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Examining the Relevancy and Utility of the American Fisheries Society Certification Program to Prepare Future Fisheries Professionals

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INTRODUCTION

Fisheries science is a diverse field that requires individuals to be knowledgeable in many disciplines in addition to fisheries (e.g., economics, sociology, political science, chemistry; Kelso and Murphy 1988). This challenges students attempting to enter a career in fisheries, as well as academic institutions and eventual employers, to develop both depth and breadth of knowledge needed to succeed in the profession (Oglesby and Krueger 1989). The preparedness and competency of young professionals entering the workforce has long been a problem (Stauffer and McMullin 2009). Several constraints and ongoing challenges facing the profession have continued to magnify these issues over time (McMullin et al., this issue). These issues stem from the diversity of skills required or expected across employer groups (e.g., government agencies, private sectors, nongovernment organizations) and degree levels sought (B.Sc., M.Sc., Ph.D.), complexity of fisheries-related problems, and balancing a broad academic focus with specific training. Additionally, employers perceive that students lack well-developed critical thinking, communication, and statistical skills that are highly desired in any area of fisheries.

The American Fisheries Society's (AFS) mission of preparing and promoting the development of fisheries professionals has been addressed in many ways, including development of the AFS Professional Certification Program in 1963. This program provides minimum standards for which fisheries professionals are recognized across government, academic, and nongovernment entities. The certification program fosters greater recognition that fisheries professionals are well equipped and prepared to act on the public's behalf concerning fisheries-related issues. Two tiers of certification exist, with first-tier certification (Associate Fisheries Professional) contingent upon the completion of higher education courses in

six broad subject areas. In this article, we focus on the first tier of certification, the basic education determined by AFS to be critical in preparing young professionals for a career in fisheries. The second-tier certification (Certified Fisheries Professional) expands upon academic requirements to include minimum professional experience and development standards; therefore, we do not evaluate this second-tier level of requirements.

In addition to the benefits of AFS professional certification (see Goldberg 2011; Long and Slaughter 2012; Essig 2016), certification serves as a standard for developing curricula across many university programs (Bonds et al. 2014). Thus, certification has widespread consequences relating to the coursework and training many young professionals receive prior to entering the workforce. To remain relevant, the certification program must be dynamic in delineating the skills and knowledge required to be effective in a fisheries-related profession. Thus, developing curricula to meet these needs is extremely challenging (i.e., broad vs. specialized or liberal arts vs. science-oriented classes; Oglesby and Krueger 1989; Bleich and Oehler 2000).

AFS is in a unique position to evaluate and address concerns involving preparedness and quality of newly hired young fisheries professionals. These concerns could be addressed and perhaps alleviated in part through the AFS certification program and a restructuring and revision of course curricula, among other avenues (see McMullin et al., this issue). However, first we must identify where, or whether, employers' needs and expectations diverge from the AFS certification requirements and, if so, identify potential options for AFS and the program to remain relevant. Three specific objectives are addressed and explored concerning this topic: (1) examine whether there is a misalignment with AFS certification course requirements and employer desired skills and knowledge; (2) identify where this misalignment occurs, if it exists; and (3) offer suggestions

Table 1. Major subject areas defined by the AFS Professional Certification Program, the number of semester credits or quarter hours required for Associate-level certification, and course examples for each subject area. Please see the AFS Professional Certification Program document for more details (fisheries.org/docs/wp/AFS-Professional-Certification-Program-description.pdf).

Subject area	Semester credits or quarter hours	Course examples
Mathematics/statistics	6 or 9	Courses pertaining to calculus and statistics
Human dimension	6 or 9	Human dimensions of natural resources, policy, planning, administration, law, ethics
Communication	9 or 13	Composition, technical writing, verbal communication
Fisheries/aquatic sciences	12 or 18	Fisheries science, limnology, oceanography, fisheries management, aquaculture
Physical sciences	15 or 23	Chemistry, physics, soils, geology, hydrology, earth science, astronomy, meteorology
Other biological courses	18 or 27	Biology, ecology, evolution, genetics, conservation biology, wildlife management

for how to remedy disconnects and potentially use the AFS certification program to better equip young professionals. Results presented here were part of a larger study that surveyed AFS members to address the importance of job skills and knowledge of recently hired fisheries professionals (see McMullin et al., this issue). A subset of that information is used here to compare AFS certification coursework requirements at the Associate Fisheries Professional level with employer-based desired job skills and knowledge necessary for an entry-level position.

METHODS

Survey respondents were asked to rate the importance of six academic study categories corresponding to those outlined in the Associate Fisheries Professional AFS certification program. Importance ratings for each academic study category were provided across degrees sought (B.A./B.Sc., M.A./M.Sc., Ph.D.). These results were compared to the number of credit or quarter hours necessary for certification (Table 1). Survey ratings (see McMullin et al., this issue) and the number of certification credit hours were converted to a ranking, therefore allowing direct comparisons between these two data sets. Certification credit hours were ranked across all six categories based on the total number of hours required within each category. This assumes that importance is positively related to the number of credit hours required. Survey ratings were ranked according to the mean importance rating of each of the six categories across entry-level hires at the B.Sc., M.Sc., and Ph.D. levels. A composite ranking was also tabulated that included all degrees, reflecting overall importance ratings within the profession for each academic study category. We compared importance rankings between the AFS certification program and the survey results using the Kendall's tau correlation test in R 3.2.3 (package = 'Kendall'; R Development Core Team 2015). Therefore, if importance rankings were similar between the AFS certification program and survey results (i.e., composite, B.Sc., M.Sc., and Ph.D.-level responses), we would expect a strong positive (correlation coefficient) and significant ($\alpha = 0.05$) relationship.

RESULTS AND DISCUSSION

The skills or specific knowledge desired by employers for newly hired fisheries professionals did not align with the AFS Professional Certification Program (Table 2). Composite (across all degrees) survey rankings were unrelated to the AFS certification program rankings (Kendall's tau = -0.28 ; $P = 0.56$). This misalignment is further reflected across B.Sc. (Kendall's tau = -0.41 ; $P = 0.34$), M.Sc. (Kendall's tau = -0.41 ; $P = 0.34$), and Ph.D. (Kendall's tau = -0.28 ; $P = 0.56$) educational levels. The composite AFS membership survey results rated

communication and mathematics/statistics (hereafter statistics) categories much higher than the AFS certification course requirements. Alternatively, the AFS certification program placed greater importance on the physical science category compared to the AFS survey composite results. Importance rankings were more similar for course categories relating to human dimensions, fisheries, and other biological disciplines (Table 2).

The six academic study areas had similar relative importance rankings at both B.Sc.- and M.Sc.-level hires but differed at the Ph.D. level (Table 2). Employers ranked statistics, human dimensions, and communication categories at the B.Sc. and M.Sc. level higher than what is reflected in the AFS certification program. In contrast, physical science and other biological disciplines were given a lower ranking than the AFS certification program. The Ph.D. and composite rankings of the six academic study areas were more similar to the AFS certification program rankings compared to B.Sc.- and M.Sc.-level rankings, although all were unrelated to the AFS certification program.

Major areas of concern include employers placing a higher emphasis on communication and statistical coursework and perhaps less emphasis on general coursework (see Gabelhouse 2010). These general biological or physical science courses contribute most of the non-aquatic credit hours to the certification process (Table 1) but were not rated as important as other subject areas according to the survey results. These findings were not especially surprising considering that most other biological or ecological disciplines have identified these areas to be extremely important as well (Burger and Leopold 2001; Kendall and Gould 2002; Millenbah and Wolter 2009). In addition, the physical sciences category acts as a "catch-all" category for non-biological and aquatic courses and is very diverse itself (e.g., chemistry, physics, hydrology, geographic information systems). The challenge remains to properly balance the broad focus of most academic programs while also delivering specific training in areas most important to future employers, such as statistics and written/verbal communication skills.

Importance rankings differed across individual degrees with respect to subject area. This seems intuitive given that most B.Sc.- and M.Sc.-level positions are management (and not research) focused, requiring different skills and knowledge. For example, human dimensions was ranked higher for B.Sc.- and M.Sc.-level positions compared to Ph.D.-level positions. Management biologists likely confront human dimension issues more frequently than positions that are more research oriented (e.g., academic, research biologist). Perceived performance in these subject areas was also higher for professionals with graduate degrees (M.Sc. and Ph.D.) compared to those with an undergraduate degree (McMullin et al., this issue). This

Table 2. Course categories and importance rankings (1 = most important; 6 = least important) according to the AFS Professional Certification Program and the AFS membership survey (see McMullin et al., this issue). A negative difference corresponds to a higher importance ranking in the survey compared to the certification process, whereas a positive difference reflects the opposite. Differences were calculated by subtracting the survey ranking from the certification ranking (i.e., the standard). Mathematics/statistics and human dimension categories require the same number of credit hours in the AFS certification program and thus were assigned a value of 5.5, representing the average ranking.

Category	Composite survey ranking	B.Sc. survey ranking	M.Sc. survey ranking	Ph.D. survey ranking	Certification ranking (AFS)	Composite difference	B.Sc. difference	M.Sc. difference	Ph.D. difference
Mathematics/statistics	2	3	2	2	5.5	-3.5	-2.5	-3.5	-3.5
Human dimension	4	2	3	4	5.5	-1.5	-3.5	-2.5	-1.5
Communication	1	1	1	1	4	-3	-3	-3	-3
Fisheries/aquatic sciences	5	5	5	5	3	2	2	2	2
Physical sciences	6	6	6	6	2	4	4	4	4
Other biological courses	3	4	4	3	1	2	3	3	2

further strengthens the utility and importance of pursuing the appropriate degree (and associated knowledge and skill sets) for obtaining the desired career within this diverse profession (Kaemingk et al. 2013). Currently, it appears that AFS certification program requirements align better for young professionals entering a fisheries career at the Ph.D. level rather than at the B.Sc. and M.Sc. levels, the education levels required for the vast majority of fisheries jobs.

The next step is to identify how best to reconcile this misalignment, if necessary. AFS has options available to encourage new fisheries professionals to bridge the identified gap through the AFS certification program. Options available are discussed in the following subsections.

Modify the AFS Certification Program Coursework Requirements

This approach would include requiring more statistical, communication, and human dimensions coursework and reducing the total number of credit hours in the physical and other biological science categories. Some of the general biological and physical science courses could be retained without a major sacrifice in the overall requirements, considering these categories comprise 50% of the current coursework (Table 1). For example, reducing the total biological science credit hours from 18 to 9 would still allow three courses (three credits each) to be offered without entirely compromising this subject area. This would free up credits for the aforementioned subject areas that were ranked higher in importance. The most difficult challenge would be allocating how many credits should be added within each category without compromising the broad academic focus and becoming too specialized in these areas (Oglesby and Krueger 1989), despite their perceived importance. This may not be feasible either because many smaller universities or liberal arts colleges do not have human dimension specialists to offer the additional courses required by this revision of the AFS certification program.

Another option could be to create separate “tracks” that would better accommodate both the broad nature of fisheries and the degree level sought. Although more complex than the first option, this would allow students the flexibility to seek a track that would better align with the needs of eventual employers. For example, students seeking private employment at the B.Sc. degree level could seek coursework that prepares them for this field as opposed to a one-size-fits-all AFS certification program (i.e., the current model). Alternatively, modifying the

AFS certification program to more closely align with composite survey rankings would be a major improvement without a drastic loss in the preservation of individual degree differences.

Supplement or Create Flexibility in the AFS Certification Program Requirements

This option would consider implementing other requirements besides coursework or creating flexibility in the program to become certified, similar to the Certified Fisheries Professional level (i.e., second tier). For example, extending certification at this level beyond just coursework could bridge this gap and better prepare students for a career in fisheries (Kroll 2007). The deficiency in communication skills could be improved by giving professional talks or presenting posters at conferences, participating in local outreach events, or publishing popular articles—or some combination of these (Gabelhouse 2010). However, many of these activities are often completed at the graduate level where more specialized training occurs (Hard 1995). Concerns about the narrow focus or training stemming from option 1 (above) could be alleviated with this strategy, which would combine the broad academic focus with the additional requirements or experiences desired by employers.

The certification requirements at the associate level are quite stringent with respect to which courses are required and that these courses must be provided through an accredited university or college. It may be advantageous to build in some flexibility in how these requirements are met by providing opportunities through the use of work experience, continuing education courses, or other related avenues to count toward certification at this level. This may also encourage and provide options for those who did not meet the course requirements during their educational training (e.g., small liberal arts college) but are reluctant to enroll in university courses (to achieve certification) because of other constraints (e.g., time, money, job responsibilities).

The potential drawbacks of this option would be standardizing or evaluating these activities across applicants and selecting which activities should qualify toward certification, although adding presentations at state, regional, or national/international meetings could likely be incorporated with minimal difficulty. Additionally, current students already face several constraints to graduating in a timely manner and securing full-time employment (Bound et al. 2012); therefore, adding more requirements may not be the best option if certification is to be achieved upon completion of a bachelor’s degree.

Graduate-level experiences should provide ample opportunity to acquire any needed, missing, or additional AFS certification requirements.

Do Not Modify, Supplement, or Create Flexibility in the AFS Certification Program Requirements

The last option would be to refrain from revising or adding to the current AFS certification requirements. This would be the easiest option, but perhaps it would ignore a critical weakness in newly hired fisheries professionals that could be addressed in part through the AFS certification program. After all, the certification process provides many universities with an existing framework for curriculum development. Alternatively, one could argue that the number of courses required for communication, human dimensions, and statistics are currently adequate but reflect deeper issues unrelated to the number of classes within these categories (Oglesby and Krueger 1989). These areas are consistently addressed and regarded as deficient among newly hired professionals within ecology and natural resource disciplines and simply adding more coursework may not help (Kendall and Gould 2002; Millenbah and Wolter 2009) and may not be needed. Considering the broad nature of the fisheries profession, it may be difficult to find employees with an interest and skills relating to communication, human dimensions, and statistics while also performing highly in all other areas required to be effective professionals (e.g., fisheries knowledge, field skills, critical thinking; Johnson et al. 2001).

CONCLUSIONS

AFS should play an active role in identifying which skill sets and specific knowledge fisheries employer groups are seeking in order to remain relevant for new fisheries professionals, as well as for the university programs that use the AFS certification requirements when developing academic programs of study. This responsibility remains especially critical as AFS strongly promotes the development of fisheries professionals. Though most survey respondents generally placed greater responsibility on university programs and employers themselves (McMullin et al., this issue), AFS can and should remain active in this area. A particular finding worthy of further exploration within AFS is how the certification program appears to better match preparation of entry-level professionals at the Ph.D. level than at the B.Sc. and M.Sc. levels. One could argue that the focus should be on the B.Sc. and M.Sc. levels because they represent a disproportionate group of trained professionals within fisheries and AFS. Therefore, striving for equity across educational levels will remain important for long-term relevancy and utility of the AFS certification program. We can use information collected through the membership survey and consider all options to better prepare future fisheries professionals for a career in this highly diverse field. Important skills and knowledge identified in this survey are likely to change through time as fisheries and environment-related problems become more interdisciplinary in nature and complex (Lubchenco 1998). Given that the AFS certification program was last revised about 20 years ago (1997), it may be timely to consider revisiting the curriculum and making the appropriate changes. Any changes applied to the certification program should be evaluated and monitored to ensure that the certification process and overall benefits have been improved (Pegg et al. 1999). Thus, by taking a proactive approach we can continue to strive as a Society to set standards that improve the conservation and sustainability of fisheries and aquatic resources through the existing AFS certification

program. Equipping young professionals to face these challenges and become highly effective within any fisheries-related job should remain a primary focus of AFS (Boreman 2012).

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