the lower proficiency ratings (often by two or more points) suggest that employers do not feel that entry-level hires perform as well in basic job skills and academic topics as desired. Stauffer and McMullin (2009) found a similar pattern in responses of wildlife professionals. The greatest differences between importance and proficiency ratings occurred for the most important job skills: critical thinking, written communication, and oral communication.

Fisheries curricula will, and should, continue to include a substantial component of liberal arts, consistent with the recommendations found in several previously published papers (Hester 1979; Oglesby and Krueger 1989). Employer responses to this survey suggested that the central focus of fisheries curricula should be in fisheries-specific courses, communications, and mathematics/statistics. Employer responses mirror the recommendations found in previous papers that emphasized the need for greater quantitative skills among fisheries graduates (Hard 1995; USDOC and USDE 2008). The greatest disparities between employers' perceptions of importance and proficiency relative to academic topics occurred in the areas of population dynamics, mathematics/statistics, and human dimensions. Thus, in addition to the

The message to students should be clear: they should view a bachelor's degree as a stepping stone on the way to postgraduate education if they wish to maximize their chances of becoming a successful fisheries professional.

desire for greater quantitative skills, employers desire graduates who understand and appreciate the social science, policy, and administrative aspects of fisheries conservation. The need for increasing knowledge of human dimensions in natural resources has long been recognized (Cutler 1982; Kelso and Murphy 1988; Peek 1989; Decker and Enck 1996). Of course, all of these needs compete with the desire to maintain a "hands-on" educational experience so that natural resource graduates develop strong field skills as well as topical knowledge (Sample et al. 2015).

Research Question 3: Does postgraduate education contribute significantly to perceptions of how well prepared students are to succeed as fisheries professionals?

Master's students also felt that their programs prepared them well for entry-level positions, especially in the basic job skills, where their ratings exceeded those of undergraduate students on five of the seven skills (Table 3). In contrast, master's students rated their program preparation lower than undergraduate students on all but one of the academic topics.

University faculty rated their programs' preparation of graduate students (both master's and doctoral degrees) for entry-level positions similarly to the master's students' ratings for basic job skills (Table 3). In contrast to their lower ratings for undergraduate students, faculty members rated master's students' preparation higher than the students did for critical thinking skills, practical field skills, technical knowledge of fisheries/aquatic sciences, and 11 of the 14 academic topics (Table 3). Curiously, master's students rated their programs substantially lower than faculty members in preparing them for entry-level jobs in the academic topics of population dynamics and mathematics/statistics, both of which receive substantial emphasis in most graduate fisheries programs.

Employers who hired entry-level employees primarily at the master's degree level rated the proficiency of recently hired employees higher than employers that hired at the bachelor's degree level. State agency employers that hired entry-level professionals with master's degrees rated proficiency of those employees significantly higher ($P < 0.05$) for four of the seven basic job skills, and all five academic topics they rated as most important to early career success (communication courses, fisheries management, fisheries techniques, fish ecology, population dynamics) compared to state agency employers hiring bachelor's degree entry-level hires (Table 4).

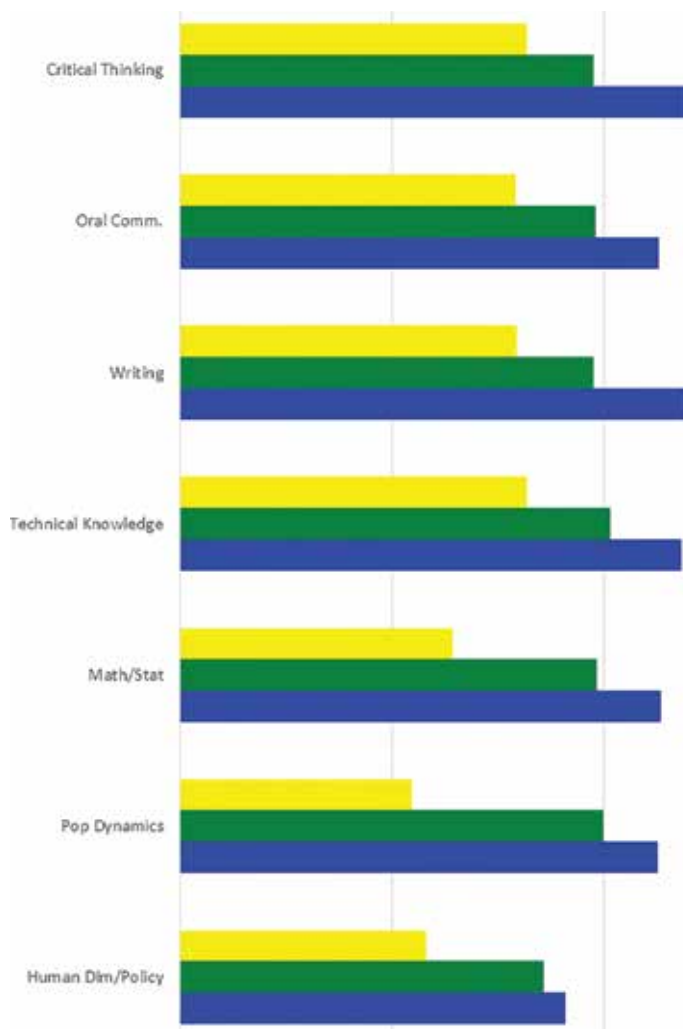


Figure 4. Comparison of employers' perceived proficiency of entry-level hires with B.S. degrees and the perceptions by university faculty and undergraduate students of how well their undergraduate curricula prepared them to succeed as entry-level professionals.

Federal employers also rated proficiency of entry-level employees with postgraduate degrees significantly higher than bachelor's degree entry-level hires ($P < 0.05$) for critical thinking, written communication, and oral communication skills (Table 5). Among the five academic topics federal employers rated as most important to early career success (communication courses, fish ecology, conservation biology, fisheries techniques, fisheries management), proficiency of entry-level hires with postgraduate degrees was rated higher only for fish ecology and conservation biology. Federal employer perceptions of the proficiency of entry-level employees with Ph.D. degrees did not differ greatly from perceived proficiency of master's students, with the exception of population dynamics and aquatic entomology/invertebrate zoology.

Although nongovernmental organization employers perceived large gains in proficiency among master's degree entry-level hires compared to employees with bachelor's degrees (range = 0.83 to 1.67; Table 3) in the five academic topics they deemed most important to career success (communications courses, fish ecology, fisheries management, conservation biology, human dimensions/policy), the differences did not differ significantly ($P > 0.05$), probably because of the small

sample size of NGO respondents. Private-sector employers did not perceive significant gains in proficiency in the five academic topics they deemed most important to career success (communications courses, fish ecology, fisheries techniques, mathematics/statistics, other biological sciences) for any degree level ($P > 0.05$).

Increases in perceived proficiency for entry-level employees hired at the postgraduate level in state and federal agencies provide evidence of the value of advanced fisheries education and may help to explain why the largest employers of fisheries professionals hire the majority of their entry-level professionals at the postgraduate level (Kaemingk et al. 2013). The message to students should be clear: they should view a bachelor's degree as a stepping stone on the way to postgraduate education if they wish to maximize their chances of becoming a successful fisheries professional. Although some professional-level jobs are available to graduates with bachelor's degrees, more often, the bachelor's degree provides preparation for graduate school or technician-level jobs. Employers valued critical thinking and communication skills above all else in their entry-level employees, and postgraduate education clearly enhanced the perception of proficiency in those skill areas.

Research Question 4: What should be done to better prepare future fisheries professionals to succeed in their careers and who should take primary responsibility to improve their preparation?

Overall, respondents indicated that both universities and employers should have major roles in developing important job skills of entry-level professionals, with professional societies playing a lesser role (Table 6). Respondents suggested that universities had greater responsibility than employers or professional societies for developing critical thinking and written and oral communication skills of young professionals. In contrast, respondents suggested that employers had equal or slightly greater responsibility than universities for developing the ability to communicate effectively with nontechnical audiences, working in teams, and practical field skills.

Respondents rated experiential learning opportunities, such as internships and student participation in undergraduate research, as most effective in enhancing the knowledge, skills, and abilities of entry-level fisheries professionals (Figure 5). Continuing education workshops, revising university curricula, and involvement in AFS also rated high as effective strategies, whereas establishing university program accreditation rated slightly lower, and revision of the AFS professional certification criteria ranked lowest in effectiveness.

Most of the literature addressing how to adequately prepare students and young professionals to become highly effective natural resource professionals focuses on how universities can do a better job of educating students (e.g., Chapman 1979; Donaldson 1979; Kelso and Murphy 1988; Oglesby and Krueger 1989; Bullard 2015). We submit that the responsibility for meeting the challenge of preparing the next generation of fisheries professionals rests with the entire profession, not only with universities. The high ratings by respondents for both universities and employers (and, to a lesser extent, professional societies) to our question about who should be responsible for developing job skills suggests that the majority of AFS members agree with us. To

Table 3. Mean ratings by master's students (MS) and university faculty (Faculty) of how well university graduate curricula prepare students in job skills (A) and academic topic addressed by the AFS certification program (B) and perceptions of employers in state/provincial agencies (State), federal agencies (Fed), tribal/first nation organizations (Tribe), nongovernmental organizations (NGO), and the private sector (Private) who hire primarily MS-level graduates of the proficiency of MS graduates as entry-level professionals (biologists/scientists/managers) in the fisheries profession. Rating scales were 1 = very poorly to 10 = very well (for students and faculty) and 1 = not at all proficient to 10 = very proficient (for employers).

A. Skill/knowledge area	Universities		Employers				
	MS n = 105	Faculty n = 184	State n = 472	Fed n = 227	Tribe n = 27	NGO n = 55	Private n = 192
Effective written communication skills	8.3	8.2	6.5	6.6	7.8	6.8	6.0
Effective oral communication skills	8.2	8.2	6.5	6.6	8.0	6.6	5.9
Ability to communicate effectively with nontechnical audiences	7.5	7.0	6.1	6.1	7.3	6.7	5.5
Critical thinking skills	8.2	8.3	6.5	6.4	7.0	7.1	6.5
Working in teams	7.6	7.5	7.3	6.9	9.0	7.3	7.2
Practical field skills	7.5	7.9	7.0	6.8	7.0	6.3	6.4
Technical knowledge of fisheries/aquatic sciences	7.8	8.1	7.2	7.0	7.3	6.4	6.7
B. AFS certification area	Universities		Employers				
	MS n = 105	Faculty n = 184	State n = 472	Fed n = 227	Tribe n = 27	NGO n = 55	Private n = 192
Fisheries management	7.4	7.5	6.8	6.5	6.0	5.5	5.0
Fish ecology	7.6	8.0	6.9	6.9	7.5	6.3	6.2
Fisheries techniques	7.4	7.0	6.8	6.4	7.0	4.9	6.1
Aquaculture	4.3	4.9	4.1	4.2	5.0	3.5	3.4
Limnology/aquatic/marine ecology	6.0	7.3	5.4	5.5	7.0	5.2	5.4
Population dynamics	7.0	8.0	5.9	5.5	7.3	5.1	4.7
Conservation biology	6.7	7.5	6.1	6.2	7.5	6.2	5.3
Ichthyology	6.1	6.4	6.3	5.7	7.5	5.0	5.1
Aquatic entomology/invertebrate zoology	5.2	5.9	5.0	4.7	7.0	4.1	4.7
Other biological sciences	7.1	7.6	6.8	6.9	7.3	7.4	6.3
Physical sciences	5.7	6.5	5.6	5.5	6.3	5.6	5.5
Mathematics/statistics	7.2	8.0	6.1	5.9	5.8	5.6	5.8
Communications courses	7.2	7.1	5.7	5.8	6.8	6.3	5.4
Human dimensions/policy	6.3	6.2	4.7	5.2	4.0	6.4	4.4

effectively prepare the next generation of fisheries professionals, members of the profession should understand the unique challenges that students, university programs, and employers face and then collaborate to develop strategies to address those challenges.

What Can Students Do?

Today's university students face greater economic pressures to complete their education more quickly than previous generations of students. For example, the total cost of tuition, fees, and room and board at public institutions of higher education in the United States (where the majority of fisheries students get their education) increased by 40% between the 2001–2002 and 2011–2012 academic years (USDE 2013). During that same time period, the Consumer Price Index increased 27% (USBLS 2014). The cumulative student loan debt (in constant 2009 dollars) for graduates with bachelor's degrees in 2008 averaged US\$24,700, 65% more than that of 1993 graduates (Woo and Soldner 2013). As a result of that economic pressure, many students seek to minimize their total expenses by taking summer classes in an effort to shorten their degree programs by one or more semesters. However, taking classes in summer often prevents students from gaining the experiential learning they could acquire through summer employment in the fisheries field. Students who wish to be competitive for jobs (or graduate school) in the fisheries field must balance their desire to complete their education quickly with the enhancement of their résumés that results from internships, undergraduate research, and other forms of experiential learning (Kaemingk et al. 2013).

Although most undergraduate curricula in fisheries and

wildlife are so packed with university-mandated general education requirements and degree-specific requirements that little room is left for elective courses, results of our survey suggest that students would be wise to focus on communication-related courses for the few elective courses they can take.

Similarly, graduate students (especially at the M.S. level) usually have few opportunities for elective courses beyond the degree-specific requirements (which often include multiple courses in quantitative subjects in addition to fish and wildlife courses). Graduate students also could benefit from more coursework in communications. In recognition of this need, numerous universities have developed graduate courses specifically addressing communication of science to nonscientific audiences (e.g., see Alan Alda Center for Communicating Science, www.centerforcommunicatingscience.org).

The Millennial generation (those born between 1981 and 1995) of students currently in college and entering the profession may be less patient with “paying their dues” to acquire knowledge and skills that normally come with more formal education and experience (Millenbah et al. 2011). Millennials also tend to overestimate their abilities. Sixty-nine percent of college freshmen responding to the Cooperative Institutional Research Program's Freshman Survey in 2012 rated themselves among the top 10% or above average in academic ability (Pryor et al. 2012). Curiously (and perhaps ominously, given the importance employers attach to communication skills), 46% of those same students rated themselves among the top 10% or above average in writing ability.

Superior academic performance (actually being a high achiever rather than perceiving it to be true), combined

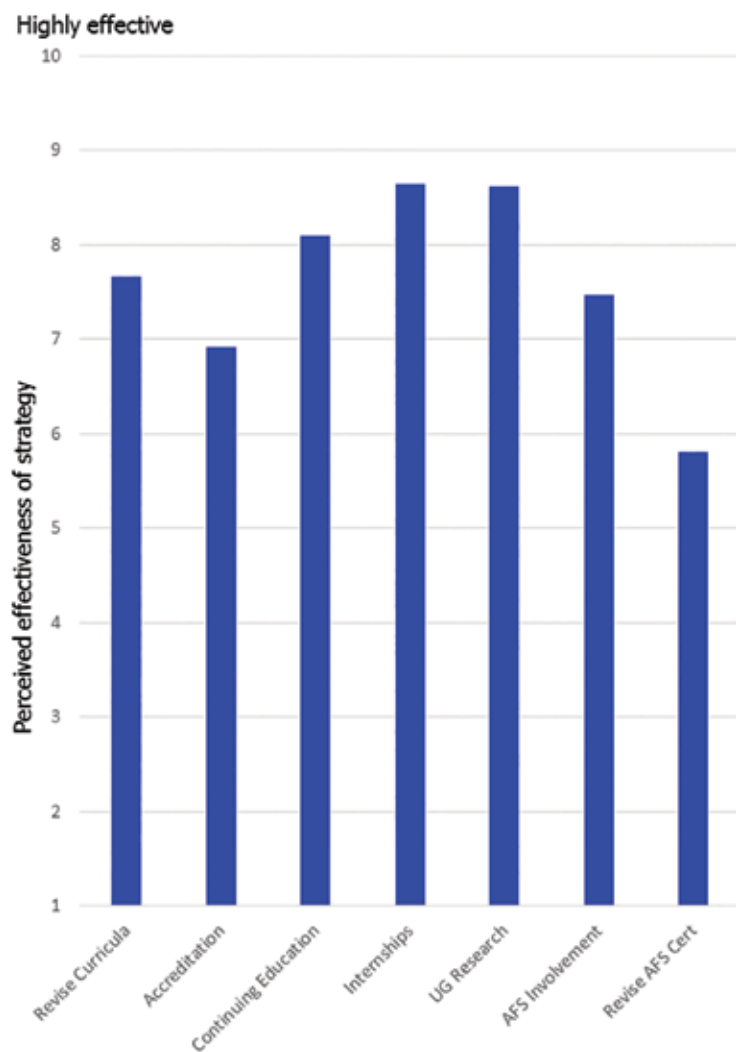


Figure 5. Perceived effectiveness of various strategies for enhancing the knowledge, skills, and abilities of entry-level fisheries professionals.

with practical experience gained through internships or undergraduate research, has always been key to opening the door to successful and rewarding careers in fisheries. Paying your dues through proven academic performance, practical experience, and postgraduate education is especially important in the highly competitive job market created by a backlog of graduates seeking jobs during the economic downturn that began in 2008–2009. Regardless of terminal degree, students and professionals at all levels in the fisheries profession should pursue lifelong learning. The knowledge and skills required of competent fisheries professionals change dramatically with time and technology, demanding continuous learning throughout one's career.

What Can Universities Do?

Universities face many challenges as they attempt to educate the next generation of fisheries professionals. Despite the rapidly rising cost of tuition, fisheries programs at many public universities have seen their budgets shrink as state governments have reduced their financial contributions to higher education. As the cost of a college education has shifted more to students and their families, pressure on universities to ensure that students can graduate in four years has intensified. For

example, at the home institution of the lead author, today's students must complete 120 semester credits to earn a B.S. degree in fisheries conservation, 15 fewer credits than the degree required 20 years ago. The loss of an entire semester of courses increases the difficulty of simultaneously providing a broad undergraduate education and meeting the expectations of employers to produce competent fisheries professionals. Thus, university programs must choose between dropping liberal arts courses that broaden a student's perspective, science courses that may provide a broader foundation for fisheries education but may be less directly related to fisheries (for example, some physical sciences; see Gabelhouse 2010), or more directly related courses that emphasize hands-on, experiential learning but may be expensive to offer.

Universities cannot simply add more courses to address all of the skills and topics that employers cite as important to succeed as a professional. University-mandated general education requirements and basic science and mathematics courses that serve as prerequisites to fisheries-related courses often make up more than 80% of the total credits required to graduate. Adding required fisheries-related courses to the mix leaves little room for additional courses deemed important to career success. Applegate (2009) listed 68 university courses that he felt should be the minimum requirements to adequately prepare wildlife students for employment, more courses than most institutions require to earn B.S., M.S., and Ph.D. degrees. Instead, universities should employ pedagogical approaches that incorporate development of critical thinking, problem-solving, and communication skills across existing curricula. Fisheries educators today increasingly use case studies of real-world problems to force students to employ problem-solving techniques for interdisciplinary problems (Murphy et al. 2010). The case study approach, long a staple of teaching in business and law schools, forces fisheries students to integrate knowledge acquired (at least in theory) in previous courses, to work in teams, and to develop communication skills (Touval and Dietz 1994). Changing pedagogical approaches also requires university faculty to redirect some effort from research to the practice of teaching, something that many university promotion and tenure systems frequently do not reward (Nielsen 1987; Arlinghaus 2014).

What Can Employers Do?

Employers also must assume responsibility for continued development of their employees. Their responsibilities begin with having realistic expectations of entry-level employees at various levels of education; that is, not expecting an employee with a bachelor's degree to perform at the same level as an employee with a master's degree. Employers and universities should collaborate in the design and revision of fisheries curricula to ensure that graduates receive training in the topics of greatest importance to their future employers (CNRS 2011). Perhaps the most important responsibility of employers is to continue to invest in the development of their employees through continuing education and attendance at professional conferences.

The survey results indicated that employers should assume

Table 4. Comparison of perceived proficiency of recently hired entry-level employees in state agencies with bachelor's degrees and master's degrees (* $P < 0.05$, ** $P < 0.01$).

Skill/knowledge area	Bachelor degree entry-level hires (n = 104)	Master's degree entry-level hires (n = 247)	Master's degree hires - bachelor's degree hires
Effective written communication skills	5.6 (0.37)	6.5 (0.21)	0.9**
Effective oral communication skills	5.7 (0.36)	6.5 (0.20)	0.8**
Ability to communicate effectively with nontechnical audiences	5.8 (0.37)	6.1 (0.22)	0.3
Critical thinking skills	5.7 (0.37)	6.5 (0.21)	0.8**
Working in teams	7.1 (0.37)	7.3 (0.19)	0.2
Practical field skills	6.6 (0.41)	7.0 (0.22)	0.4
Technical knowledge of fisheries/aquatic sciences	6.3 (0.37)	7.2 (0.2)	0.9**
Fisheries management	5.4 (0.4)	6.8 (0.24)	1.4**
Fish ecology	5.8 (0.38)	6.9 (0.20)	1.1**
Fisheries techniques	5.9 (0.37)	6.8 (0.23)	0.9**
Aquaculture	3.9 (0.44)	4.1 (0.26)	0.2
Limnology/aquatic/marine ecology	4.9 (0.4)	5.4 (0.25)	0.5*
Population dynamics	4.5 (0.43)	5.9 (0.26)	1.4**
Conservation biology	5.6 (0.43)	6.1 (0.26)	0.5
Ichthyology	5.5 (0.42)	6.4 (0.24)	0.9**
Aquatic entomology/invertebrate zoology	3.8 (0.41)	5.0 (0.26)	1.2**
Other biological sciences	6.2 (0.35)	6.8 (0.18)	0.6**
Physical sciences	5.2 (0.34)	5.6 (0.22)	0.4
Mathematics/statistics	4.9 (0.38)	6.1 (0.23)	1.2**
Communications courses	4.9 (0.37)	5.7 (0.22)	0.8**
Human dimensions/policy	4.4 (0.38)	4.7 (0.24)	0.3

Table 5. Comparison of perceived proficiency of recently hired entry-level employees in federal agencies with bachelor's degrees, master's degrees, and Ph.D. degrees (letters indicate significant ANOVA, $P < 0.05$, Duncan's post-hoc comparison).

Skill/knowledge area	Bachelor's degree entry-level hires (n = 39)	Master's degree entry-level hires (n = 94)	Ph.D. degree entry-level hires (n = 30)	Master's degree hires - bachelor's degree hires	Ph.D. degree hires - master's degree hires
Effective written communication skills	5.4 ^a	6.6 ^b	7.1 ^b	1.2	0.5
Effective oral communication skills	5.5 ^a	6.6 ^b	7.0 ^b	1.1	0.4
Ability to communicate effectively with nontechnical audiences	5.7 ^a	6.1 ^a	5.9 ^a	0.4	-0.2
Critical thinking skills	5.4 ^a	6.4 ^b	7.1 ^b	1.0	0.7
Working in teams	6.5 ^a	6.9 ^a	6.9 ^a	0.4	0.0
Practical field skills	6.2 ^a	6.8 ^a	6.8 ^a	0.6	0.0
Technical knowledge of fisheries/aquatic sciences	6.4 ^a	7.0 ^{ab}	7.6 ^b	0.6	0.6
Fisheries management	5.2 ^a	6.5 ^b	6.0 ^{ab}	1.3	-0.5
Fish ecology	6.0 ^a	6.9 ^b	6.9 ^b	0.9	0.0
Fisheries techniques	6.2 ^a	6.4 ^a	6.1 ^a	0.2	-0.3
Aquaculture	3.3 ^a	4.2 ^{ab}	4.4 ^b	0.9	0.2
Limnology/aquatic/marine ecology	4.7 ^a	5.5 ^{ab}	6.3 ^b	0.8	0.8
Population dynamics	4.5 ^a	5.5 ^b	6.6 ^c	1.0	1.1
Conservation biology	5.0 ^a	6.2 ^b	6.5 ^b	1.2	0.3
Ichthyology	5.2 ^a	5.7 ^a	5.9 ^a	0.5	0.2
Aquatic entomology/invertebrate zoology	4.5 ^a	4.7 ^a	5.6 ^b	0.2	0.9
Other biological sciences	5.6 ^a	6.9 ^b	7.4 ^b	1.3	0.5
Physical sciences	4.9 ^a	5.5 ^a	5.6 ^a	0.6	0.01
Mathematics/statistics	4.8 ^a	5.9 ^b	6.4 ^b	1.1	0.5
Communications courses	5.1 ^a	5.8 ^{ab}	6.3 ^b	0.7	0.5
Human dimensions/policy	4.5 ^a	5.2 ^a	4.7 ^a	0.7	-0.5

Table 6. Perceived level of responsibility (1 = Low, 10 = High) of universities (U), employers (E), and professional societies (S) in developing knowledge and ability in various job skills (n = 1,490).

Job skill	U	E	S
Effective written communication skills	9.1	7.0	6.4
Effective oral communication skills	8.9	7.2	6.9
Ability to communicate effectively with nontechnical audiences	7.7	8.0	6.5
Critical thinking skills	9.0	7.0	5.6
Working in teams	7.7	8.2	5.4
Practical field skills	7.9	8.3	5.5
Technical knowledge of fisheries/aquatic sciences	8.9	7.5	7.1

much of the responsibility for developing employees' ability to communicate effectively with nontechnical audiences, to work effectively in teams, and to enhance field skills. In addition, employees will likely gain more knowledge and skills in some areas (e.g., supervision, leadership, working with stakeholders) through continuing education, after they have gained some job experience and can better relate to those topics. As budgets shrink, employers often cut back on opportunities for employees to travel and attend conferences and workshops. Unfortunately, shrinking budgets also frequently result in fewer vacant positions being filled and additional responsibilities being shifted to employees. Employees who are expected to do more with less need more continuing education and professional involvement, not less. Some employers hesitate to invest in employees for fear that their investment to improve the skills of employees will result in those employees seeking employment elsewhere. Employers should ask themselves, "What if we don't invest in our employees and they stay?"

What Can AFS Do?

The American Fisheries Society can play an important role in ensuring that the next generation of fisheries students enters the profession well-prepared. Although survey respondents did not attribute great responsibility to AFS for developing the knowledge and skills that employers seek in entry-level employees, the Society has primary responsibility for setting the standards of professionalism in fisheries. The criteria established by AFS for certification as a fisheries professional significantly influence the content of university fisheries curricula because most universities want their students to qualify for certification upon graduation. Although revision of the AFS certification program rated low among the strategies for improving the knowledge and skills of fisheries professionals, periodic revision of the certification criteria will ensure that the standards of professionalism in fisheries remain current. Recent examples of changing expectations of fisheries professionals reflected in revision of the certification program include increased emphasis on human dimensions and allowance of geographic information systems courses to fulfill the physical sciences requirement. Certification criteria probably cannot address the desire of employers for better critical thinking skills among entry-level hires, but increasing emphasis on communication skills could be addressed by certification. AFS should consider increasing offerings of continuing education courses at Society meetings at all levels that address the communication skills deemed so important by employers. Furthermore, AFS-sponsored

continuing education workshops could help to address areas of knowledge frequently lacking in entry-level employees, such as human dimensions and quantitative skills. Accreditation of fisheries programs by AFS also rated low as a strategy for improving knowledge and skills of entry-level employees. Scalet and Adelman (1995) suggested that accreditation of university fisheries and wildlife programs would be redundant with the certification programs of both AFS and TWS and, furthermore, that attempts to establish accreditation would encounter substantial resistance from universities. The Society of American Foresters has taken a different path, emphasizing the value of accreditation of university forestry programs (Redelsheimer et al. 2015).

The American Fisheries Society can continue to play a major role in improving the knowledge and skills of fisheries professionals by promoting interaction and sharing of information through its meetings at Chapter, Division, and Society levels. Chapters play a particularly important role, because they provide more convenient and economical opportunities for fisheries professionals to meet and learn than Division or Annual Meetings of the Society. For many state agency employees who face severe restrictions on out-of-state travel, Chapter meetings may provide the only realistic possibility of involvement in the Society. The American Fisheries Society should continue to explore opportunities to expand the availability of continuing education workshops and content of conferences beyond those physically attending, but for fisheries professionals who are serious about upgrading their credentials and staying current in the profession, actual participation and the associated networking far surpasses virtual participation.

CONCLUSION

The challenge of adequately preparing the next generation of fisheries professionals faces the entire profession, not just universities. Universities play a critical role in building the foundation upon which professionalism is built, but employers, AFS, and the individual members of the profession all share in the responsibility to develop the next generation of fisheries professionals. To be effective, future fisheries professionals must think critically, employ excellent problem-solving skills, and communicate effectively with nontechnical audiences, specialists in other disciplines, and other fisheries professionals. Of course, they still must have a solid foundation of knowledge of fisheries and aquatic sciences, basic sciences, and mathematics. In most cases, graduates with bachelor's degrees will have only begun the process of becoming professionals. Postgraduate education will enhance the knowledge and skills that lead to success as a fisheries professional, but regardless of the number of degrees earned, professionals must embrace lifelong learning.

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University of Alaska

Education and Training for Maritime, FY15

The University of Alaska is committed to preparing today's students for tomorrow, recognizing that tomorrow's careers require advanced skills, greater knowledge, and more flexibility than ever before. Specific to the maritime industry, the University offers career and technical training as well as advanced degrees. This inventory, updated on an annual basis, provides the locations of programs and degrees or certificates offered in FY15, which includes three terms: summer 2014, fall 2014, and spring 2015. Additional programs and courses may be added throughout the year that are not included in this inventory. Current information can be found by contacting a local campus.

The University of Alaska is unique in its offerings of education and training programs to assist in building a skilled workforce for the maritime industry:

- Core programs include vocational and technical training directly related to the maritime industry as well as bachelors and advanced education programs directly related to biology, logistics, and oceanography.
 - 11 Occupational Endorsements, 7 Certificates, 8 Associate Degrees, 10 Bachelor's Degrees, 1 Graduate Certificate, 7 Master's Degrees, and 4 Doctorates.
 - Additional information on maritime training can be found throughout this report.
 - 1,198 degrees were awarded to graduates in the core programs between 2010 and 2014.
- Support programs include the broader vocational and technical training and advanced degrees in such fields as accounting, business, engineering, and rural development.
 - 6 Occupational Endorsements, 14 Certificates, 26 Associate Degrees, 21 Bachelor's Degrees, 1 Graduate Certificate, 14 Master's Degrees, and 4 Doctorates.
 - Information on these programs can be located at: <http://www.alaska.edu/research/wp/ua/>.
- Approximately 33 percent of the maritime core and support programs have e-Learning components.
- Additionally eight campuses offered 145 maritime classes across 23 communities to 1,332 students who between them earned 1,446 credits and 244 continuing education units during 5,210 hours of instruction.
- The University engages in advisory councils to inform and guide education and training programs.
- The University has specialized capacities such as the UAF Institute of Marine Science, the Marine Advisory Program, the Kodiak Seafood and Marine Science Center, and the Kasitna Bay Marine Laboratory.

For more information, please contact:

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Note: Data Supplied by the universities via UA Information Systems: UA Decision Support Database (RPTP.DSDMGR) FY15 in conjunction with UA Office of Workforce Development.
Compiled by UA Institutional Research, Planning, and Analysis. August 2015, N-70

Core Programs



Anchorage Campus, www.uaa.alaska.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Advanced Welding	Occupational Endorsement Cert	UAA	Anchorage	Traditional
Biological Sciences	Bachelor of Arts	UAA	Anchorage	Traditional
Biological Sciences	Bachelor of Science	UAA	Anchorage	Traditional
Biological Sciences	Master of Science	UAA	Anchorage	Traditional
Coastal, Ocean and Port Engn	Graduate Certificate	UAA	Anchorage	Traditional
Global Log Supply Chain Mgmt	Bachelor of Business Admin.	UAA	Anchorage	Traditional
Global Supply Chain Mgmt	Master of Science	UAA	Anchorage	Traditional
Heavy Duty Trans & Equip	Associate of Applied Science	UAA	Anchorage	Traditional
Heavy Duty Trans & Equip	Certificate	UAA	Anchorage	Traditional
Logistics & Supply Chain Ops	Associate of Applied Science	UAA	Anchorage	Traditional
Logistics & Supply Chain Ops	Certificate	UAA	Anchorage	Traditional
Logistics & Supply Chain Ops	Occupational Endorsement Cert	UAA	Anchorage	Hybrid
Occupational Safety & Health	Associate of Applied Science	UAA	Anchorage	Distance
Weld & NonDestruct Test Tech	Associate of Applied Science	UAA	Anchorage	Traditional
Welding	Occupational Endorsement Cert	UAA	Anchorage	Traditional

Kenai Peninsula College, www.kpc.alaska.edu/KPC/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Welding Technology	Certificate	UAA	Kenai	Traditional

Kodiak Campus, www.koc.alaska.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Welding	Certificate	UAA	Kodiak	Traditional

Mat-Su Campus, matsu.alaska.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Commercial Refrigeration	Occupational Endorsement	UAA	Wasilla	Traditional
Refrigeration and Heat Technology	Associate of Applied Science	UAA	Wasilla	Traditional
Refrigeration and Heat Technology	Certificate	UAA	Wasilla	Traditional

Prince William Sound College, www.pwscc.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Industrial Technology	Associate of Applied Science	UAA	Valdez	Hybrid
Industrial Technology	Certificate	UAA	Valdez	Hybrid



Fairbanks Campus, www.uaf.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Biological Sciences	Bachelor of Arts	UAF	Fairbanks	Hybrid
Biological Sciences	Bachelor of Science	UAF	Fairbanks	Traditional
Biological Sciences	Doctor of Philosophy	UAF	Fairbanks	Traditional
Biological Sciences	Master of Arts in Teaching	UAF	Fairbanks	Traditional
Biology	Master of Science	UAF	Fairbanks	Traditional
Fisheries	Bachelor of Arts	UAF	Fairbanks	Hybrid
Fisheries	Bachelor of Science	UAF	Fairbanks, Juneau	Traditional
Fisheries	Doctor of Philosophy	UAF	Fairbanks, Juneau	Traditional
Fisheries	Master of Science	UAF	Fairbanks, Juneau	Hybrid
Marine Biology	Doctor of Philosophy	UAF	Fairbanks	Hybrid
Marine Biology	Master of Science	UAF	Fairbanks	Hybrid
Oceanography	Doctor of Philosophy	UAF	Fairbanks	Distance
Oceanography	Master of Science	UAF	Fairbanks	Distance



Juneau Campus, www.uas.alaska.edu/

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Biology	Bachelor of Arts	UAS	Juneau	Traditional
Biology	Bachelor of Science	UAS	Juneau	Traditional
Diesel/Heavy Duty	Occupational Endorsement Cert	UAS	Juneau	Traditional
Diesel/Marine	Occupational Endorsement Cert	UAS	Juneau	Traditional
Marine Biology	Bachelor of Science	UAS	Juneau	Traditional
Marine Engine Room Prep	Occupational Endorsement Cert	UAS	Juneau	Traditional
Power Technology	Associate of Applied Science	UAS	Juneau	Traditional
Welding	Occupational Endorsement Cert	UAS	Juneau	Traditional
Welding Technology	Occupational Endorsement Cert	UAS	Juneau	Traditional

Ketchikan Campus, www.uas.alaska.edu/ketchikan/index.html

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Marine Transportation	Associate of Applied Science	UAS	Ketchikan	Traditional
Marine Transportation	Occupational Endorsement	UAS	Ketchikan	Traditional
Maritime Multi Skilled Worker	Certificate	UAS	Ketchikan	Traditional

Sitka Campus, www.uas.alaska.edu/sitka/index.html

Maritime Related Programs, FY15				
Program	Degree	University	Location	Delivery
Fisheries Management	Occupational Endorsement	UAS	Sitka	Hybrid
Fisheries Technology	Associate of Applied Science	UAS	Sitka	Hybrid
Fisheries Technology	Certificate	UAS	Sitka	Hybrid
Fisheries Technology	Occupational Endorsement	UAS	Sitka	Hybrid
Welding Technology	Occupational Endorsement	UAS	Sitka	Traditional
Welding	Occupational Endorsement	UAS	Sitka	Traditional

Workforce Training

Highlights

- UAA Kodiak College launched a series of [vessel maintenance and repair](#) classes with input from local vessel operators.
- UAA Kachemak Bay Campus is working closely with their local marine trades association and has launched a [series of local classes](#) as has the UAS Ketchikan Campus.
- UAF Alaska Sea Grant (ASG) Marine Advisory Program, with a donation from Icycle Seafoods, established a new 40-hour [Seafood Processing Quality Control Training Program](#), as well as continuing the [Alaska Seafood Processing Leadership Institute](#), both offered at the Kodiak Seafood and Marine Science Center, and the [Alaska Young Fishermen's Summit](#).
- UAF Bristol Bay Campus and the ASG Marine Advisory Program offered fishermen training programs including net hanging, fishing business skills and [outboard maintenance and repair](#). This is the beginning of their development of an occupational endorsement in commercial fishing.
- UAS Ketchikan began offering a [Maritime and Multi-Skilled Worker](#) course.
- [Ammonia Refrigeration training](#), coordinated by the ASG Marine Advisory Program and taught by UAA Mat-Su Professor Dan Mielke, was offered both at Mat-Su College and at the Kodiak Seafood and Marine Science Center.
- UAS and ASG Marine Advisory Program developed a new [Boat Electrical](#) asynchronous course online to target commercial fishermen and all boaters.
- UAF Fisheries Division has enhanced their BA in Fisheries in partnership with the Rural Development Program.



Kachemak Bay Campus, www.kpc.alaska.edu/KPC/

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Aluminum Fabrication	34	Noncredit	UAA	Homer	Traditional
Aluminum Fabrication	27	Noncredit	UAA	Homer	Traditional
Arc Welding	128	4 Credits	UAA	Homer	Traditional
Arc Welding	128	4 Credits	UAA	Homer	Traditional
Arc Weld-Low Hydrogen Elect	128	4 Credits	UAA	Homer	Traditional
Boat Construction Materials	3	Noncredit	UAA	Homer	Traditional
Lines, Rigging and Gear	3	Noncredit	UAA	Homer	Traditional
Marine Electronics	3	Noncredit	UAA	Homer	Traditional
Marine Mechanical Systems	3	Noncredit	UAA	Homer	Traditional
Marine Safety	3	Noncredit	UAA	Homer	Traditional
Pipe Welding	128	4 Credits	UAA	Homer	Traditional
What Makes a Boat Go?	3	Noncredit	UAA	Homer	Traditional

Kodiak Campus, www.koc.alaska.edu/

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
ABYC Marine Electrical Certification	35	Noncredit	UAA	Kodiak	Traditional
AWS D1.1 Welding Certification	30	1 Credits	UAA	Kodiak	Traditional
AWS D1.1 Welding Certification	30	1 Credits	UAA	Kodiak	Traditional
Flux Cored Arc Welding	120	4 Credits	UAA	Kodiak	Traditional
FT Carpentry I & Weatherization Tech I	300	Noncredit	UAA	Kodiak	Traditional
Fundamental of CAD for Construction	90	4 Credits	UAA	Kodiak	Traditional
Gas Metal Arc Welding	120	4 Credits	UAA	Kodiak	Traditional
Gas Metal Arc Welding	120	4 Credits	UAA	Kodiak	Traditional
Injury Prevention and Risk Management	75	4 Credits	UAA	Kodiak	Distance
Intr. To Technological Principles	60	3 Credits	UAA	Kodiak	Traditional
Introduction to Industrial Hygiene	60	4 Credits	UAA	Kodiak	Traditional
Metal Fabrication	75	3 Credits	UAA	Kodiak	Traditional
Safety Program Management & Recordkeeping	45	3 Credits	UAA	Kodiak	Distance
Shielded Metal Arc Welding	120	4 Credits	UAA	Kodiak	Traditional
Steel Welding and Fabrication	75	3 Credits	UAA	Kodiak	Traditional
Welding of High Strength Steel	120	4 Credits	UAA	Kodiak	Traditional
Workplace Injury and Incident Evaluations	60	4 Credits	UAA	Kodiak	Distance

Mat-Su Campus, matsu.alaska.edu/

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Introduction to Ammonia Refrigeration	30	3 CEUs	UAA	Wasilla	Traditional

Prince William Sound College, www.pwscc.edu/

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Incident Command System	16	Noncredit	UAA	Valdez	Traditional
Marine Safety and Survival	45	1 Credit/7 CEUs	UAA	Valdez	Traditional
Marine Technology I	150	4 Credits/28 CEUs	UAA	Valdez	Traditional
Marine Technology II	150	4 Credits/20 CEUs	UAA	Valdez	Traditional



Bristol Bay Campus, www.uaf.edu/bbc/

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Basic Welding	15	1 Credit	UAF	Dillingham	Traditional
Bristol Bay Fisheries: Harvesting, Processing and Marketing	15	1 Credit	UAF	Dillingham	Traditional
Business of Fish/Small Business Planning	15	1 Credit	UAF	Dillingham	Traditional
Fisheries Sanitation and HACCP	10	1 Credit	UAF	Dillingham	Traditional
Introduction to Aquatic Biology	45	3 Credits	UAF	Dillingham	Traditional
Introduction to Commercial Fisheries	15	1 Credit	UAF	Dillingham	Traditional
Introduction to Methods in Environmental Studies Reporting	45	2 Credits	UAF	Dillingham	Traditional
Introduction to Small Engine Repair: Outboard Engine Maintenance and Repair	15	1 Credit	UAF	Dillingham	Traditional
Introduction to Traditional Crafts: Net Hanging	15	1 Credit	UAF	Dillingham	Traditional
Introduction to Traditional Crafts: Net Mending	15	1 Credit	UAF	Dillingham	Traditional
MIG Welding	15	1 Credit	UAF	Dillingham	Traditional
Onboard Drill Conductor	8	Noncredit	UAF	Dillingham	Traditional
Small Engine Repair	15	1 Credit	UAF	Dillingham	Traditional
Understanding Ocean Changes: The Effect of Ocean Changes on Local Resources	20	1 Credit	UAF	Dillingham	Traditional

Alaska Sea Grant, www.seagrant.uaf.edu

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Alaska Shellfish Farming Technology	24	Noncredit	UAF	Anchorage	Traditional
Ammonia Refrigeration	40	Noncredit	UAF	Kodiak	Traditional
AMSEA Drill Conductor	12	Noncredit	UAF	Cordova	Traditional
AMSEA Marine CPR/First Aid	12	Noncredit	UAF	Cordova	Traditional
Boat Electrical		Noncredit	UAF	Sitka	Hybrid
Business of Fish (Direct Marketing, Fish Biz Resources, Vessel Pre-season Maintenance)	8	1 CEU	UAF	Dillingham	Traditional
Cold Water Safety - Emergency Communications	8	Noncredit	UAF	Cordova	Traditional
Fishing Vessel Drill Conductor Training	12	Noncredit	UAF	Kodiak	Traditional

Alaska Sea Grant (cont.)					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Gillnet Net Mending	8	4 CEUs	UAF	Cordova	Traditional
HACCP	16	Noncredit	UAF	Sitka	Traditional
Intro to Shellfish Aquaculture - Module 1	24	Noncredit	UAF	Ketchikan	Traditional
Intro to Shellfish Aquaculture - Module 2	24	Noncredit	UAF	Ketchikan	Traditional
Introduction to Outboard Maintenance and Repair	19	Noncredit	UAF	Dillingham	Traditional
Microbiology (Seafood Processing)	8	Noncredit	UAF	Unalaska	Traditional
Outboard Motor Maintenance	8	Noncredit	UAF	Dillingham	Traditional
Seafood Environmental Compliance	8	Noncredit	UAF	Kodiak	Traditional
Seafood Processing Quality Control Training	80	Noncredit	UAF	Kodiak	Traditional
Shellfish Farming Workshop	24	Noncredit	UAF	Homer	Traditional
Smoking Alaska Seafood for Fun and Profit	24	Noncredit	UAF	Kodiak	Traditional
Alaska Shellfish Farming Technology	24	Noncredit	UAF	Anchorage	Traditional
Ammonia Refrigeration	40	Noncredit	UAF	Kodiak	Traditional
AMSEA Drill Conductor	12	Noncredit	UAF	Cordova	Traditional
AMSEA Marine CPR/First Aid	12	Noncredit	UAF	Cordova	Traditional
Boat Electrical		Noncredit	UAF	Sitka	Traditional
Business of Fish (Direct Marketing, Fish Biz Resources, Vessel Pre-season Maintenance)	8	Noncredit	UAF	Dillingham	Traditional
Cold Water Safety - Emergency Communications	8	Noncredit	UAF	Cordova	Traditional
Fishing Vessel Drill Conductor Training	12	Noncredit	UAF	Kodiak	Traditional
Gillnet Net Mending	8	Noncredit	UAF	Cordova	Traditional
HACCP	16	Noncredit	UAF	Sitka	Traditional
Intro to Shellfish Aquaculture - Module 1	24	Noncredit	UAF	Ketchikan	Traditional
Intro to Shellfish Aquaculture - Module 2	24	Noncredit	UAF	Ketchikan	Traditional
Introduction to Outboard Maintenance and Repair	19	Noncredit	UAF	Dillingham	Traditional
Microbiology (Seafood Processing)	8	Noncredit	UAF	Unalaska	Traditional
Outboard Motor Maintenance	8	Noncredit	UAF	Dillingham	Traditional
Seafood Environmental Compliance	8	Noncredit	UAF	Kodiak	Traditional
Seafood Processing Quality Control Training	80	Noncredit	UAF	Kodiak	Traditional
Shellfish Farming Workshop	24	Noncredit	UAF	Homer	Traditional
Smoking Alaska Seafood for Fun and Profit	24	Noncredit	UAF	Kodiak	Traditional



Ketchikan Campus, www.uas.alaska.edu/ketchikan/index.html

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
CEU 041 Wrangell Narrows/Peril Straits Seminar	8	0.3 CEU	UAS	Ketchikan	Traditional
DESL 106 Diesel Engines Simplified	44	6 Credits	UAS	Ketchikan	Traditional
DESL 110 Diesel Engines	120	6 Credits	UAS	Ketchikan	Traditional
DESL 125 Basic Hydraulics	45	3 Credits	UAS	Ketchikan	Traditional
DESL 130 Refrigeration & AC	39	2 Credits	UAS	Ketchikan	Traditional
DESL 193 Marine Electrical Systems	51	3 Credits	UAS	Ketchikan	Traditional
MTR 119 Skiff Operator	24	1 Credit	UAS	Juneau	Traditional
MTR 129 Basic Safety Training	40	2 Credits	UAS	Ketchikan	Traditional
MTR 220 Proficiency in Survival Craft	32	2 Credits	UAS	Ketchikan	Traditional
MTR 225 Able Seaman	40	2 Credits	UAS	Juneau Ketchikan	Hybrid
MTR 226 Ratings/Navy Watch	24	1 Credit	UAS	Ketchikan	Traditional
MTR 228 Fast Rescue Boat	36	2 Credits	UAS	Ketchikan	Traditional
MTR 239 Master 100 Ton & Operator of Uninspected Passenger Vessel	88	5 Credits	UAS	Juneau Ketchikan Wrangell	Traditional
MTR 240 Master 200 Ton Upgrade	24	2 Credits	UAS	Ketchikan	Hybrid
MTR 242 Advanced Fire Fighting	32	2 Credits	UAS	Ketchikan	Traditional
MTR 244 Crisis Management	14	1 Credit	UAS	Ketchikan	Traditional
MTR 250 Radar Observer	40	2 Credits	UAS	Ketchikan	Traditional
MTR 254 Electronic Chart Display	36	2 Credits	UAS	Ketchikan	Traditional
VTEC 005 First Aid/CPR Mariner	8	Noncredit	UAS	Juneau Ketchikan	Traditional
VTEC 031 Basic Safety Training Refresh	24	Noncredit	UAS	Ketchikan	Traditional
VTEC 032 Crowd Management	4	Noncredit	UAS	Ketchikan Seward	Traditional
VTEC 032 Knot Seminar	4	Noncredit	UAS	Ketchikan	Traditional
VTEC 032 Marine Safety Instructor Training	50	Noncredit	UAS	Ketchikan	Traditional
VTEC 035 Radar 1-3 Day Renewal	8	Noncredit	UAS	Ketchikan	Traditional
VTEC 039 Online Radar Refresher	4	Noncredit	UAS	Ketchikan	Traditional
VTEC 040 Basic Hydraulics	16	Noncredit	UAS	Ketchikan	Traditional
VTEC 041 Applied Math for Trades	16	Noncredit	UAS	Ketchikan	Traditional
WELD 120 Basic Welding	62.5	3 Credits	UAS	Ketchikan	Traditional
WELD 175 Intro to Pipe Fitting	62.5	3 Credits	UAS	Ketchikan	Traditional
WELD 175 Advanced Welding	62.5	3 Credits	UAS	Ketchikan	Traditional

Sitka Campus, www.uas.alaska.edu/sitka/index.html

Maritime Related Training, FY15					
Program	Hours	Credit/Noncredit/CEUs	University	Location	Delivery
Alaska Salmon Culture Lab	15	1 Credit	UAS	Sitka	Traditional
Boat Electrical	10	1 CEU	UAS	Sitka	Traditional
CTPM Customer Service	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Facility Safety	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Fire Safety	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Harbor Administration	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Haz Materials and Waste	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Marine Structures	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Oil Spills	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Operations Planning	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Utilities: Electrical	15	1.5 CEUs	UAS	Sitka	Traditional
CTPM Utilities: Water	15	1.5 CEUs	UAS	Sitka	Traditional
Fisheries Mgmt Techniques Lab	15	1 Credit	UAS	Sitka	Traditional
Intro to Alaska Aquaculture	15	1 Credit	UAS	Sitka	Traditional
Marine Hydraulics	6	0.6 CEU	UAS	Sitka	Traditional
Scientific Diving	30	2 Credits	UAS	Sitka	Traditional
Welding Certification Lab	Varies	Varies	UAS	Sitka	Traditional