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An International Workshop
**Training Managers
for 21st Century Fisheries**

Queenstown, New Zealand, December 5-7, 2001



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An International Workshop
**Training Managers
for 21st Century Fisheries**
Queenstown, New Zealand, December 5–7, 2001

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EXECUTIVE SUMMARY

Training Managers for 21st Century Fisheries

December 5-7, 2001

Queenstown, New Zealand

<http://oregonstate.edu/dept/trainfishmgr/>

Introduction

The dawning of the 21st century reveals a fisheries management process experiencing unprecedented socioeconomic, environmental, and institutional challenges. Over the last 50 years, fisheries governance has rapidly evolved from primarily open access to regulated common property and rights-based institutions. Under the rubric of "sustainability," 21st century fisheries managers are charged with balancing society's conflicting needs with the unknown desires of future generations while employing vaguely defined concepts of precautionary and ecosystem-based management principles. Managers are also expected to accommodate an ever-widening range of community and industry "stakeholder" interests in the management and scientific process. The rapidly mounting legal and social pressures are eroding fishery management systems and revealing fundamental flaws in governance and institutional design. The pressures are also revealing an equally disturbing and related problem: society has not adequately invested in the human capital capable of co-designing and implementing the institutional structures that will lead to rational management of 21st century fisheries.

The low level of investment in human capital is illustrated by the observation that the majority of fishery managers worldwide have received no formal academic training in the discipline. Where academic training does exist in fisheries management, it has traditionally evolved from a biologically oriented focus to include varying degrees of multidisciplinary coursework, usually with the goal of creating entry-level administrators or broadly balanced research scientists. However, given the problems facing 21st century fisheries, managers must also be expert problem solvers, leaders, and institutional innovators capable of working with a variety of stakeholders and advisors. In addition, as the definition of the "fisheries manager" broadens in response to evolving institutions and increased participation in management, our understanding of training needs must also expand.

The need to invest in human capital is paramount as many nations are experiencing problems with recruitment and retention of quality managers. In the United States, for example, 45 percent of National Oceanic and Atmospheric Administration (NOAA) Fisheries (National Marine Fisheries Service) employees who are upper level scientists, managers, and administrators are eligible for retirement in 2005. During the economically vibrant 1990's, many nations lost existing or potential quality fishery scientists and managers to private corporations capable of providing better salary and benefits. Managers in both developed and developing nations are now suffering from regulatory implementation overload. Managers need the educational tools to

enable effective implementation of a wide variety of regulations, including those suitable to rationally developing and managing smaller scale fisheries.

In recognition of the challenges facing contemporary fisheries management, organizers designed the international workshop, *Training Managers for 21st Century Fisheries*, held in Queenstown, New Zealand, on December 5-7, 2001. The workshop engaged recognized government, industry, academic, and nongovernmental organization (NGO) leaders from Oceania, North America, and Europe (Appendices A and B) in defining the necessary skills, training curricula, and professional working environments necessary to produce effective fishery managers. Sixty-three speakers and participants addressed a wide range of issues, organized under five headings: 1) vision and management challenges of 21st century fisheries; 2) requisite skills and knowledge; 3) current training and curricula; 4) incentives, responsibilities, and rewards to enhance recruitment and retention; and 5) consensus strategies. Breakout groups organized by topic and in some cases by sector (government, industry, academic) addressed leading questions organized around these headings. Participants developed a common vision, generated a list of general curriculum needs, suggested retention and recruitment barriers and solutions, and developed consensus strategies for addressing future training and education needs. The conference concluded with establishing an international steering committee charged with facilitating implementation of major recommendations and strategies. A full copy of the workshop notes is available in Appendix E (available online only at: <http://oregonstate.edu/dept/trainfishmngr/report.html>).

Vision

The workshop group developed a vision of 21st century fisheries and described a challenging and complex management future requiring a broad range of skills and abilities (Section 2). Defining the “fisheries manager” was a central issue in all discussions. There was no vision of a single manager, but consensus that depending on the governance system, there may be many “managers” in the fisheries process including stakeholders, stakeholder leaders, formal directors of private sector and NGO groups, mid-level government managers, elected policymakers, and policy analysts and institutional designers. Participants agreed that the definition of fisheries manager has evolved to include many of the participants in the fisheries management process.

Curriculum

Workshop participants developed a comprehensive set of management skills and knowledge for effective management of fisheries through pre-workshop focus questions, presentations, and group discussion at the workshop (Section 3). Responses to focus questions primarily identified the need for leadership qualities and skills related to leadership: communications, conflict resolution, decision making, problem solving, critical thinking, systems analysis (including modeling and integrative multidisciplinary, holistic thinking). Respondents also identified more traditional but necessary skill and knowledge areas including analytical science skills, and fisheries and related marine science, ecosystem science and management, economics, social science, policy, law, and business administration knowledge and related skills (Table 3.1).

Although the type and rigor of training should vary depending on the sector, management system, and management responsibilities, the workshop participants reached consensus that management at all levels required interdisciplinary training in a broad range of science and

management skills, reality-based classroom experiences, internships, and field practice. The participants particularly stressed the need for greater emphasis on effective communication and working relationships, problem solving, and strategic leadership. Presentations and group discussion also emphasized the need for skills in managing the interface between specialists and decision-makers, skills in incorporating indigenous and industry knowledge, and knowledge of all stakeholder groups. Group discussion highlighted some institutional or sectoral differences in training needs (Table 3.2). There was also varied opinion on whether training should occur primarily through academic programs, continuing education, or on-the-job training.

Training needs and delivery methods specific to managers of different sectors, responsibilities, regions and nations must be further defined and developed; this task was beyond the scope of the workshop.

Current Training

As input to discussion of curricular needs and training delivery methods, the workshop included presentations assessing current training capacity and examples of continuing education models, summarized in Section 4.

The current training review identified 72 academic programs offering 165 degree options (primarily with postgraduate diploma or certificate, Masters, or Ph.D.) at a total of 46 institutions with at least some specific focus on fisheries management. Programs were discovered through an exhaustive search of online literature. Regardless of degree title, most were primarily fisheries science programs. Only 20 percent of the programs emphasized leadership, decision-making, or critical thinking skills in their website literature. This stood in contrast to the leading business management, public administration, and natural resource or forestry educational programs that unanimously emphasized “capstone” integrated courses or requirements with emphasis on leadership, teamwork, and critical decision-making skills. In addition, the presenters developed a comprehensive website indexing links to all relative training programs identified during the web search, primarily academic programs, but also some continuing education and professional programs. While no single education program can be expected to provide all the necessary knowledge, skills, or expertise, there are significant components of top training programs that should be considered if the goal is to develop effective leaders and decision makers for 21st century fisheries.

Presentations on continuing education or professional training programs developed by Oregon State University Extension Forestry and the New Zealand Seafood Industry Training Organisation (SITO) emphasized the need to develop flexible learning pathways that recognize the existing hierarchy of knowledge, attitudes, skills, and abilities of managers as well as the time that professionals have available for training. Presenters also suggested developing training programs based on needs assessment, goal identification, and evaluation—including measuring goal achievement, formative evaluation during the educational program, and more formal summative evaluation to determine effectiveness (see Appendices G and H).

Cooperative and innovative efforts within and among academia, government, industry, and NGOs could be highly beneficial toward developing new opportunities. For example, academic

programs can provide additional degree options, such as certificates or diplomas, suited to continuing education of professionals. They can also develop specialized workshops (onsite or online) based on in-house expertise, and industry and government can participate as instructors in academic programs.

Furthermore, communication and exchange of information on training opportunities and curricular resources within and across sectors should be enhanced through websites or e-mail groups dedicated to fisheries management training.

Incentives and Rewards

The pre-workshop focus survey (Appendices C and D) and workshop discussion emphasized that fisheries management as a profession is in crisis (Section 5). Key symptoms of this crisis in agencies include difficulty recruiting, high turnover, low retention, and an aging workforce. Several internal and external causes were identified, including limited professional development opportunities, low job satisfaction, perceived conflict between science and management disciplines, the political and, in some jurisdictions, litigious nature of fisheries management, and low morale. Participants also identified reluctance by non-agency stakeholders to engage in the fisheries management process because of past failure to achieve positive outcomes, or because they achieved better results through direct political approaches.

The group believed that given the challenges of fisheries management, effective leadership requires a supportive working environment with appropriate responsibilities and rewards, including strategic incentives and ongoing professional education. In addition, promoting management successes and collaborative work between all stakeholders (agency and non-agency) could improve involvement in the management process. Creating an international association tasked with developing and promoting fisheries management as a profession could benefit this effort.

Consensus Strategies and Recommendations

Workshop participants unanimously expressed a desire to continue working together to improve the education of fisheries managers by focusing on the following consensus strategies (Section 6):

1. Develop creative partnerships within and among institutions, sectors, and nations.
2. Include the management process as a learning experience.
3. Broaden and lengthen career paths.
4. Identify the gaps between those supplying and demanding management training.
5. Create a website that shares information about training programs and resources.
6. Encourage industry scholarships.
7. Develop a case study library similar to those created by the top business management programs.
8. Establish a network of training providers.

The group highlighted three areas for international cooperation: 1) exchanges in formal education of graduate students; 2) international internships and secondments* for students and working managers; and 3) development of fishery management case studies.

A steering committee was formed at the workshop and additional members have joined as a result of a follow-up meeting held at the August, 2002, International Institute of Fisheries Economics and Trade (IIFET) Conference in Wellington, New Zealand. The steering committee has international representation from academia, government, and industry:

- Lee Anderson, University of Delaware, College of Marine Studies (lgafish@udel.edu)
- Darrin Apanui, Manager, Human Resource Development, Te Ohu Kai Moana (Darrin.Apanui@tokm.co.nz)
- Poul Degnbol, Institute for Fisheries Management and Coastal Development, Denmark (pd@ifm.dk)
- Michael Harte, Falkland Islands Government (mharte@sec.gov.fk)
- Laura Jodice, previously Marine Resource Management, Oregon State University, now Clemson University (jodicel@clemson.edu)
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- Jon Sutinen, University of Rhode Island, Department of Environmental and Natural Resources Economics (jsutinen@uri.edu)
- Gil Sylvia, Oregon State University, Coastal Oregon Marine Experiment Station (gil.sylvia@oregonstate.edu)

This committee is currently developing plans for implementing and facilitating the workshop recommendations.

A website (<http://oregonstate.edu/dept/trainfishmngr/>) and listserv (trainfishmngr@lists.orst.edu) have been created to aid communications for this initiative. The website includes instructions for joining the listserv. A copy of this report, progress reports, a current training index, and other resources are also available on the website.

* A secondment is the transfer of personnel to another section or organization for a specific period followed by their return to their original position. They experience no change in salary or terms of employment. For example, a stock assessment scientist was seconded from Oregon State University to the At Sea Processors Association for one year to assist with the development of an industry-led stock assessment program.

SECTION 1

Workshop Background and Rationale

Introduction

Given the significant challenges that nations and regions confront in managing fishery resources, it is vital to reconsider the training, education, and working environment necessary for 21st century fishery managers. For this reason, the international workshop "Training Managers for 21st Century Fisheries" was held in Queenstown, New Zealand, on December 5-7, 2001. This workshop brought together recognized leaders from government, industry, and academic sectors to discuss the challenges for fisheries management and to define the training, education, and professional working environments necessary to produce fishery managers who are problem solvers, leaders, and innovators. Representatives of environmental organizations were also invited but none was able to attend. The 63 invited participants included leading representatives of industry, academia, and government from Oceania, North America, and Europe (Appendix A). This report summarizes workshop outcomes and recommendations in six sections:

1) Workshop Background and Rationale, 2) Challenges for 21st Century Fisheries and Broad Vision for Training, 3) Defining the Fisheries Manager: Skills and Knowledge Summary, 4) Review of Current Training Programs, 5) Linking Capacity to Opportunity: Incentives and Rewards, and 6) Consensus Strategies and Recommendations.

Rationale

Over the last half-century, fisheries have transitioned from unregulated open access to regulated common property. In response, management has broadened to include greater regional, community, and industry participation and developed longer term and broader sets of environmental, social, and economic objectives. New legal mandates under the rubric of "sustainable fisheries" require that fisheries managers achieve challenging and potentially conflicting objectives including rebuilding stocks, reducing by-catch, protecting fish habitat, sustaining fishing communities, maximizing economic benefits, and conducting cost effective research and management. Managers are required to achieve these objectives using precautionary and ecosystem-based management strategies consistent with conserving stocks at levels capable of producing maximum sustainable yield.

Given the enormity of the challenge, traditionally trained fishery managers and policy-makers may not have the requisite skills to advance private and public welfare. Most fishery managers are trained in biological sciences or government administration, fields that may leave them inadequately prepared for the challenges of contemporary fisheries. Some university programs provide interdisciplinary training in marine resource management and policy through courses in biology, economics, law, and policy. Although these programs offer a breadth of training, they rarely provide enough depth or focus to produce graduates equipped to be strategic and accountable managers. Many students of these programs are trained to facilitate a fishery management process, rather than to successfully manage an organization.

Recognizing the limitations of training programs, many government agencies have continued to promote biological scientists to key management positions, and industry typically recruits top managers from business programs. However, few programs exist that are designed to provide professional development training in fishery management and decision making for the working fishery manager. This method of creating managers is insufficient to meet 21st century challenges.

Redesigning curricula and training programs, however, may only be part of the solution for improving the skills of fishery managers. Attracting people with intellect and ability requires a work environment that provides appropriate freedoms, responsibilities, and rewards. Talented managers have many opportunities in the global marketplace. Unless provided an enabling and rewarding professional environment, they will seek opportunities elsewhere, leaving fisheries with perfunctory administrators and second-rate managers.

Objectives

The workshop had seven major objectives:

1. Create a vision of fisheries management for the 21st century and describe the challenges and opportunities inherent in that vision.
2. Determine the management competencies and individual qualities necessary to meet these challenges.
3. Evaluate the extent to which existing educational and training programs provide for these competencies and qualities.
4. Evaluate the organizational management structure necessary to attract and reward such individuals.
5. Recommend educational and training programs necessary to attract and produce individuals with the appropriate abilities.
6. Communicate workshop results to appropriate educational, management, and industry organizations.
7. Encourage follow-through in instituting change.

Workshop Organization

The workshop was divided into three sessions designed to promote interaction among speakers and other participants (see Appendix B for agenda; see <http://oregonstate.edu/dept/trainfishmngn/action.html> for link to all presentations).

Day 1—The focus was on defining a collective vision of fishery management and the skills needed by managers. In Session I speakers presented a vision of fishery management in the 21st century with particular focus on the intellectual skills, personal abilities, and working environments necessary to produce competent fishery managers. Session II speakers reviewed existing programs for educating and training fishery managers. These were compared to programs that educate managers in other natural resource and business fields. Following these presentations, participants divided into workgroups by sector (government, industry, academic) to define a collective vision and to develop a list of key skills and capstone courses or opportunities that educators should be emphasizing in their curricula.

Day 2—The focus was on linking capacity to opportunity. Session I speakers discussed how organizations can be structured to attract, support, and enable successful managers. Session II speakers reviewed specific examples of flexible learning pathways that provide alternative models of training suitable for continuing professional development. Participants divided into mixed sector workgroups to discuss how to develop professionally rewarding opportunities for people involved in fisheries management and how to create training programs accessible to a wide range of learners.

Day 3—The focus was on ideas for the future. Session I speakers presented ideas for future training strategies. Workgroup discussions from the previous two days were summarized. Participants then met in sector workgroups to discuss options for implementing workshop ideas. Each workgroup developed a list of action items, prioritized by the magnitude of likely impact. Participants then reconvened in a final session to discuss approaches for summarizing, communicating, and following-up workshop recommendations to ensure the widest and most significant impact.*

Speakers and Panelists

Speakers included managers from the private and public sectors in fisheries and other natural resource industries, industry and government decision-makers, university educators and administrators, and NGOs. Speakers represented a cross section of fisheries, management organizations, industries, and educational organizations (Appendix B).

Workshop Products

This workshop produced a website describing fishery manager training programs worldwide and two reports: 1) workshop summary to be distributed to relevant organizations and 2) manuscript analyzing workshop results and recommendations to be published in a leading fisheries journal.

Organizers

The workshop was organized by the New Zealand Seafood Industry Council and the Coastal Oregon Marine Experiment Station, Oregon State University.

Sponsors

This workshop was sponsored by NOAA Fisheries (National Marine Fisheries Service), New Zealand Ministry of Fisheries, New Zealand Seafood Council, Te Ohu Kai Moana, New Zealand Foundation for Research, Science and Technology, and American Fisheries Society (Marine Division).

* Originally, workshop organizers planned to have sector oriented sub-groups develop specific ideas for curricula and programs for training and educating fishery managers in 1) government fishery agencies, 2) private fishing and seafood companies, 3) non-profit industry organizations representing groups of firms and/or community interests, 4) non-governmental agencies, and 5) politically-elected fishery decision-makers. While ideas were discussed for specific sectors, workgroups tended to produce strategies relative to all sectors as there was not sufficient time to be more detailed. However, a few sector specific ideas did emerge. In the future, it would be useful to have sector specific workshops to discuss and develop more detailed curriculum for that sector.

SECTION 2

Challenges for 21st Century Fisheries and Broad Vision for Training

What is the vision for fishery management 10 years from now?

Introduction

The opening session of the workshop focused on visions for 21st century fisheries and the challenges those visions represent. No attempt was made to define a succinct consensus vision for fishery management. Rather, the session focused on elucidating how visions of future fishery management influence perceptions about the knowledge, skills, and personal qualities needed by future fishery managers. Speakers and participants agreed that fishery managers face major difficulties in addressing mandates for sustainable fisheries, ecosystem management, rights-based management, and greater stakeholder and community participation. However, specific challenges and their perceived priority varied by the participants' management experience, their political, economic, and social context and the sector they represented (e.g., government, industry, academia, indigenous, NGOs).

Speakers and participants with significant administrative responsibilities emphasized the gap between recent legal mandates for sustainable fishery management and existing management practices. They argued that rather than develop new or ambitious visions, fishery managers should use the next 10 years to overcome "implementation overload" and address legal responsibilities under current law. They emphasized the need for eliminating overfishing, rebuilding stocks, reducing harvesting capacity, generating profitable fisheries, solving allocation, addressing jurisdictional complexities, and reducing litigation.

Many participants stressed the need to transition to stronger rights-based approaches for fishery management. Industry representatives emphasized the importance of private sector stakeholder responsibility for fishery management; however, they also recognized the challenge of reconciling management by fishing rights holders with other stakeholder groups.

Representatives of indigenous people highlighted the need to meet sustainability mandates and the needs of future generations. They stressed the importance of ethics in fishery management and integrating ethics with institutional design and scientific management responsibilities. They also cited the value of indigenous knowledge and the need to minimize loss of historical, cultural, and resource knowledge as traditional users and managers retire or end their participation in fisheries.

Fishery Management Challenges

Highlights from the discussion and written comments on the vision for 21st century fishery management focused on the following categories of challenges, opportunities, and needs:

Cooperative and Stakeholder-based Management and Research

- Increasing public demand for authentic participation in all aspects of fisheries management
- Developing a transparent flexible working relationship with environmental groups, non-fishery stakeholders, and government agencies
- Evolving fisheries management from a mostly top-down process to one that is more stakeholder-based with strong research and technical support from academic and government sides
- Developing, implementing, and working with effective co-management (partnership) agreements (includes arranging funding and providing accountability for funds)
- Educating urban populations about marine and coastal rural resource issues
- Facilitating debate between different sectors on resource use and management
- Reaching an appropriate balance between industry desire for self management and government stewardship responsibilities
- Supplementing scientific knowledge with stakeholder knowledge

Ecosystem Management

- Developing and implementing ecosystem based fisheries management policies
- Managing for multiple species
- Improving our understanding of natural system variability, climate change, and anthropogenic impacts on fisheries
- Rebuilding depleted fishery stocks consistent with ecosystem principles

Management Under Risk and Uncertainty

- Contending with lack of basic biological and economic information, e.g., fish stocks; ecosystems; economic data from commercial, recreational, and non-consumptive users
- Making appropriate management decisions in the presence of the inherent uncertainty of resource stocks, industry, markets, enforcement, and government behavior
- Making timely decisions with little information

Property Rights and Allocation

- Implementing an integrated rights-based fisheries management framework
- Allocating fish resources among stakeholders, including commercial, recreational, and indigenous
- Dealing with future failures in poorly designed Individual Transferable Quota (ITQ) systems
- Maintaining the diversity of user groups
- Improving management recognition, inclusion, and capability for representing the public's right to share inshore fisheries

International Management

- Evaluating the relationship of individual and national fisheries to transboundary ecosystems, markets, and legal jurisdictions
- Growing fishing pressure on high seas fish stocks
- Increasing global population and demand on fisheries
- Increasing trade in fisheries products
- Managing high seas, shared, and trans-boundary fisheries
- Breaking down trade barriers and realizing new trade opportunities

Public Environmental Objectives

- Evaluating the relationships between fisheries and society as a whole
- Increasing public opposition to commercial fishing based on concerns over environmental impacts
- Understanding and managing the conflict between commercial uses of fish resources and environmental goals
- Rationally addressing the increasing demands to implement marine protected areas as a fisheries management tool or as a means to accomplish other goals such as biological diversity or stock preservation
- Integrating broad conservation agendas to the satisfaction of their proponents while sustaining economically viable fisheries

Improving Management Effectiveness

- Developing efficient and effective fishery management institutions
- Fostering innovation in fishery management practices to address complexity
- Promoting cost-effective compliance
- Focusing fisheries management on substantive issues rather than short-term emotive issues
- Incorporating economic principles into fishery management
- Integrating socio-economic issues into management decision making
- Defining and evaluating expectations, measures of success, and accountability
- Decreasing public budgets for fishery management
- Delivering the efficient use of fisheries management budgets, particularly in the context of cost recovery
- Accommodating and incorporating privatization of services

Improving Ocean Governance

- Developing governance systems for multiple ocean use and conflict resolution
- Integrating aquaculture systems in comprehensive coastal resource management

Litigation

- Recognizing the increasingly litigious environment and role of the courts in fishery management
- Contending with compensation claims where existing rights are impacted by management decisions
- Successfully managing lawsuits once initiated

Summary: Visions for the Ideal 21st Century Fishery Manager

The vision session on fishery management concluded by addressing implications for general abilities and competencies of the 21st century fishery manager. Reflecting the difficulty in defining a simple or single vision for fishery management, there was no consensus vision of an ideal fishery manager. Participants generally agreed that fishery managers in the 21st century must be effective policy leaders possessing significant moral character and intellectual ability. They must not only be able to lead a policy process but lead teams of competent professionals capable of addressing management challenges. They should be passionate about improving management of fishery resources and increasing public and private benefits. They must also have the necessary technical management skills, but must not lose touch with the physical and human components of fishery management—the fish, the water, the fishermen, and the seafood processors.

While participants could agree on general ideal characteristics, they did not agree on specific characteristics. Although differences in opinions can be partially explained by a participant's experience, nationality, and sector, they also stem from different perspectives on the underlying models of fishery management and the perceived complexities of the management process. These issues are discussed in detail in the next section of this report.

SECTION 3

Defining the Fisheries Manager: Skills and Knowledge Summary

What are the key skills that educators should be emphasizing when designing training programs for 21st century fisheries managers?

What are the “capstone” areas of a curriculum for 21st century managers?

Defining Competencies

The workshop participants attempted to define the key skills, knowledge, and capstone opportunities educators should be emphasizing when designing curricula for 21st century fisheries managers. However, they first found it necessary to establish significant assumptions about the definition of a 21st century fisheries manager.

1. **Fishery management is a process, not a tightly bounded organization.** In the past, fisheries management might have been more narrowly defined as an occupational category, but in reality, it is a decision-making process with an integrated view, focusing on how to manage impact. Furthermore, fisheries management, like management in any complex system or organization, is a dynamic process requiring team-based analysis and implementation. Thus, fisheries management involves individuals with strengths in different disciplines and skill sets that must be melded together to address complex problems. Consistent with this view, workshop discussion focused on including everyone who significantly participates in the fishery management process as a “manager”—including scientists, decision makers, industry and the public—in the definition of fisheries manager. For example, depending on the fishery or management system, stakeholders may play a primary role that requires education to enable effective participation. The workgroup discussion emphasized the need to train all participants in management.
2. **All necessary skills and knowledge cannot exist in one manager.** Effective team-based analysis requires managers to take a comprehensive perspective, understand the management process, identify problems and challenges, and lead teams to address ecosystem-level problems at different scales of management. The challenge is to train managers who recognize the value of different areas of expertise and who possess the necessary professional skills to lead a team toward a management solution. All participants in fisheries management will require some common skills and knowledge, but at different depths. Participants will need to be familiar with other areas of expertise, but the level of familiarity will vary depending on their role in the process. There will still be a need for specialists, but specialists will also need some knowledge of other disciplines.

3. **The role of the fisheries manager varies.** The degree of accountability and authority held by the manager will vary depending upon the manager's role in the process. Managers primarily responsible for implementing decisions and monitoring and evaluating outcomes generally have a lower level of authority and accountability than managers responsible for strategic planning, policy making, innovation, and leadership. Stakeholders with decision making authority have a higher level of accountability than others who are only advisory. The manager's role and level of accountability is also defined by:

- Institutional setting, as outlined in the following model:

Institution	Manager
Scientific centralized	Scientifically trained federal manager makes management decisions for national or regional fisheries
Pluralistic	Resources are federally owned but regionally appointed representatives develop management policies— significant public participation
Rights-based	Owners of user rights/property rights charged with management responsibilities subject to regional and federal oversight

- Sector—e.g., industry, government, NGOs
- Management scale—e.g., international, national, local
- Type of fishery
- Level of economic development

The challenge is how to address the specific training needs for a variety of levels, sectors, and target groups.

The length of this workshop did not provide for in-depth discussion of specific training needs for each type of manager. The workshop discussion did, however, suggest that depending on the fishery governance system, there are at least seven classes of “managers,” with each class requiring different skill sets and depth and breadth of knowledge. These management types include:

- Industry, community, and NGO stakeholders
- Managers of individual fishery organizations including leaders of fishing businesses and NGOs
- Leaders of NGOs with significant responsibilities for contributing to the design and implementation of fishery management plans—e.g., private sector quota management organizations
- Mid-level governmental managers charged with implementing management decisions and leading interdisciplinary teams of scientists

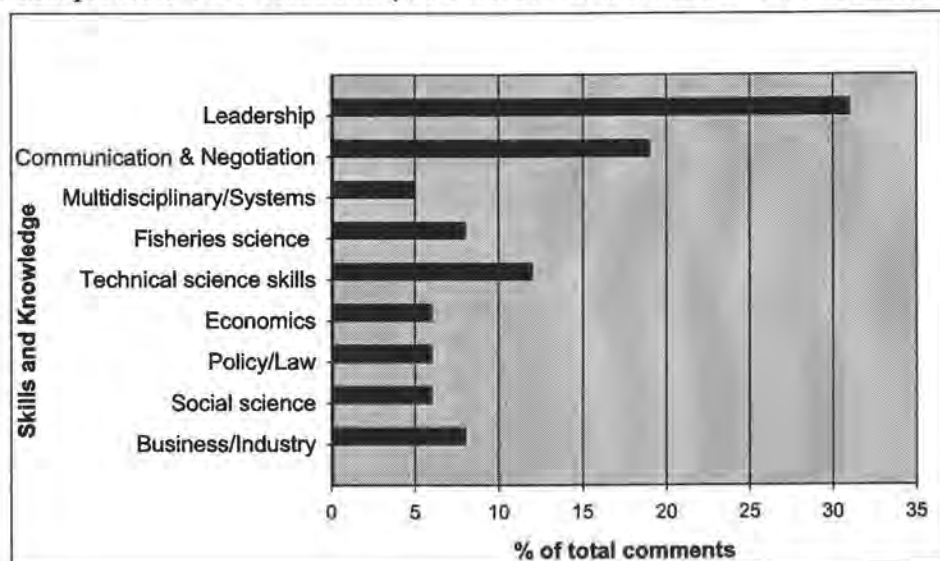
- Lead managers of government fishery agencies who must effectively lead and improve the management organization
- Institutional analysts charged with developing new ideas about policy, institutions, and governance
- Policymakers tasked with evaluating and voting for policies, regulations, and management strategies

Collective List of Skills and Knowledge

Workshop participants developed a comprehensive set of management skills and knowledge for effective management of fisheries (Table 3.1 and 3.2). Two mechanisms were used to help develop this set of skills and abilities:

1. **Pre-workshop survey.** Participants were surveyed by e-mail to develop a preliminary list of knowledge and skills necessary for effective management in the 21st century (Appendix C). Twenty-seven people (approximately one-fourth of all who were originally invited to attend the workshop) responded (Appendix D). A summary of responses to "List three to five skills that managers will need in order to successfully address these challenges" is provided in Figure 3.1 and Table 3.1. Most comments focused on leadership qualities and skills related to leadership—communications, conflict resolution, decision making, problem solving, critical thinking, and systems analysis. For those focusing on scientific knowledge, respondents placed a strong emphasis on knowledge of ecosystem science and management. For those focusing on critical thinking and problem solving, there was extra emphasis on holistic, multidisciplinary systems thinking.

Figure 3.1. Training Managers for 21st Century Fisheries pre-workshop survey response on the three to five skills that managers need: total comments = 118; total respondents = 27; average respondent provided 4 to 5 comments (see Table 3.1 for more information on each category).



2. **Workshop discussion groups.** During the workshop, participants divided into government, industry, and academic workgroups to address the two questions listed at the beginning of this section. The results are summarized in Table 3.2. Compared to the pre-workshop survey, this session helped identify perspectives specific to government, industry, and academia as well as perspectives shared across groups.

The three groups agreed that managers need:

- Generic skills/knowledge:
 - Basic sciences (especially biology, ecology), economics, social science, policy, law, business and environmental risk analysis
 - Leadership and management skills in communications (conflict resolution, consensus building, facilitation, people skills, intercultural skills), integrative or system-level critical thinking, decision making, problem solving, and risk analysis and management
- Fisheries-specific skills/knowledge:
 - Fisheries science
 - Fisheries management tools (risk analysis, stock assessment)
 - Knowledge of all stakeholder groups
 - Skills in managing the interface between specialist and decision-maker
 - Skills in incorporating indigenous and industry knowledge

However, the three groups placed different emphasis on specific types of skills and knowledge. For example, the government and industry groups emphasized technical management, planning, and decision process skills more than the academic group. This resulted in discussion about where training should occur—through academic programs, continuing education, or on-the-job training. Some government representatives suggested there should be a balance between academic and practical training. Some industry representatives rejected the notion that a truly competent fisheries manager could only come from an academic graduate level program and suggested that real world experience combined with certification or performance standards or a combination of real world and academic training may be sufficient. Some academic representatives questioned whether conflict resolution, leadership, and teamwork skills should be taught or learned best in the classroom, or whether these skills are learned best through on-the-job training. This view is reflected in our review of current training programs in section 4 of this report, where we found that academic programs appear to place less emphasis on these types of skills.

Capstone Opportunities

Capstone opportunities are experiences that allow students to integrate and apply knowledge and skills acquired through a training or academic program. Participants agreed that capstone opportunities should be reality-based or real-world experiences that are specific to fisheries or other natural resource management areas.

Reality-based opportunities are integrated experiences with practical application.

Workshop participants identified the following priority opportunities:

- Case studies—e.g., outcomes of specific management plans; comparative systems
- Applied research projects
- Analytical team projects
- Applied management courses
- Fishery management plan development
- Modeling or simulation—e.g., business problem solving
- Role playing or debating—e.g., developing arguments for or against legislation, facilitating discussions among sector specialists to integrate information
- Studies of the connection between fisheries and other social issues at local and international scales

Real-world opportunities are projects or assignments with the private or public sector.

Workshop participants identified the following priority opportunities:

- Internships, professional mentoring or shadowing, and secondments*
 - Part of academic program—middle and end; suitable length
 - In-service—cross-sector or cross-agency
 - Requires cooperation among sectors to integrate internship with the long-term interest of the intern host
- Sea time—e.g., commercial, research, fisheries observer program
- Field experience in multi-party conflict resolution
- Interaction with fishing communities
- Interaction with fishery management decision making processes (e.g., fishery council work)

Case studies, internships, and secondments were stressed in varying degrees by all work groups (Table 3.2).

Solutions

Effective training of managers of 21st century fisheries will require communication, cooperation, and coordination among all groups involved in fisheries management, enhanced through the formation of cooperative partnerships within and across sectors.

To define needed skills and knowledge, future workshops should focus on:

- Defining training needs specific to managers of different sectors, responsibilities, regions, and nations. This may mean performing sector-level needs assessments and identifying gaps between existing training programs—academic, continuing education, and others. Some

* See page 5.

organizations represented at the workshop have already performed needs assessments—e.g., Food and Agriculture Organization (FAO), New Zealand Ministry of Fisheries, NOAA Coastal Services Center.

- Developing and adopting specific training objectives and performance standards related to target levels of management skills.
- Identifying the best delivery methods and venues for specific types of training—i.e., academic programs, continuing education, or on-the-job training.
- Developing capacity for reality-based and real-world integrated training opportunities such as case studies, internships, and exchanges that would include supporting cooperative agreements and financial commitments.

In addition, communication within and across sectors should be enhanced through websites or e-mail groups dedicated to fisheries management training. These could be associated with a clearinghouse for internship opportunities, an online database of case studies, and other reality-based training resources.

Table 3.1. Pre-workshop survey: skills summary (see Appendices C and D).

KNOWLEDGE — <i>Multidisciplinary holistic understanding of the dynamics of fishing and the ecosystem, and knowledge of and/or exposure to real world activities regarding fisheries and fish habitat.</i>	
Science <ul style="list-style-type: none"> • Science basics • Fisheries science <ul style="list-style-type: none"> - Stock assessment - Ecology - Biology • Ecosystem science <ul style="list-style-type: none"> - Time, space - Species interactions - Integrated marine ecology • Environmental impacts • Marine and climate sciences (physical, biological, geological, and chemical oceanography, atmospheric sciences) Policy/Law - Legal framework of management <ul style="list-style-type: none"> • Law of the Sea (including enforcement) • Legal/legislative process • Federal laws, regulations, and policies • Compliance with regulations (to eliminate lawsuits) • Applying institutional structures to enhance fisheries management objectives and outcomes 	Social science <ul style="list-style-type: none"> • Human behavior • Socio-economic indicators (fisheries) • History of fisheries • Stakeholder communities • Myth and belief structures Economics <ul style="list-style-type: none"> • Resource economics • Fisheries economics • Specific concepts: externalities, market institutions • Biostatistics/econometrics • Economic management Business/Industry <ul style="list-style-type: none"> • Global industry • Business administration • Seafood marketing • Co-management—sharing management responsibility with constituents
ANALYTICAL AND CRITICAL THINKING SKILLS	
Technical analysis skills <ul style="list-style-type: none"> • Geospatial statistics and data handling • GIS design and implementation • Integration of remotely sensed data • Competent computer skills • Accessing fisheries oceanography and industry data • Population estimates • Stock assessment methods • Assessment of noncommercial harvest • Ecosystem modeling • Systems analysis—methodologies to assess effects of different management regimes and regulations (evaluation, real time) • Risk analysis and procedures • Conducting socio-economic studies 	Critical thinking, problem solving, decision making <ul style="list-style-type: none"> • Applies knowledge and experience • Develops new approaches • Team decision making and planning • Lateral thinking and acting processes • Analytical and integrative thinking <ul style="list-style-type: none"> - Facts-based - Complex relationships - Big picture and small details • Timely • Recognizes level of authority • Business/project/fish management planning • Strategic planning • Uncertainty

Table 3.1. Pre-workshop survey: skills summary, *continued*

PEOPLE SKILLS — <i>working with wide range of stakeholders and sectors.</i>	
Consensus Building and Conflict Resolution <ul style="list-style-type: none"> • Facilitation • Mediation • Bargaining and negotiation • Team building/group process • Inclusion— e.g., public involvement • Community-based planning • Willing to listen to all user groups 	Communications <ul style="list-style-type: none"> • Effective and clear with diverse audiences • Translation/transformation and presentation of technical information/scientific knowledge for stakeholders, policy-makers, and the public • Cross-cultural interpersonal skills—ability to interact with people whose beliefs/actions are not determined on the basis of scientific information
LEADERSHIP SKILLS — <i>qualities in addition to above that make a good leader or executive manager.</i>	
General leadership skills <ul style="list-style-type: none"> • Trust and respect within own company/user group • Ability to create positive change and enable others to support it • Building relationships (identifies key contacts, develops partnerships) • Ability to pro-actively work collaboratively and draw upon resources and talents from people with a wide variety of interests, goals, knowledge, and skills • Coherent delegation skills • Strong organizational skills • Ability to sell concepts • Listening, understanding, and responding (communicates clearly, responds to concerns, motivates to action) • Improved understanding of and ability to engage with members of an increasingly pluralistic society • Success, even under difficult conditions 	Personal character/qualities <ul style="list-style-type: none"> • Well-directed passion • Good judgment • Open minded • Ability to find enjoyment • Ability to work under huge pressures and stress • Unlimited patience and tolerance • Statesmanship and integrity • Vision of the future and able to lead this vision • Proactive • Initiative—addresses current opportunities, manages crises, plans ahead • Adaptability • Creative and innovative Administrative skills <ul style="list-style-type: none"> • Executive management—personnel, budgets, workload planning, etc. • Recognition of, and provision for professional advancement of staff, including need for training • Recognition of the limitations of staff and the need to fill gaps from outside, particularly for special problems

Table 3.2. Workshop groups: skills summary.

GOVERNMENT	INDUSTRY	ACADEMIC
Knowledge <ul style="list-style-type: none"> • Traditional disciplines: <ul style="list-style-type: none"> - Economics - Science - Law • Social sciences, value systems, and human behavior • Mechanics of fishing • Marketing • Business • Governance frameworks 	Knowledge <ul style="list-style-type: none"> • Fisheries and fish resources—Mix of theory and experiential • Some basic knowledge of technical disciplines: <ul style="list-style-type: none"> - Science - Policy - Law - Society - Economics 	Knowledge <ul style="list-style-type: none"> • Key management tools • Risk management • Enforcement • Stock assessment • Basic biology • Economics • Law • Politics • Culture • Population dynamics • Comparative systems • Fleet dynamics/fishing capacity • Practical knowledge of the fishing industry
Planning/Decision making <ul style="list-style-type: none"> • Problem solving • Policy analysis • Institutional analysis • Rule making, codification • Government decision-making • Strategic planning • Manage change, recognize change drivers • Process of management • Project management 	Planning/Decision making <ul style="list-style-type: none"> • Policy development and implementation • Facilitate delivery of programs and policy • Think strategically and creatively • Process and analyze information in best interest of fishery • Develop strategic management options • Knowledge of management process 	Planning/Decision making <ul style="list-style-type: none"> • Problem solving • Critical thinking skills
Technical management skills <ul style="list-style-type: none"> • Understand use of information technology • Monitoring and reporting • Decision support skills 	Technical management skills <ul style="list-style-type: none"> • Risk assessment and mitigation • Processing and analysis of information, information transfer • Decision support systems • Tools for decision making and planning 	
Leadership <i>Communication skills</i> <ul style="list-style-type: none"> • Conflict resolution • Facilitation • Negotiation • Communication • People • Build/maintain consensus 	Leadership <i>Communication skills</i> <ul style="list-style-type: none"> • Facilitation • People skills • Communication • Listening • Negotiation (negotiate collective outcomes) • Multilingual • Public relations • Integrity 	Leadership <i>Communication skills</i> <ul style="list-style-type: none"> • Communication • Conflict resolution • Mediation • Interpersonal • Teamwork

Table 3.2. Workshop groups: skills summary, *continued*.

GOVERNMENT	INDUSTRY	ACADEMIC
Leadership <i>Integrative thinking</i> <ul style="list-style-type: none"> • Ability to integrate across disciplines • Integrated marine resource management • Big picture 	Leadership <i>Integrative thinking</i> <ul style="list-style-type: none"> • Skills to integrate disciplines 	Leadership <i>Integrative thinking</i> <ul style="list-style-type: none"> • Synthesis • Comprehensive knowledge (via continuing education)

SECTION 4

Review of Current Training Programs

Introduction and Challenges

Training a variety of generalists and specialists with different degrees of breadth and depth in knowledge and skill will require a variety of approaches. While much of fisheries management training has occurred at academic institutions, a postsecondary, undergraduate, or graduate academic program is not always the answer for training all types of managers. For example, on-the-job and in-service training may be the best approach for industry. Specialized extension courses or workshops might be best for stakeholders or professionals. Graduate-level academic training or advanced continuing education may be the best solution for training managers with responsibilities for decision making, policy, planning, and research administration.

In the past, workshops on fisheries training have focused on undergraduate education and preparation for entry-level management positions or on continuing professional training, primarily for mariners. In 2000, the U.S. Ocean Studies Board of the National Research Council held a workshop titled "Education and Training Needs for Fisheries Science and Management: Stock Assessment Science, Fisheries Economics, and Fisheries Social Science." The workshop focused on graduate-level training of science and management specialists to meet the needs the National Marine Fisheries Service, but did not consider the education of broadly trained managers capable of leading teams.

The physical and biological dynamics of marine systems and their institutional challenges create a need for management skills in integrative and critical thinking. The challenge is to determine the best way to produce these skills through a variety of educational media. This section provides a summary of academic graduate programs and some information on continuing education programs that are targeted at training fishery managers toward the level of training highlighted by the workshop.

Assessing Training Capacity—Review of Current Programs

Workshop participants were provided with a review of current graduate-level training programs by Jodice and Sylvia (see Appendix F for full report) and presentations on models of flexible learning appropriate for continuing education (see Appendix G and <http://oregonstate.edu/dept/trainfishmngtr/presentations.html> for workshop presentations by Cloughesy and Johnsen on this topic). Given the need for advanced training in fisheries management, the review of existing programs focused on graduate-level academic programs but also provided some information on relevant training capacity in continuing education and advanced professional training. Existing training programs were identified through a web search of academic or university-based, postgraduate programs (postgraduate diploma or certificate, Masters, or Ph.D.) and continuing education programs with information available in English. Any programs with relevance to marine fisheries management (marine resource management, environmental management, environmental studies, conservation biology, environmental policy, resource economics, agribusiness, human ecology/human dimensions, and forestry; environmentally or socially

oriented public administration, law, business, or management science programs; dual or joint degree programs; and leadership programs) were also examined and included as links on the current training website (<http://oregonstate.edu/dept/trainfishmngtr/training/TFM21.html>) created for this review.

The review, conducted between August and October 2001, found 72 graduate/postgraduate academic programs offering 165 degree options at a total of 46 institutions, located in the United States, Canada, Europe, Asia, and Australia, with at least some specific stated focus on fisheries management. Fifty-four percent of the programs were located in the United States (Figure 1 in Appendix F, Appendix F.1).

These 72 programs were reviewed more thoroughly by searching academic program web literature for keywords in vision, mission, goals, degree requirements, and courses. The keyword list was created from skills, knowledge, and training goals emphasized in previous fisheries and natural resource management training workshops. This effort produced qualitative information on program organization, curricular features, and quality.

Organization

Academic, graduate, or postgraduate programs in fisheries management range from science-based or other specialist programs (e.g., fisheries, aquatic, or marine science, fisheries economics, law or policy) to more management-based, multi-disciplinary, generalist programs (e.g., marine or natural resource management or policy, dual or joint degree between science or environmental management) containing a fisheries management concentration or emphasis (Appendix F.1). The 72 programs reviewed have the following organizational attributes:

- Programs in fisheries management appear to have evolved primarily from fisheries sciences programs. Fifty-eight percent of the academic degree programs reviewed offer “fisheries” as a major, usually as fisheries science. Some institutions offer fisheries as a major but also as an emphasis or option within another degree program.
- Curricula titled “fisheries management” occur most frequently as 1) single course offerings or a series of courses (43 percent); 2) as a degree specialization, option, or emphasis (38 percent); and 3) less typically as an actual major (19 percent). A fisheries management emphasis is also possible as a thesis or research project focus within programs that are primarily fisheries science or some other natural science or resource management discipline.
- Curricula on fisheries management are available at various degree levels (Figure 4. 2). Of the 72 programs, 58 percent offer a Masters degree with a required thesis, 37 percent offer Ph.D. training, and 24 percent offer non-thesis masters-level degrees. Less than 20 percent offer a postgraduate certificate or diploma and only 6 percent provide continuing education programs.

Several programs offer more than one degree option (Appendix F.1). A few United States programs offer both thesis and non-thesis options, certificate programs which must be combined with a graduate degree, or dual major programs. European programs typically offer a Postgraduate Certificate (Pg.C.), Postgraduate Diploma (Pg.D.), and Masters thesis or non-thesis options (e.g., M.Sc. or Mphil.), depending on the number of courses the student completes and whether the student also completes a research project or dissertation, as well as a Ph.D. option. Australian Maritime College's "MBA in Marine Resource Management" adds even more flexibility by offering accelerated (6-day live in) or distance courses suitable for practicing managers. This type of degree flexibility provides a model for evolving a more traditional, academic program toward inclusion of academic-based continuing education opportunities for industry or agency managers, as well as other stakeholders.

Curriculum Strategy and Content

Fisheries management curricula vary in their mission and goals, course requirements, and skill and disciplinary emphases.

- **Goals:** The typical focus is on training entry-level professionals in areas of fisheries science and/or resource management and providing a scientific foundation for further graduate work leading to the Ph.D. degree; some focus is on developing scientists and professional resource managers capable of leadership and multidisciplinary problem analysis.
- **Mission statements:** The most common key word occurring in mission statements of the 72 programs was "sustainable" (45.8 percent). Fewer than 15 percent of programs include words such as "innovation," "leadership," "synthesis," "stakeholders," "collaborate," "critical thinking," and "resolution." At least a third of the programs use words such as "interdisciplinary," "integrated," or "multidisciplinary" in describing their curriculum or approach to resource management problems.
- **Disciplinary foundation:** Fisheries management programs are located in a variety of disciplinary or academic homes, which in turn influences curricula (e.g., core course emphasis). Twenty-nine percent of the programs are located in departments focused on fisheries science, 20 percent are located in departments focused on fisheries management, and the remainder are spread among departments focused on natural resources, aquaculture, marine or ocean science, marine affairs or policy, environmental policy, economics, and wildlife science.
- **Science and management curricula:** The most common science-related key words found in materials describing curricula were "fisheries biology" (76 percent), "fisheries ecology" (68 percent), and "economics" (70 percent), with "aquatic science," "aquaculture," and "population dynamics" also being fairly common. Management related key words primarily include "fisheries management" (80 percent), "policy" (62 percent), "sociology" (52 percent), "law" (47 percent), and "business" (35 percent).

Despite what would appear to be a heavy interest in fisheries management and economics, only 31 percent of the institutions offer a course titled “fisheries economics,” and 55 percent offer marine or more commonly natural resource and environmental economics. In most cases, there is only one course in fisheries or resource economics. Ninety percent of the institutions offer a course titled “fisheries management,” but emphasis for this type of course varies from the more common focus on habitat management to the less common social and political focus.

- **Skills:** Program literature was searched for key words similar to those listed by New Zealand workshop participants (Tables 3.1 and 3.2). Administrative skills, such as teamwork, employee supervision, and budget preparation occur the least in academic program web literature. Research, scientific analysis, and technical writing skills receive the greatest emphasis (see Figure 7 in Appendix F).

Quality indicators

Among fisheries management academic programs, indicators of program quality include:

Program capacity:

- Course quantity, diversity, and quality
- Opportunities for fisheries-related research and faculty performing fisheries-related research

The quality, quantity and diversity of course offerings and research opportunities is influenced by whether the program depends on several other departments or on faculty and courses within a single department, and the strength of these departments or the institution as a whole. Most of the multidisciplinary training programs draw faculty and/or courses from several other departments. These relationships are likely more robust when departments cooperate on course scheduling, include fisheries or at least aquatic resource issues in their teaching and research programs, and cooperate on faculty hiring. The University of Maine’s School of Marine Studies and the University of Washington’s School of Marine Affairs are both able to offer a suite of fisheries-specific courses in management, economics, policy, and social science due to strengths within their own programs.

Innovative curriculum:

- Capstone or integrative synthetic courses or opportunities, including reality-based or real hands-on work provide a mechanism for students to integrate knowledge and skills.

The most typical graduate-level capstone in fisheries is the research thesis or project, while emphasis on case studies, leadership training, and team projects is fairly low. Other management and public administration programs serve as resources for capstone opportunities appropriate for fisheries management training. For example, many business management (e.g., M.B.A.) and public administration programs

advertise integrative teaching methods, such a group study, team projects for real clients, case study, and simulation, which also develop practical management skills such as teamwork and leadership. Many of these programs made recent changes in their curriculum to allow for integration of research teaching, research, and industry and specialized global immersion experiences. Appendix F.2 provides a table listing the primary teaching methods and capstone experiences employed by the top 10 MBA programs in the United States and top 7 non-U.S. institutions (as listed by *Business Week* 2001). Some similar capstone opportunities occur in fisheries management graduate programs. For example, in the United States, Oregon State University's Marine Resource Management and the University of Washington's Marine Affairs programs use special course projects to develop products to meet needs of state or federal agencies. In addition, the University of Rhode Island's Department of Environmental and Natural Resource Economics has created a policy simulation laboratory using computer visualization technology to examine the consequences of policy actions.

Facilities and location:

- Appropriate facilities, including availability, size, and proximity of a marine lab and access to a research vessel
- Proximity and access to the commercial fishing industry or other types of fisheries-dependent communities

Of 46 institutions represented by the 72 training programs reviewed, at least 61 percent appear to be close to a commercial fishing fleet, 63 percent have some type of marine or aquatic lab associated with their program, and 54 percent have access to an oceanographic or smaller coastal research vessel; 39 percent have all three of these characteristics.

Integrative partnerships:

- Inter- and intra-sectoral partnerships and/or cooperative agreements at the local, national, or international level, with industry groups or associations, marine or aquatic resource management government agencies, other academic institutions, other degree programs, or educational delivery programs (such as extension, outreach), research institutes, and other NGOs.

There are a few examples of notable integrative partnerships. Wageningen University and Research Center in the Netherlands claims to have formed a "unique alliance between a university and market-oriented research institutes" that "combines fundamental and applied research with innovative education." In the United States, NOAA Fisheries has developed partnerships with academia to offer Ph.D. fellowships in Population Dynamics and Marine Resource Economics. These fellowships fund students to work on thesis problems of public interest and relevance and to perform internships under the guidance of a NOAA Fisheries mentor.

Other Academic Programs

Various academic programs that are not fisheries specific provide resource management and policy-related training relevant to fisheries management. Graduates of these programs will likely need additional training in fisheries before or after employment as a fishery manager. Many relevant programs are listed in the current training index prepared for this report (<http://oregonstate.edu/dept/trainfishmngtr/training/TFM21.html>).

Continuing Education

Workshop participants learned about the Oregon State University (OSU) Forestry Extension Master Woodland Manager Program that provides progressive training through basic forestry short courses, resource management planning, advanced woodland management, and eventual certification as Advanced Master Woodland Manager. OSU also develops specialized training workshops based on the needs of private landowners, professional managers, and stakeholders. Instructional design recognizes that learning is hierarchical, and thus, programs are designed to meet the instructional needs of the learners by first assessing existing knowledge, attitudes, skills and abilities (KASAs) of the learners. The curriculum is then adjusted through feedback from formative evaluation (see Appendix G). Workshop participants also heard about the New Zealand Seafood Industry Training Organization (SITO) training program that works with individual companies to analyze and meet their needs by creating relevant training tailored to the learners' knowledge, skills, and attitudes (<http://oregonstate.edu/dept/trainfishmngtr/presentations/Johnsen.ppt>).

The review of current programs revealed four categories of continuing education programs suitable for training mid- or upper-level managers:

Academic:

- Extension and outreach education programs offering specialized, needs-based workshops, some conducted through fisheries or marine institutes;
- Postgraduate certificate, diploma, or professional Masters programs with flexible learning options.

Government:

- National agency-based training centers—e.g., U. S. Fish and Wildlife Service, National Conservation Training Center;
- Agency in-house training.

Industry:

- Training developed by and coordinated by industry based associations or trade groups for industry members—e.g., New Zealand SITO.

Non-profit/Foundations:

- Open-enrollment or custom-designed leadership and other administrative and management training workshops—e.g., Center for Creative Leadership in North Carolina.

Solutions

Workshop participants suggested that training needs could be met by a variety of academic and continuing education programs, including flexible learning opportunities and on-the-job training. Based on workshop comments, review of past workshops, and the review of existing programs, the following are recommendations for interrelated strategies to improve training capacity in fishery management:

1. **Perform sector-based needs assessments.** Collect input from employees, employers and stakeholders on training needs and the suitability of training methods for different sectors and levels of management. The outcome of these needs assessments could be used to develop certification standards.
2. **Survey and evaluate existing training programs.** Conduct a more in-depth survey of programs, expanded to include all possible training programs (including those without website literature in English); academic, continuing education, and in-house. Survey training program representatives (directors, faculty, and continuing education trainers) to gain accurate information. Graduates and employers of graduates should also be surveyed to assess effectiveness of training. Analysis should include programs in other natural resource management, business, management, and public administration that might serve useful for fisheries management and should also identify any redundancy in training within management sectors to indicate areas of potential partnership.
3. **Gap analysis.** Identify the gaps between existing training and the skills and knowledge required for each class of manager. This will require comparison of information from an expanded review of training programs with sector-based needs assessments and graduate and employer survey input. The gap analysis would strongly complement the needs assessment and program review.
4. **Develop and online training database.** Create an online, easily updated database of training programs and courses identified as suitable and categorize these by sector and/or management levels.
5. **Improve curriculum.** Based on needs assessment and gap analysis, academic programs should consider offering additional degree options and flexible learning options suitable to working professionals, particularly if certification standards are developed that require professionals to receive periodic training. Academic programs should also explore developing more options for integrative learning, research, and reality-based or experiential training at the M.S. and Ph.D. levels.
6. **Improve marketing and recruiting.** The web is becoming the primary search tool for students and professionals seeking information on training and education opportunities, as well as a relatively inexpensive method for marketing and recruiting. However, the quality of web literature is highly variable. Training programs interested in recruiting more and higher quality students should place priority on keeping web-based marketing current and professional. Web literature should detail how students gain specific skills and knowledge

with a clear link to the goals, objectives and philosophy guiding the curriculum, and if relevant, reflect the most prevalent concepts in resource and fisheries management.

7. **Use existing potential to build new capacity.** Training institutions should continue to evaluate whether they can develop a new or stronger fisheries management training program by 1) more fully utilizing or enhancing existing capacity within their institution; 2) developing new cooperative partnerships with other training institutions or local, national, and international agencies, NGOs and other groups in need of training; 3) providing flexible degree pathways and learning options; and 4) developing new continuing education opportunities for upper level managers and specialists.
8. **Encourage innovation.** Through funding mechanisms, encourage development of innovative curriculum and capstone integrative opportunities and cooperative multidisciplinary or multi-institutional models for training partnerships between industry, government, and academia—including fellowships for professionals seeking advanced training or sabbaticals and cross-sectoral training, internship, and exchange opportunities.

SECTION 5

Linking Capacity to Opportunity: Incentives and Rewards

This section reports on the challenges of attracting, supporting, and enabling fisheries managers to develop rewarding careers. The following questions framed the discussion:

How do we attract, support, and enable skilled fisheries managers to succeed?

Present participants in fisheries management may be the “gatekeepers” of future professional opportunities. How do we enlighten the gatekeepers and the decision makers?

How do we develop responsible, professionally rewarding opportunities?

How can programs be designed and delivered to ensure that they are accessed by a wide range of learners including existing participants in fisheries management?

Challenges

The pre-workshop focus survey (Appendices C and D) and workshop discussion (Appendix E) emphasize that fisheries management as a profession is in crisis. Attracting and retaining non-agency personnel to fisheries management is increasingly difficult. Presenters and participants identified the following challenges:

- Within management agencies, key symptoms of the crisis include:
 - Difficulty recruiting recent graduates
 - High turnover of all staff and low retention of capable, middle-managers with leadership potential
 - Aging workforce
- Suggested “internal” causes for retention and recruitment problems include:
 - Low rates of pay compared to the private sector or other agencies
 - Limited career prospects in hierarchical agency structures
 - Limited professional development opportunities
 - Low job satisfaction
 - Perceived conflict between science and management disciplines within management agencies
- External causes for retention and recruitment problems include:
 - Limited exposure and recognition of fisheries management in the field of natural resource management
 - Absence of interest in fisheries management by graduates of management or non-biological programs
 - Lack of public and stakeholder trust in fishery management institutions
 - The political and litigious nature of fisheries management that weakens management professionals and creates low morale

Knowledgeable non-agency people involved in fisheries management are also increasingly reluctant to engage in the fisheries management process. Most stakeholders enter into management situations expecting success. Failure to achieve the expected outcome is often perceived by the participants as a personal failure. Moreover, the media and stakeholders antagonistic to particular aspects of fishery management give disproportionate attention to failure compared to successes.

Solutions

Workshop discussions produced no single solution for resolving staff recruitment and retention issues within agencies or for rewarding non-agency participants in management. However, several non-exclusive measures were identified.

Strategies within management agencies:

- Attracting high achieving graduates from a diverse range of management, resource, and biological disciplines by:
 - Benchmarking entry-level remuneration at the mean range of salaries paid in comparable public sector agencies
 - Articulating clearly identified career development pathways within fisheries management agencies
- Rewarding staff by:
 - Providing performance-based increases in wages and salaries
 - Creating leadership positions outside the normal hierarchy of agency structures that allow individuals to take initiatives, seek solutions, and mentor other staff
 - Involving all professional staff in the decision-making process and ensuring that this occurs at an early stage in the process
- Encouraging professional development through:
 - Training in new areas or advancing existing knowledge of an area
 - Secondment of staff into different agencies, private sector, NGOs, or academia, including sea-time
 - Giving stretch assignments that develop staff both personally and professionally
 - Rotating positions within organizations so that, for example, biologists work with economists and economists work with biologists; rotating staff from operational positions into strategic positions to give professionals time to reflect and draw on operational experiences that will help improve management systems and procedures

Strategies external to management agencies:

- Improving the image of fisheries management by actively promoting management successes
- Working collaboratively with non-agency stakeholders including indigenous peoples
- Creating an international association tasked with developing and promoting fisheries management as a profession

SECTION 6

Consensus Strategies and Recommendations

Workshop discussions developed a wide range of ideas for improving the education of fishery managers. Many of these were summarized by panel discussants and breakout groups that considered the three questions described below:

Which ideas does the workgroup support?

If there are good ideas, what are the key barriers to making them work and what steps can we take to overcome them?

What actions could workshop participants undertake over the next 12 - 18 months to achieve these ideas and strategies? (Choose the top 3 most likely to have impact.)

Potential Strategies

The six sector workgroups developed remarkably similar recommendations about improving fishery management education (see Appendix E for breakout summaries). The following strategies were presented by panelists and by two or more groups as top priorities:

1. Develop creative partnerships:

- Support new educational partnerships: e.g., government, NGOs, industry
- Support peer exchanges:
 - Managers and agency personnel
 - Share experiences
 - Cost sharing
 - Highly focused
- Develop teaching fellowships to support government or industry participation in academic teaching
- Design MBA/Public Administration partnerships
- Develop policy simulation and management experiments using laboratories and the internet to link management and academic organizations internationally

2. Use the management process as a learning experience:

- Conduct ongoing evaluation of management outcomes and feed results back into the management and learning process:
 - Evaluate stakeholder needs and behavior
 - Evaluate manager behavior, needs, and incentives
 - Use management analysis to design courses, case studies, simulation games

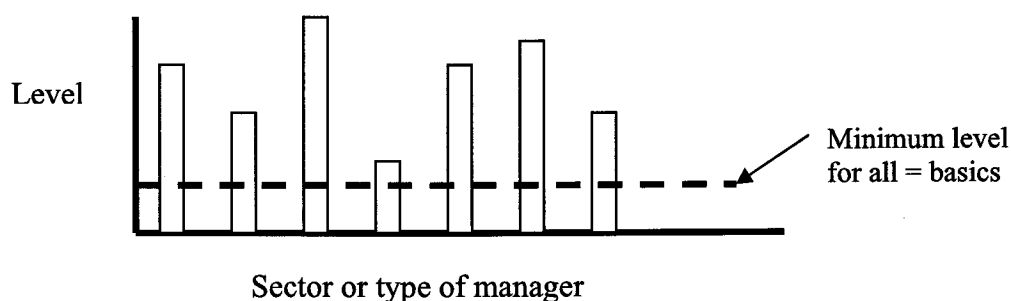
- Incentives and outcomes
 - Universities can gain access to management process, primary data for research
 - Stakeholders (include agencies)—can develop systematic learning experience

3. Broaden and lengthen the fishery management career path:

- Recruit from a broader range of disciplines
- Provide long-run management career paths including supportive working environments and educational opportunities

4. Conduct a gap analysis of curriculum needs—existing and potential programs for educating all “classes” of fishery managers:

- Recognize the need and develop a minimum level of skills and knowledge for managers at all levels and classes of management (See Appendix H)



- Needs assessment should include an evaluation of current employee recruitment patterns to provide a better picture of how manager positions are filled

5. Complete the development of an international fishery management education and training website:

- Comprehensive database with links to all educational programs including industry and stakeholder training
- Multilingual
- Clearinghouse for programs and opportunities
- Educational institutions market programs
- Notice board for internships, secondments, and fellowships

6. Design industry scholarships for fishery managers:

- Industry could signal their concern and ensure that students have a basic familiarity with industry
- New Zealand industry would be willing; United States' industry may be willing but would need someone/group to lead effort

7. Develop a library of fishery management case studies:

- Perform a survey to determine existing cases already used in courses, and perform a literature search for existing published case studies
- Case studies include written, video, policy simulation software
- Establish a process, standards, and templates for case studies
- Include a learning and evaluation component
- IIFET could act as possible coordinator—special workshops for writing and developing cases, special sessions at conferences for presenting cases, provide structure, clearinghouse
- Use *Marine Resource Economics*—a section in each issue or a whole issue devoted to case studies
- Major barriers—funding and incentives compelling individuals to develop cases

8. Organize a network of training providers and users:

- Need individual/organization to coordinate, head up network, provide accountability
- International needs assessment by sector
- Launch at World Fisheries Conference in Vancouver
- Use internet and website as coordinating tools

Barriers and Strategies for Overcoming Barriers

A number of practical barriers were discussed that would hinder development and implementation of strategies:

- Institutional inertia—within (e.g. , work overload) and between sectors
- Lack of understanding of importance by stakeholders
- Financial support
- Leadership
- Time
- Practicality
- Accessibility (local, global, time)
- Difficulty in determining appropriate service providers for training
- Cultural issues and diversity
- Institutional framework and terms of reference

None of these barriers was considered insurmountable. However, the workshop participants recognized that it would require a committed effort by national and international organizations to address these challenges. The actions summarized below were considered essential first steps in achieving success and overcoming barriers.

Actions Workshop Participants Agreed to Undertake

The final activity of workshop participants was to develop strategies to implement consensus conference recommendations during the next 12-18 months. Participants agreed to the following actions:

- Establish an international steering committee to develop the infrastructure to carry on the initiative
- Steering committee meets at IIFET in Wellington, New Zealand in August 2002 to discuss next steps in implementing actions; Develop initial terms of reference and funding possibilities
- Develop case study concept
- Complete the website to coordinate activities and act as clearinghouse for programs
- Consult with executive IIFET committee to determine interest in supporting efforts
- Make workshop results available to relevant audience
- Pursue funding possibilities and ideas within individual countries
- Pursue funding ideas through international funders: EU, NATO, World Bank
- Pursue partnerships—IIFET, FAO, World Bank, NOAA Fisheries
- NOAA Fisheries as a significant financial sponsor of this workshop agreed to review results and recommendation for follow through and support

Next Steps

Creating managers who are leaders, innovators, and creative decision makers is recognized as a critical step toward achieving effective management of 21st century fisheries. Participants in this inaugural international workshop were engaged and passionate about the many ideas and strategies discussed, and clearly saw value in developing training capacity for 21st century fishery managers. Since December, 2001 and the follow-up meeting at the IIFET 2002 conference in Wellington, New Zealand, the project has continued to gain in interest, and organizers have received several international inquiries for the workshop report and requests to join the new e-mail listserv (trainfishmngr@lists.orst.edu) associated with this initiative. A draft copy of the entire workshop report including appendices and presentations was made available online (<http://oregonstate.edu/dept/trainfishmngr/>) by mid-2002, and will be replaced by this final draft. Through the listserv and website, the steering committee will continue to gather information on progress within and among sectors and nations toward accomplishing the workshop strategies. However, momentum will be lost without significant and sustained commitment, in the form of funding, time, and cooperation, to strategies and coordination of this effort.

APPENDIX A

Training Managers for 21st Century Fisheries Participant List

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APPENDIX B

Agenda



**OREGON STATE
UNIVERSITY**

THE NEW ZEALAND SEAFOOD
INDUSTRY COUNCIL LTD



NOAA Fisheries

Training Managers for 21st Century Fisheries

An international workshop: 5-7 December 2001

Queenstown, New Zealand



NZ Seafood Industry Training Organisation
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Oregon State University

TRAINING MANAGERS FOR 21ST CENTURY FISHERIES

Day 1—Wednesday 5 December 2001

8:30am Welcome

Speakers

Kevin Stokes, New Zealand Seafood Industry Council

Gil Sylvia, Oregon State University

9am Plenary 1: The Visions—What Skills Will Fishery Management Require?

Chair

Susan Hanna, Oregon State University

Speakers

Bruce Morehead, National Marine Fisheries Service

David Doullman, FAO of the UN

Whaimutu Dewes, Treaty of Waitangi Fisheries Commission

What is the vision for fishery management 10 years from now? What are the skills that fishery managers will require?

10:30am Morning tea

11am Plenary 2: Current Programmes and Courses for Fisheries Managers

Speaker

Gil Sylvia, Oregon State University

12 noon Lunch

2pm Workgroups: The Visions for Management, Managers, and Education

Discuss the following questions and develop a workgroup response—the response may acknowledge agreement or disagreement within the group

1. Is there a collective vision robust enough to allow education providers to use it as a base for designing training programs?
2. What are the key skills that educators should be emphasising when designing training programs for 21st century fisheries managers?
3. What are the capstone areas of a curriculum for 21st century fisheries managers?

4pm Afternoon tea

4:30pm Plenary 3: Workgroup Responses

Facilitator

Barbara Johnsen, New Zealand Seafood Industry Training Organisation (SITO)

TRAINING MANAGERS FOR 21ST CENTURY FISHERIES

Day 2—Thursday 6 December 2001

9am **Plenary 1: Linking Capacity to Opportunity**

Chair

Kevin Stokes, New Zealand Seafood Industry Council

Speakers

Mark Holliday, National Marine Fisheries Service

Alain Laurec, ENSAR (Ecole Nationale Supérieure Agronomique de Rennes)

Mike Arbuckle, Ministry of Fisheries

How do we attract, support and enable skilled fisheries managers to operate? How do we avoid the micro-management of future fisheries managers, and create opportunities for them to manage? Present participants in fisheries management may be the gatekeepers of the future. How do we enlighten the gatekeepers and the decision makers, within the governance of all sectors?

10:30am **Morning Tea**

11am **Workgroups: Opportunities and Pathways**

Discuss the following questions and develop a workgroup response—the response may acknowledge agreement or disagreement within the group.

1. Quality people won't be "delivered" if responsible, professionally rewarding opportunities are not developed. How do we develop the opportunities?
2. How can programs be designed and delivered to ensure that they are accessed by a wide range of learners, including existing participants in fisheries management?
3. What are the capstone areas that should be delivered to existing participants in fisheries management?

12noon **Lunch**

1:30pm **Plenary 2: Flexible Learning Pathways**

Chair

Lee Anderson, University of Delaware

Speakers

Barbara Johnsen, New Zealand Seafood Industry Training Organisation (SITO)

Michael Cloughesy, College of Forestry, Oregon State University

We can create flexible learning pathways, but will they be used? Examples of successful flexible learning pathways for senior managers and leaders will be presented. Speakers will present their views on their chances of success for current fisheries managers

2:30pm **Workgroups to continue discussion**

4pm *Afternoon tea*

4:30pm **Plenary 3: Workgroup Responses**

Facilitator

Alan Riwaka, Treaty of Waitangi Fisheries Commission

TRAINING MANAGERS FOR 21ST CENTURY FISHERIES

Day 3—Friday 7 December 2001

9am **Plenary 1: Ideas for Future Training Strategies**

Chair

Michael Harte, Falkland Islands Government

Speakers

Jon Sutinen, University of Rhode Island

Poul Degnbol, Institute for Fisheries Management and Coastal Community Development, North Sea Centre

John Goodlad, Shetland Fish Producers Organisation

Brent Marshall, Moana Pacific Fisheries Ltd

The speakers will put forward their ideas on how we can/should best work together in the future to provide Fisheries Managers we need.

11am *Morning Tea*

11:30am **Workgroups: Putting the Ideas into Practice**

Discuss the following questions and develop a workgroup response; the response may acknowledge agreement or disagreement within the group.

1. Which ideas does the workgroup support?
2. If there are good ideas, what are the key barriers to making them work and what steps can we take to overcome them?
3. What actions could workshop participants undertake over the next 12 to 18 months to achieve these ideas and strategies?

12:30pm *Lunch*

1:30pm Plenary 2: Workgroup Responses and Next Steps

Facilitator

Miranda Cassidy

What are the actions to be taken over the next year?

4pm *Afternoon tea*

4:20-

5:30pm Plenary 3: Looking Back, Looking Forward

Chair

Susan Hanna

Speakers

Bruce Morehead, National Marine Fisheries Service

David Doulman, FAO of the UN

Whaimutu Dewes, Treaty of Waitangi Fisheries Commission

APPENDIX C

Pre-workshop Focus Questions

Note: This survey was sent by e-mail to all invited participants.

The following questions have been developed to help you consider the key issues that will be addressed at the "Training Managers for 21st Century Fisheries" Workshop. Please provide brief lists of responses to each question. We will compile the responses and include a summary in the registration packet.

Please return this questionnaire via e-mail to Sandra Diesveld (sandr@d@seafood.co.nz) no later than November 21.

1. List three to five important challenges that fishery management will face over the next quarter century.

- 1.
- 2.
- 3.
- 4.
- 5.

2. List three to five skills that managers will need in order to successfully address these challenges.

- 1.
- 2.
- 3.
- 4.
- 5.

3. Describe up to five educational/training strategies that will support the development of these skills.

- 1.
- 2.
- 3.
- 4.
- 5.

4. List three to five incentives, rewards, responsibilities, or changes in the working environment necessary to attract and retain successful managers of 21st century fisheries.

- 1.
- 2.
- 3.
- 4.
- 5.

5. List three to five actions that your organization can take individually, or in cooperation with other groups, to support development of the education, skills, and rewards/incentives necessary for successful management of 21st century fisheries.

- 1.
- 2.
- 3.
- 4.
- 5.

6. Please indicate the country(s) in which you have had your primary experience in fisheries _____.

7. Please select the sector(s) in which you have been employed in fisheries.

Circle all that apply:

- a. Private industry
- b. Government
- c. Academia
- d. Other _____

APPENDIX D

Pre-Workshop Focus Question Results

This list has been sorted to help demonstrate numbers and range of comments on specific issues.

1. List 3-5 important challenges that fishery management will face over the next quarter century.

Institutional/ Governance *(Some key issues—role and authority of the manager; who does the management; the cost efficiency of management; tension between stakeholders, industry, and government in terms of who should be responsible for management; rights and allocation.)*

General

- Implement strategies to overcome the loss of historical, cultural, and resource knowledge as many users, managers, researchers etc. leave
- Integrate/assimilate new fishery management processes developed in such workshops into existing fisheries management
- Development of governance systems for multiple ocean use and conflict resolution
- Redefining the part(s) to be played by public authorities
- Failure to develop and implement effective capacity management, which leads to stock collapses in spite of Total Allowable Catch (TAC) management in place
- Co-ordination of all fisheries users

Funding/efficiency

- Development of efficient-effective fishery management institutions
- Declining government budgets
- Reduced government expenditure and increased cost-recovery will result in limited funding for fisheries management
- Delivering the best and most efficient use of fisheries management budget, particularly in context of cost recovery
- Management costs and efficiency
- Adequate financial resources

Lawsuits

- Managing the lawsuits
- Increasingly litigious environment

Legislative/policy issues

- Time it takes for council to approve fisheries management plan (FMP) in regard to it becoming law
- Integrating multi and conflicting federal laws
- Contributing to and implementing the governments' Ocean's Policy

Co-management

- Developing and implementing co-management arrangements
- Government/industry co-management
- Develop, implement, and work with effective co-management (partnership) agreements
- Arrange funding and provide accountability for funds
- Evolving fisheries management from a mostly top-down process to one that is more stakeholder-based with strong research and technical support from academic and government sides
- Reaching an appropriate balance between industry desire for self management and government stewardship responsibilities

Decision making

- Developing integrated rationale and values-based decision-making frameworks
- Being able to make appropriate management decisions in the presence of the inherent uncertainty about stock, industry, enforcement, and government behaviour
- Timely decisions with little information

Rights/allocation

- Implementation of property-based management regimes
- Allocation of fish resources amongst stakeholders, including commercial, recreational, and indigenous
- Property rights
- Changing industry ownership
- Completing an integrated rights-based fisheries management framework
- Resource privatisation
- The transition to rights-based management systems
- Dealing with future failures in poorly designed ITQ systems
- Accommodate and incorporate privatization of services.
- Allocations among recreational users
- Overcapacity, limiting access, and allocation
- Allocation of shares of the sustainable yield across sectors
- Dealing with compensation claims where existing rights are varied
- Improved recognition, inclusion, and capability for representation of the public's right to a share of the inshore fisheries, in New Zealand's fishery management process
- Fairly allocating available takes of fishery stocks among different user groups and fishing-dependent communities
- Allocation of limited resources among competing users

Global

- To fully understand where our fisheries fit into the global picture
- Globalisation
- Global pressure on fish stocks
- Increased global trade in fisheries products
- Managing high seas, shared, and trans-boundary fisheries

- Increasing global population and demand on fisheries
- Breaking down of trade barriers and opportunities created

Involvement/Stakeholders

- Need to deal with more diverse constituency
- To better understand the user/stakeholder groups in order to have a harmonic working relationship
- To continue a vertical-integrated positive working relationship with aquaculture management people
- Developing a transparent flexible working relationship with environmental groups and government agencies
- Balancing management decisions between the resources and the users
- Stakeholder involvement
- Public demand for real participation in all aspects of fisheries management
- Working with non-fishery stakeholders including environmental groups and other marine industries/interests such as shipping, recreation, or shore-based industries that will compete for shore and water access or may produce environmental or habitat effects that are detrimental to fish stocks
- The need to focus fisheries management on substantive issues rather than the short-term emotive issues
- Getting interested parties to agree; that is, bridging the gap between rational self-interest and rational common-interest
- Education of urban populations about rural resource use issues
- Facilitation of debate between different sectors on resource use and management
- To increase stakeholder involvement in the decision-making process
- To supplement scientific knowledge of the fish resources with stakeholder knowledge
- Relationships between scientists and non-experts
- The need to integrate and engage all fisheries stakeholders into the management process in a meaningful way

Ecosystem management and sustainability

- The conduct of viable, sustainable commercial fisheries given fishing pressure, habitat concerns, "species at risk," other use pressures, etc.
- Managing for multiple species
- Developing and implementing ecosystem-based fisheries management policies
- Broadening management to encompass ecosystem management
- Managing for sustainable development (economic, social, and ecological)
- Increasing habitat and enhancing the resource by increasing the use of artificial reefs made of historical materials
- Ecosystem and integrated fisheries management
- Ability to address fisheries management from an ecosystem-based approach, which includes interactions with non-harvested species, as opposed to a species-by-species approach, but being able to recognise when the ability to do so is hindered by current knowledge and management realities and then knowing what the second best option is
- Ecosystem management—beyond single stock/species management

- Improving our understanding of natural system variability and anthropogenic impacts on fisheries (e.g., habitat alteration at sea, in estuaries, in watersheds; pollution; fishing mortality) and their interactions, i.e., building good, whole-system conceptual models that can be tailored to different areas to understand key fisheries
- Complexities of ecosystem-based management
- Coordination with other environmental issues, e.g., climate change
- Designing/implementing management strategies and techniques for the sustainable use of still-healthy fishery stocks
- Bringing about recognition of, and allowance for, environmental and associated species impacts from target species fishing
- Rebuilding depleted fishery stocks
- More efficient fishing technology will increase the challenges of sustainability and precaution. It is not easy to give precise meaning to these concepts for fish stocks that fluctuate enormously for environmental reasons beyond human control. Fishing may, however, enhance the adverse effects of environmental fluctuations and perhaps make some changes irreversible, all the more so and all the more quickly the more efficient the fishing technology is.

Marine protected areas

- The resistance to closed access in any form and the resulting tendency to overinvest because of the common property problem; this is an old problem but not all countries have dealt with it successfully, and what has been accomplished is often challenged
- Being able to intelligently address the likely ever-increasing demands to implement marine protected areas as a fisheries management tool or as a means to accomplish other goals such as biological diversity or stock preservation
- The conflict between commercial uses of fish resources and environmental goals; Whales and seals have been elevated to a status of sacred animals beyond exploitation even if their products are valuable and there probably is a case for keeping these stocks down because of predation on commercially valuable stocks. More generally there is a growing tendency to regard the world oceans as wilderness to be preserved for its own sake and not as a source of valuable food or other products. *Marine protected areas are a good example.* If we only could get the fishermen out of the way.
- Using marine reserves as a management tool
- Deal rationally with the no-take reserve issue

Public/environmentalist or green pressure

- Public demand for higher environmental standards
- Relationships between fisheries and society as a whole
- Environmental issues
- Green pressure and public tolerance of fisheries policy
- Increased opposition to commercial fishing, based on concerns over the environmental impacts
- Integration of conservation agendas beyond stock conservation to the satisfaction of the contingencies of these agendas while sustaining economically viable fisheries
- Lack of acceptance in general public that fisheries management is responsible

Economic sustainability

- Changing industry and consumer needs
- Foster innovation to traditional fishery management practices to more effectively grapple with increasing complexity
- Promoting cost-effective compliance
- Incorporate rational economic principles into fishery management.
- Develop management strategies that allow for business planning
- The need to better integrate socio-economic issues into management decision making in a more formal and structured way

Competition

- Increased competition between fisheries and aquaculture and other uses of coastal space
- Integrating aquaculture and hatchery (enhancement) systems in fisheries management
- The importance of recreational fisheries will undoubtedly increase as people become more wealthy and leisure increases; recreational and commercial fisheries compete for the same resources
- Being able to effectively address the perennial problem of balancing the short-run need to support current fisheries-related industries and activities and the long-run need to maintain viable fish stocks. Part of this involves the allocation of current available harvest among competing recreational and commercial stakeholders.
- Increased demand for limited seafood resources from all sectors; commercial, recreational, customary (and non-harvest)
- Increased demand for seafood

Accountability/evaluation

- Better define expectations, measures of success, accountability and participants involved/affected by fishery management actions
- Increased accountability to both government and the community

Best science/management science/research needs (also see ecosystem/sustainability)

- Lack of basic science and social information, e.g., fish stocks; environmental; ecosystem; economic data from commercial, recreational, and non-consumptive users
- Improved assessment of noncommercial harvest, both public and customary Maori
- Demand for more and better data
- Matching capacity to resource availability
- Lack of applied science tools to incorporate the above (matching capacity to availability) into management and decision making
- Inability to deal with uncertainty: 1) incorporating uncertainty into decision making; 2) communicating need to incorporate uncertainty into management; 3) describing tractable vs. intractable uncertainty, i.e., some types of uncertainty can be reduced by improved technology and tools (e.g., predicting El Nino events), other types of uncertainty will never go away
- To change the management approach from prediction to adaptation

- Translation of complicated model results into management advice
- To understand how fishers adapt to changes in imposed regulations (fishing practice, compliance, investments, etc.)

Training

- Recognize the difference between, and the need for, a transition from technician to policy-maker
- Raise the level of technical competence and issue sophistication of staff without losing touch with the physical marine environment (fish, water, fish harvesters)
- Recruiting and training

Enforcement/compliance

- Improved awareness of, and compliance with, amateur regulations
- Compliance and enforcement
- Complying with Sustainable Fisheries Act (SFA)
- Control over fishing on the high seas will become more important. This has two aspects. First, are the institutional arrangements (the straddling stocks treaty) adequate? Second, policing the high seas is a costly process. Who will do it and who should pay for it?

2. List 3-5 skills that managers will need in order to successfully address these challenges.

Specialization vs. generalization

- A caveat is in order when making this list. It would be not be practical to have all fisheries professionals in government agencies, fisheries businesses, and other related organizations acquire all listed skills. While all participants will need to become familiar with more areas, there will still be a need for specialization.

Communication/conflict resolution/consensus building

Negotiation/Facilitation/Consensus

- Facilitation skills
- Consensus building
- Facilitation and team building
- Ability to mediate interests and negotiate
- Ability to facilitate dialogue between all fisheries stakeholders and meaningfully engage them in the fisheries management process.
- Negotiation
- Negotiation skills
- Conflict resolution procedures and strategies.
- High level negotiation and conflict resolution
- Group process, facilitation, negotiation and bargaining, community-based planning processes, public involvement methods
- Ability to organise confrontation of all relevant points of view

Communication

- Communication skills
- Strong communication skills
- Ability to communicate effectively with diverse audiences
- Communication skills, both the ability to simply talk to people and effectively present technical information
- Ability to explain scientific knowledge to stakeholders and policymakers
- Ability to transform technical documents into laymen's terms so that the public understands

Liason/people skills

- Liaison skills with a wide range of stakeholders
- Highly developed cross-cultural interpersonal skills
- The ability to interact with people whose beliefs/actions are not determined on the basis of scientific information
- Speak the fishermen's language and have their confidence
- People skills to better deal with all sectors

Multi or Interdisciplinary

- Interaction of multiple disciplines (economics, biology, etc.)
- Integration of competing demands on the resource
- Ability to integrate information from a wide spectrum of disciplines
- Ability to integrate basic understanding of science, social science, and policy into effective fisheries management
- Holistic understanding of the dynamics of fishing and the ecosystem (biology, economics, management, and social)
- Ability to understand the various components of real fisheries management

Co-management

- Sharing of management responsibility with constituents

Science knowledge

- Basic understanding of science, social science, and policy
- Science understanding—stock assessment and ecology
- Robust scientific understanding of fisheries
- Good knowledge of fisheries biology
- The ability to understand the exploitation of technologically and biologically interrelated species in time and space
- Better understanding of species interactions
- Improved knowledge of the actual impacts on the environment and associated species
- Fundamentals of marine and climate sciences, including physical, biological, geological, and chemical oceanography, atmospheric sciences, and integrated marine ecology

Science-based technical skills

- Conducting population estimate studies/ socio-economic studies
- Accessing data on fisheries oceanography and industry behaviour
- Improved methods of assessment of the noncommercial harvest
- Geospatial statistics and data handling, GIS design and implementation, integration of remotely sensed data
- Knowledge of principles of stock assessment, responsible fishing
- Principles of stock assessment
- Competent computer skills set

Decision science

- Methodologies to assess the likely biological, economic, and social effects of different management regimes and regulations, taking into account likely changes in the behaviour of participants
- Methodologies to assess in real time the actual biological, economic, and social effects of different management regimes and regulations, to see if management objectives are being met, and procedures to appropriately modify management actions where necessary
- Models and model building: whole ecosystems, with nested time and space scales; stock assessment; stock allocation; community and regional economy; etc.

Risk assessment

- Improved understanding of risk assessment and management
- The ability to manage fisheries in an environment characterised by high levels of uncertainty and a high risk of litigation
- Risk analysis and procedures and strategies for decision making under uncertainty
- Understanding biological and economic risks associated with use strategies

Economics skills/knowledge

- Understanding externalities and how to account for them
- Economics understanding
- Good knowledge of fisheries economics and how economic incentives work
- Strong understanding of market institutions
- Biostatics/econometrics
- Knowledge of resource economics
- Economic management

Policy/law

- Good knowledge of the international law of the sea, not least enforcement aspects (what constitutes a breach of international law, who has the power to prosecute, what sanctions can be applied to those who break the rules or refuse to prosecute their own vessels and fishermen?)
- Ability to understand and apply institutional structures to enhance fisheries management objectives and outcomes
- Better legal/legislative process grounding

- Knowledge of federal laws, regulations and policies
- Understanding the Sustainable Fisheries Act (SFA) and being able to comply to eliminate lawsuits
- Legal framework of management

Sociology/Anthropology/History

- Better understanding of fishing and aquaculture industries and their communities
- Understanding of human behaviour and how it affects people's actions
- Better understanding of socio-economic indicators associated with fisheries
- Understanding of the history of fisheries
- Social structure of stakeholder communities, including fishers, environmental, and management
- Resource user (fishers, environmental, and management) groups—myth and belief structure

Business/industry

- Be commercially-minded in terms of running a business
- Understanding of global industry
- Business administration
- Business/marketing of seafood, recreation, and management

Personal character/leadership qualities

- Well-directed passion
- Have a vision of the future and to lead this vision
- Strategic thinking and long-range vision
- Trust and respect within own company/user group
- Building relationships (identifies key contacts, develops partnerships)
- Initiative (addresses current opportunities, manages crises, plans ahead)
- Ability to work under huge pressures and stress
- Coherent delegation skills
- Listening, understanding, and responding (communicates clearly, responds to concerns, motivates to action)
- Ability to proactively work collaboratively and draw upon resources and talents from people with a wide variety of interests, goals, knowledge, and skills
- Ability to find enjoyment/some measure of success in one's fishery manager efforts, even under difficult conditions
- Ability to create positive change and enable others to support it
- Open-minded
- Good listener and willing to listen to all user groups and be able to use laymen's terms to explain management procedures—a people person
- Improved understanding of and ability to engage with members of an increasingly pluralistic society
- Ability to sell concepts
- Strong leadership
- Ability to see big picture and small details

- Thick skin/powerful friends!
- Adaptability
- Ability to look beyond personal prejudice and self-interest
- Ability to be creative and innovative to ensure proper adaptation
- Unlimited patience and tolerance!
- Principles of statesmanship and integrity

Business management skills

- Executive management skills, i.e., personnel, budgets, workload planning, etc.
- Strong organisational skills

Staff management

- Ability to provide in-service training to subordinates, particularly to prepare technicians to be promoted into policy positions
- Recognition of and provision for professional advancement of staff
- Recognition of the limitations of staff and the need to fill gaps from outside, particularly for special problems

Critical thinking/problem solving

- Proactive and lateral thinking and acting processes
- Analytical thinking (can see complex relationships and plan strategically)
- Robust analytical skills (social, economic, societal)
- Problem solver
- Ability to simplify problems and find solutions
- Problem solving and decision making

Decision making

- Judgement, decision making (facts-based, applies knowledge and experience, develops new approaches)
- Team decision making and planning
- Decision making
- Ability to decide in due time, what has to be decided at his or her level

Planning

- Planning skills (business/project/fish management)
- Strategic planning capability

Real world exposure

- Have knowledge and/or exposure of real world activities regarding fisheries and their habitat

3. Describe up to five educational/training strategies that will support the development of these skills.

Post-grad/post-secondary training

- Post-secondary training at universities and colleges
- Post-graduate education in multi-disciplinary programmes and professions
- University degree/short courses
- More field training in resource economics programmes
- Improved university-based training
- Periodic short courses where current employees of government agencies or fisheries business can study appropriate topics in fisheries biology, economics, and other social sciences
- Streamlined 1-year MBA/Masters of Economics/Masters of Biology programs (or a combination of the three) designed for current employees of fisheries agencies or fisheries businesses
- Use experimental economics as a tool to test and design better institutions
- In New Zealand, we need a post-graduate fisheries management course, with opportunity for on-going training

Integrated training (some of these could apply to continuing education programs)

- Integrated/interdisciplinary marine policy graduate (and undergraduate) programs
- Integration of multiple expertise areas (economics, population dynamics, human relations)
- Exposure to the whole fisheries picture (e.g., training in all sectors as an induction before specialising in a species or aspect: we need both generalists and specialists. The generalist, who would be an employee of a government ministry or industry organization, needs some knowledge of all three areas mentioned above. This must be at a college/university level. In addition we need specialists with in-depth knowledge of fisheries biology, economics, and international law. Some of those people will probably be needed in government ministries dealing with fisheries but they would often be found in universities and research institutions. The specialists must have a Ph.D. training in the relevant field. Insights into other fields is an asset, but the same person can hardly be a specialist in fisheries biology, economics and international law. The specialist must primarily be trained in the relevant discipline, knowledge of the fishing industry is an add-on.)
- More interdisciplinary training for biologists who have or aspire to policy roles.
- Hiring staff from interdisciplinary educational programs.
- Broad-based training in integrated coastal and ocean management (ICM), along with the place of fisheries management and development within broader international, national, and regional frameworks
- International cooperation
- Good mix of education and industry experience

- Fisheries biology and fisheries economics
- Offer postgraduate studies in natural resource management/business administration

On-the-job training

- Promote one-on-one opportunities for diverse, real-life, and quick experiences, such as job exchanges, mentoring, shadow assignments, etc.
- Internships where undergraduate and graduate students can work in government agencies or fisheries businesses while undertaking their studies
- Exchange programs with other natural resource management agencies or related industries
- Exchanges between government, private sector, and universities
- Staff secondments and exchanges, and leave-without-pay arrangements to encourage staff to gain experience with overseas fisheries management agencies
- Staff secondments between organisations within the fisheries sector should be explored
- Internships for managers in industry, and vice versa
- Required field experiences with fishers, managers, and processors/marketers
- On-the-job training and mentoring
- On-the-job training
- Life experience is a major component of education/training
- A sound knowledge in parallel industries
- An ability to assimilate successful "business management" from parallel industries
- Work experience
- Spend time at sea onboard a fishing vessel
- Good mix of education and industry experience
- Lots of exposure to all parts of industry
- Experience through exposure
- Networking opportunities
- Basis should be learning while extracting experiences from one's own work. This could include:
 - 1) Ongoing follow up of outcomes, preferably systematically as research programs in cooperation with research organizations and including recurrent communication of research results as an integral aspect of adaptive management.
 - 2) Recurrent dialogue meetings with stake holders including an evaluation of outcomes
 - 3) Recurrent update seminars communicating experiences from similar management schemes elsewhere
- Improved industry-based training programmes

Career development

- Provide sustained (career-long) and progressive education/training opportunities, with a variety of courses, experiences and opportunities
- Fostering career-long learning by a hierarchical curriculum
- Create career pathway for new managers

Recognition/certification/competencies

- Developing a certificate programme to recognise educational accomplishments
- Opportunities for staff to obtain certification as fishery professionals
- Establish a certification and review process
- Establish a set of core competencies and desired qualifications
- Developing measurable learning objectives and evaluating their achievement
- Accreditation program for marine resource agencies

Leadership and management-related training

- Training in facilitation and conflict management
- Ongoing national and international training in management and leadership
- Ability to network on a global scale
- Development of facilitation skills and conflict resolution/conflict management
- Training/experience in group facilitation, alternative dispute resolution, planning process design
- Development of project management skills
- Source (contract) suitable mediation training courses
- Establish working groups (learning by doing) to make recommendation for specific problems supported by facilitator(s)
- Understanding of all stakeholders and cultural groups that make ownership

Case studies

- Develop of case studies to share world-wide
- Knowledge of best practice world-wide
- Knowledge of different fishing management strategies around the world
- Develop role plays to demonstrate the need for a holistic approach
- Case study analyses

Technical training (these fit better with question no. 2)

- Training in the use, development, and history of artificial reefs to provide habitat to enhance the resource
- Training in social and psychological areas to understand the effects offishery management on local fishing communities
- Improve training in statistics
- Development of technical skills in socio-economics, ecology, fisheries science, human behaviour, etc.
- Data handling skill building: statistics, data processing, GIS, models of all sorts, etc.
- Technical forums

Continuing education

- Workshops and conferences
- International, national, regional training workshops
- Private/public training workshops
- Training courses at national level

- Inclusion of NGOs and interested parties (e.g. , commercial and recreational fishers) in training workshops
- Assistance in joining and being active in professional associations, attending conferences, etc.
- Tutorial workshops
- Periodic short courses where current employees of government agencies or fisheries business can study appropriate topics in fisheries biology, economics, and other social sciences (*also included under academic training*)
- Incorporation of short courses into management body meetings
- In-service training for agency personnel
- Continuing education opportunities
- Create internet interactive programs to develop needed skills

Needs assessment

- Assessing needs of fisheries managers

Compare with successful programs

- Draw upon strategies that have proved successful in other, similar disciplines/industries (e.g., forestry, mining, agriculture)

4. List three to five incentives, rewards, responsibilities, or changes in the working environment necessary to attract and retain successful managers of 21st century fisheries.

Training/learning opportunities

Continuing education

- Opportunities for continuous training and upgrading of skills
- Recognition by employers of comprehensive continuing educational effort
- Commitment of managers to lifelong learning
- Availability of funding and time for managers to participate in continuing education
- Incentives to attend workshops, e.g. , sponsorship
- Establish a dedicated and targeted training program for managers updated every 3-5 years
- Opportunities (requirements?) for continuing education provided by university outreach programs (e.g., week-long courses, "sabbaticals")
- Funding for post-graduate studies
- Creation of a learning environment
- Provide the opportunity for research and line personnel to participate in national and international professional organisations

Exchanges/mentorships/sabbaticals—cross sector, international

- Encourage staff members to gain overseas experience

- Provide for inter-organisational personnel agreements where employees of academic institutions, government agencies, and fisheries businesses can have meaningful and short-term learning assignments in other organisations
- Opportunities to work in different interest groups (e.g., industry, indigenous people, government, NGOs, etc.)
- Opportunity for intergovernmental or private sector internships or sabbaticals
- Formalise cooperative education and research opportunities with state and federal fishery management agencies (e.g., internships, short-term training, shadowing, etc.)
- Formalise cooperative education and training opportunities with fishing industry organisations and individual businesses
- Set up sabbaticals

Recruitment

- Attempt to attract students from the fishing and aquaculture communities
- Develop fishery management scholarship and other support opportunities to attract the best and brightest to the field
- Develop a greater number of skilled individuals, to minimise burnout and to provide increased creativity and other contributions from more people.
- Design recruitment processes to select the right people

Work environment

- Challenging work in a complex environment
- Foster a positive work environment—one of trust, inclusion, innovation, responsibility, recognition, and rewards.
- Working conditions
- Good working environment
- Balance between actual “on the water” interaction and office work
- Incentives should include working from home on some projects or flexible office schedules

Group/team

- Being part of a dynamic group
- Ownership of the project backed up with support of the group
- Working in multi-disciplinary teams

Accountability

- The right people thrive on accountability
- Being given accountability and responsibility for specific fisheries management outcomes

Meaningful work

- Meaningful work with environmental and social consequences
- Interesting work that makes a difference
- Doing work that one finds meaningful and that will earn respect among colleagues

- In addition to the basic day to day routines and the inevitable necessity to put out brushfires, ensure that the workload of research and line professionals provides for the opportunity to do “out of the box” thinking and innovative work to improve the field of agency and business fisheries management
- Provide for inter organisational personnel agreements where employees of academic institutions, government agencies, and fisheries businesses can have meaningful and short-term learning assignments in other organisations
- Openness with users in a constructive atmosphere

Recognition

External—profile among public/among other sectors/within government

- Public recognition for jobs well done
- Lift profile of seafood industry
- Promotion of success stories in the media
- Start awareness in schools at an early age through learning
- An improved industry profile
- Solid support from government agencies on the extreme importance of sustained fisheries resources on social, economic, and environmental areas
- Greater awareness of the role of the fishery manager
- Securing a better coverage of fishery-related issues by public media
- A more mature and open-minded sector

Internal—Employee/Employer – recognition with organization

- Employee recognition and reward incentives. Awards and other recognition for individual and team achievement and success
- Making sure the difficulty of the task is properly appreciated
- Recognition of accomplishment
- Associate success in the position with successful management of the fishery

Salary

- Salaries competitive with private sector
- Merit-base salary/promotion system
- Great remuneration package
- Economically successful fisheries with attractive compensation
- Pay
- Good pay that at least equals private industry
- Benefits (insurance, etc.) low-cost on-site day care for families
- For existing managers, ask them early-on what they would consider an appropriate reward etc., and provide it to the extent practical
- Provide for research positions in fisheries management agencies where biologists, economists and other social scientists can advance to salary levels comparable to management personnel to prevent the brain drain from research lines to management lines
- Money!—fisheries managers tend to be lower paid than other professionals

- Money for salary increases
- Higher salaries in government positions

Manager role/authority as related to governance/institution—within or outside an agency or organization

Authority

- Support for decisions from supervisors
- Authority/ability to make management decisions without political interference
- Involvement with high-level officials/boards
- Provide staff with a clear idea of how their skills are expected to contribute to the particular fisheries management role that they are undertaking
- Reduce political influence from above and give managers more decision making and operational authority
- Provide managers with more and better tools and flexibility to resolve problems, enact change and make progress
- Provide necessary authority within agency structure for managers to perform management tasks they are responsible for
- Increase responsibility for the individual manager
- Clear definition of all responsibilities

Institutional framework

- Right institutional arrangements
- Enhancement of the role of policy advice/fisheries management (as opposed to lobbyist role) in organisations outside of Mfish (New Zealand Ministry of Fisheries)
- Restructure NMFS and the Council System in the United States
- Establishment of a management framework that that increases the probability of successful fisheries management outcomes
- In the United States, clear, consistent mandates (i.e. , greater clarity within the Magnuson-Stevens Act)
- More distinct separation between science and policy, but with policies clearly based on science
- Clear agency policy guidance (contrasted with ad hoc approach)—clearly communicated
- A legal framework that provides a belief that one can make a difference
- Responsibilities or at least involvement to include the whole chain from policy through implementation to outcome evaluation
- Reduce bureaucracy
- Give possibilities for broader collaboration among managers with different backgrounds and among managers and researchers.

Resources/implementation

- Necessary resources to carry out mandates
- Budget increases for larger staffs
- Provide competent support staff

- Money for resource assessment
- Create an environment where fisheries managers actually believe they can make a difference
- Securing the proper transmission of all relevant information
- Information access: "information hubs," i.e., clearing house to gather emerging information and make it widely available
- Resources
- Provide managers with more and better tools and flexibility to resolve problems, enact change, and make progress

Career path

- A better defined career path
- Stability of employment
- Accreditation program for marine resource agencies
- More diverse kinds of employment opportunities for fishery managers
- Specializing in one or more of the areas noted above
- Making sure that acting as a fishery manager is not a dead end in a professional career

5. List three to five actions that your organization can take individually, or in cooperation with other groups, to support development of the education, skills, and rewards/incentives necessary for successful management of 21st century fisheries.

Curriculum

Development/revision

- Review and update the graduate-level fisheries management curricula at Oregon State University, consistent with the consensus developed in this workshop
- Professional Masters-level programme in fisheries management
- Assist in curriculum development for fisheries managers
- Help curriculum developer focus on writing appropriate learning objectives
- Development of a training and development framework
- Identify skills, knowledge and experience requirements
- Participation in setting up an appropriate course
- Develop courses of study for Master's Degree or Diploma programs in interdisciplinary fisheries management
- Revise our graduate programme in resource economics to include more experimental economics and decision theory
- Graduate programme to be revised and to include some natural science
- Develop curriculum for management personnel
- Develop business curriculum for biological types
- Develop biological curriculum for business/economic types
- Develop curricula with universities

Real world

- Education in modelling and combining real-world, present-time information into modelling activities
- Onsite observation and participation with affected fisheries
- Sharing of experience
- Allow for the flexibility in current educational programs for students to undertake internships as part of their course of study
- Incorporate more field trips in courses
- Bring fishermen and policy makers into the classroom
- Elucidation of staff attitudes toward incorporation of explicit socio-economic concepts into agency policy formulation; socio-economic sensitivity training

Research

- Increase research into social science side of management
- Develop research programmes

Resources/funding

- Offer scholarships and/or endowments to research chairs
- Commit sufficient financial and personnel resources for a long-term effort, with clearly defined goals and measures of progress, at an individual and organisational level
- Identify the people with the desired skills within the organisation and enlist them in the education/training effort, by providing them with appropriate incentives, etc.
- Provide resources
- Provide training

Continuing education

- Training programmes for current managers to update skills
- Provide training and special programmes for staff
- Offer mentoring services to junior staff, co-op study programmes etc
- Arrange update seminars regarding management experiences
- Undertake training seminars to explain the necessity to move from prediction to adaptation in the management approach

Short courses

- Participate in short-term training courses
- Preparation of educational presentations (short courses) related to the practical application of fishery bio-economic concepts to common fishery management issues

Workshops/networking

- Offer training/networking opportunities
- Attending workshops, seminars, and having your say
- Encourage and support attendance at workshops and conferences

Outreach

- Publish articles on useful tips for communicating in fisheries management
- Writing, editing, preparation of presentations aimed at conveying agency message

- Improved education/training of representatives from the public sector in the fishery management process; this is currently difficult to obtain in New Zealand
- Implementation of the Fishcare programme (a volunteer programme in South Africa, aimed at providing information to recreational fishermen)

Industry

- It would involve upper management within the company, so cannot say
- Pushing of modern apprenticeships and lifelong learning

Recruitment

- Identifying key people for future in industry
- Recruitment of good entry-level seafood processors
- Promotion of industry in schools
- Expansion of Honorary Fishery Officer network (New Zealand)

Collaboration

Cooperative training/cross training

- Partner with universities to deliver training
- Join with other groups to develop a worthy programme of existing or new courses and other opportunities
- Participating in conjunction with managers to gather much needed data on marine species and their environment
- Classes in educating the managers about your particular user group, their concerns and suggestions on solutions to problems facing that industry
- Outreach and follow-up communication on all issues for all sectors concerned
- Work with government, educational institutions, and NGOs on developing training programmes
- Foster positive working relationships with stakeholders
- Work with academic institutions, e.g. , guest lectures (giving and receiving), student internships
- Help to agencies in the development of overall policy guidance to aid staff
- Establishing networks among managers, researchers, and stakeholders to improve dialogue among them
- Smaller organisations can cooperate with other groups

Research partnerships

- Participate with agency biologists in the preparation of fishery management plans to incorporate bio-economic concepts
- Conduct collaborative research with managers
- Partner with universities to do research associate professorships
- Facilitate the process of integrating scientific and stakeholder knowledge

Exchange/secondments/internships

- Participate in exchange programmes
- Provide exchange opportunities

- Exchanges, secondments, etc. with other organisations
- Establish/encourage opportunities for secondment to other organisations within the sector
- Encourage/establish opportunities for staff to gain overseas experience
- Provide active mentoring of “student” fisheries managers
- Provide work experience
- Set up sabbatical opportunities with universities, businesses, NGOs, etc.

Needs assessment/evaluation

- Regularly promote, evaluate, and report on the effort
- Promote debate and discussion
- Facilitate evaluation workshops and dialogue meetings
- Undertake a market survey of key communication issues/challenges in the sector
- Increase awareness among educational institutions of the changing focus of fisheries management and the role of fisheries managers

Government/institutional support (*related to incentives and to managers authority/profile*)

- Influence the legal/political environment
- Advocate greater involvement of industry and NGOs in the management of fisheries, increased devolution of government responsibilities to the private sector, and greater security of access and stability to resource users
- Develop the appropriate fisheries management frameworks to encourage people to enter the profession
- Ask Congress to provide clear, consistent mandates, and sufficient, long-term funding
- Ask federal and state agencies to make fishery management a high priority
- Lobby for laws that make sense

Career path/competencies

- Work with other organisations to identify career path progression
- Create career paths
- Implement certification and review process
- Develop core competencies or qualifications

Information access

- Supply information to “information hub”
- Assist in collecting experiences in a systematic way through research coupled to adaptive management

6. Please indicate the country(s) in which you have had your primary experience in fisheries (*actual distribution was not included*).

- USA
- New Zealand
- Chile
- Canada
- France
- Australia
- Some experience in a number of developing countries
- UK
- EU
- Norway
- Iceland
- Denmark
- A range of countries in Asia and Africa
- Southern Africa

7. Please select the sector(s) in which you have been employed in fisheries.

a.	Private industry	1111111111
b.	Government	1111111111111111
c.	Academia	11111111111
d.	Other *	1111111

- * Participant in management activities on all levels from local to federal government
- * Eco-labelling
- * Iwi (New Zealand indigenous tribes)
- * Private, independent research and advisory organisation
- * Regional council
- * Membership on various management bodies, marine conservation fellowship
- * Non-commercial, both public and Customary Maori

APPENDIX E

Workshop Notes

Due to the length of the workshop notes, Appendix E is not included with the printed version of this report. It is available online at:

<http://oregonstate.edu/dept/trainfishmgr/report.html>

Workshop presentations which accompany Appendix E are also available online at:

<http://oregonstate.edu/dept/trainfishmgr/presentations.html>

APPENDIX F
Current Training Programs for Training Managers
for 21st Century Fisheries
(Draft 2/03)

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Introduction and Challenges

Participants in the December 2001, "Training Managers for 21st Century Fisheries" international workshop in Queenstown, New Zealand, developed a broad definition of a fisheries manager and clearly recognized the need to educate a variety of generalists and specialists with different degrees of breadth and depth in many skills in order to meet the needs of 21st century management. This will require a variety of training approaches, focusing on different levels and target populations. A 4-year undergraduate, postsecondary, or graduate academic degree may not be appropriate for training all types of fisheries managers. In some situations, on-the-job and in-service training may be just as suitable as academic training. Conversely, some may consider a graduate level academic program as the best solution for training managers with a high level of authority for decision making and policy making. Extension or outreach education might be best for certain stakeholder groups.

Several previous fisheries education workshops and conference sessions on fisheries education and training have promoted discussion on the quality and quantity of fisheries training programs over the past 30 years; the most notable are:

- 1968—The Future of the Fishing Industry of the United States, University of Washington College of Fisheries (Paulik 1968, Salo 1968)
- 1978—Fisheries Education in the 1980's, American Fisheries Society Annual Meeting in Rhode Island (Lackey 1979)
- 1980—UNESCO/FAO Workshop on university curricula in fishery science, Paris (UNESCO 1981)
- 1980—Fisheries Education in Alaska: Creating a Program of Excellence, Anchorage, Alaska (Smoker 1981)
- 1986—California Sea Grant Workshop, Educating Fisheries Managers, University of California Davis (Amidei 1987)
- 1991—2020 Vision: Meeting the Fish & Wildlife Conservation Challenges of the 21st Century (Fritzell and Adelman 1992)
- 2000—Education and Training Needs for Fisheries Science and Management: Stock Assessment Science, Fisheries Economics, and Fisheries Social Science, Woods Hole, Massachusetts (Ocean Studies Board 2001)

Most of these workshops focused on academic training for undergraduates, with some focus on continuing education and professional training. However, the 2000 Ocean Studies Board workshop focused on graduate-level training of science and management specialists, but did not consider education of broadly trained managers.

The skills and knowledge emphasized in the December 2001 New Zealand workshop (see Section 3 of the workshop report) and by previous workshops (e.g., Amidei 1987, Smoker 1981) are similar to those identified by other natural resource sectors, such as forestry (Sedjo 1991, Sample et al. 1999) and coastal management (Crawford et al. 1995), and are comparable to the leadership and management skills emphasized by academic programs in business management and public administration (McKendal 2000; Lamond 1995). Thus training in other natural resource and management programs may also be suitable for fisheries managers. However, the variety and dynamics of marine fisheries resources, system complexity, institutional challenges, and inherent uncertainty makes marine fisheries management problems relatively unique among natural resource management disciplines. Fisheries-specific integrative, innovative, and critical thinking skills are particularly important. This suggests the need for training programs that provide appropriate skills within a fisheries-specific context.

Many undergraduate fisheries programs have developed integrated curricula that provide opportunities for students to gain a variety of management skills (Oglesby and Krueger 1989; Schmidly 1990, Adelman et al. 1994). Thus, graduates of 4-year undergraduate programs are relatively well prepared for entry level positions in management agencies (Adelman 1990). However, they are not prepared to enter mid- or upper level positions that require more advanced, administrative, management, and leadership skills such as strategic planning, decision-making, problem solving, and conflict resolution. (Oglesby & Krueger 1989, Kelso 1988). Sample et al. (1999) state a similar problem for forestry managers.

The recently published July 2002 report from the National Academy of Public Administration (NAPA), *Courts, Congress, and Constituencies: Managing Fisheries by Default*, focuses on the need for the NOAA Fisheries (National Marine Fisheries Service), which faces a loss of one-third of its workforce to retirement in the near future, to recruit and support training of specialists in stock assessment, social science and economics, as well as regulatory specialists. However, the NAPA report also reflects increasing recognition of the need for well trained managers: "Although the fisheries management system has its strengths...it requires strong leadership." Also, in addition to indicating that NOAA Fisheries should hire "ecologists and conservation biologists with perspectives that are based on ecosystem-scale research rather than single species population dynamics," the NAPA report also says NOAA Fisheries "should 'grow' its future staff with state-of-the-art expertise capable of integrating multiple science disciplines to promote not only sustainable fisheries, but also to sustain healthy coasts and promote recovery of protected species."

Originally, the primary goal of the current training review was to explore all current training programs in fisheries management in an effort to assess existing capacity to develop human capital for management of 21st century fisheries. However, given the perceived need for advanced training in fisheries management, this review focuses on identification and qualitative analysis of advanced (post-graduate/graduate) academic programs suitable for training 21st century fisheries managers and explores examples of other relevant training capacity in continuing education and advanced professional training.

Review of Programs

Current training programs were identified through an exhaustive web search of academic or university based, postgraduate programs (postgraduate diploma or certificate, Masters, or Ph.D.) and continuing education programs with information available in English. Several existing online lists of programs were used for the web search (see <http://oregonstate.edu/dept/trainfishmngr/training/reference.html#lists>), including:

- American Fisheries Society Hot List of Academic Sites
- NOAA international fisheries links
- NetCoast.nl—Coastal Zone Management Training
- Coastalmanagement.com
- Consortium for Oceanographic Research and Education (CORE)
- US News Education 2002 Graduate School Rankings—Top Public Affairs Programs
- Gradschools.com
- World Resources Institute—Beyond Grey-pinstripes: Report on Leading MBA programs with social and environmental leadership curricula

The current programs included in this search were any programs with some relevancy to marine fisheries management (including marine affairs and policy, marine resource management, environmental management, public administration, business and leadership programs). The programs were sorted into the following major categories:

- Academic Degree Programs
 - Fisheries (with mention of “fisheries management”)
 - Other marine resource management
 - Other natural resource management
 - Other management (top business, public administration)
- Continuing Ed—professional, in-service, mid- or top management level
 - Fisheries
 - Other natural resource management programs
 - Other management programs

Direct links to specific program material and brief descriptions were made available on the website associated with this report:

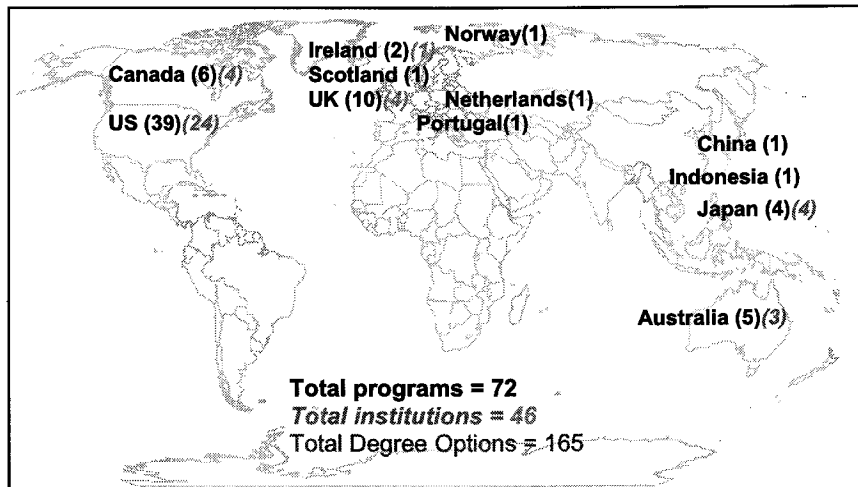
<http://oregonstate.edu/dept/trainfishmngr/training/TFM21.html>

Analysis of Academic Programs in Fisheries Management

Academic programs sorted into the “fisheries management” category were analyzed to develop a qualitative understanding of program curricula and quality with regard to the goal of training 21st century fisheries managers. In this category, the review found 72 academic programs (identified

by program title) with postgraduate or graduate training, offering 165 degree options, at a total of 46 institutions (Figure 1; Appendix F.1). The web literature for these programs was reviewed to extract summary information on organization, curriculum, and program quality.

Figure 1. Distribution of fisheries academic degree programs in the New Zealand workshop review



Academic program web literature was searched for presence of key words in vision, mission, goals, degree requirements, and course lists. The original key word list was created from skills and knowledge areas emphasized in previous workshops and published literature on training fisheries managers. A key word was recorded as present if it occurred at least once within the web literature for a program. This level of qualitative analysis resulted in some preliminary comparative summary information describing the range of programs and curricula available.

Organization

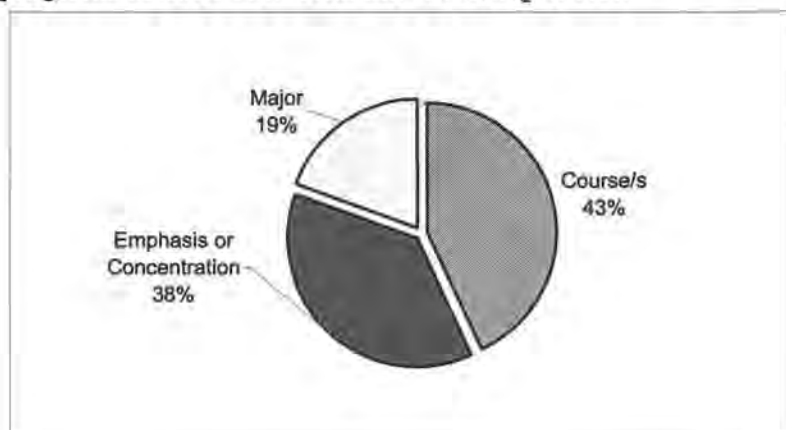
Academic graduate or post-graduate degree programs in fisheries management range from science-based or other specialist programs (e.g., fisheries, aquatic, or marine science, fisheries economics, or law or policy as the major emphasis) to more management-based, multi-disciplinary, generalist programs (e.g., marine or natural resource management or policy, dual or joint degree between science or environmental management) that allow for a fisheries management concentration or emphasis.

Fisheries management seems to have evolved out of fisheries sciences programs. Fifty-eight percent of the academic degree programs reviewed offer "fisheries" as a major, usually as fisheries science, but a variety of other resource management programs offer fisheries or fisheries management as an emphasis, option, or concentration. Some institutions offer fisheries as a major and also as an emphasis or option within a separate degree program. For example, Oregon State University (OSU) has a Fisheries and Wildlife Science degree program in their College of Agricultural and Life Sciences and a Marine Resource Management program, which is a multidisciplinary, science and policy based, professional program with a concentration in

marine fisheries management, in their College of Oceanic and Atmospheric Sciences. Students in both programs can focus on marine fisheries management, but Fisheries Science students will likely have greater depth in fisheries science, whereas those in Marine Resource Management will have developed greater breadth.

Among the 72 programs, actual curricula titled "fisheries management" occurs most frequently as a course offering, a series of courses, or a degree specialization, option, or emphasis, and less typically as an actual major (Figure 2). "Fisheries management" also occurs as a thesis or project research emphasis within many programs.

Figure 2. Highest level of "fisheries management" within 72 current fisheries academic programs in 2001 New Zealand workshop review

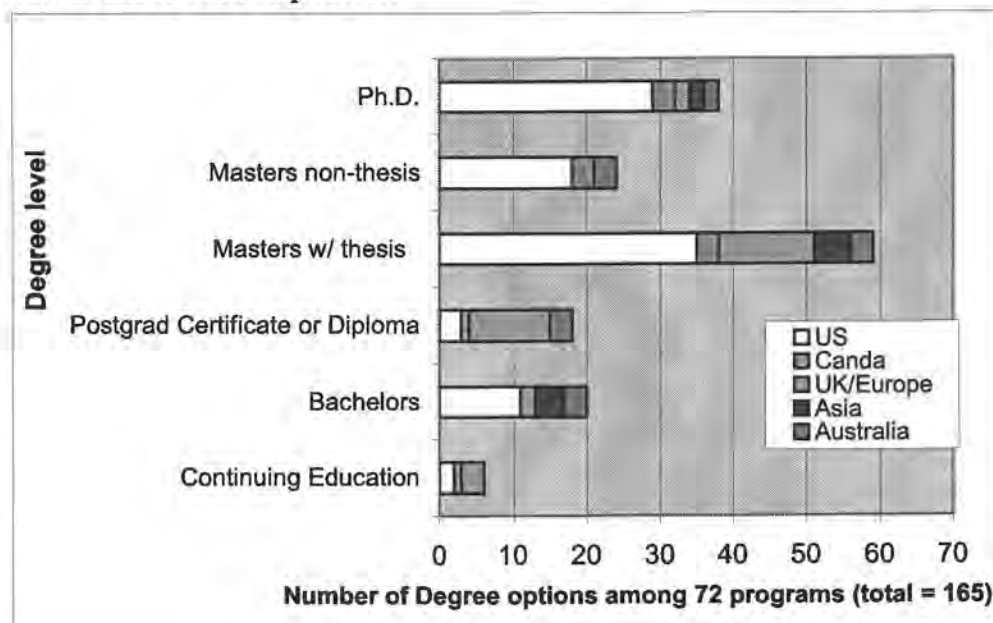


Fisheries management-related curricula are available through a variety of degree levels (Table 1, Figure 3). Masters level training is the most prevalent and Ph.D. training is the second most prevalent in the review sample.

Table 1. Number of degree types offered by 72 current fisheries academic programs in 2001 New Zealand workshop review.

REGION	ACADEMIC DEGREE OPTIONS						Total Degree options
	Continuing Education	Bachelors	Postgrad Certificate or Diploma	Masters w/ thesis	Masters non-thesis	Ph.D.	
All Institutions	6	20	18	59	24	38	165
US	2	11	3	35	18	29	98
Canada	1	0	1	3	3	3	11
UK/Europe	3	2	11	13	0	2	31
Asia	0	4	0	5	0	2	11
Australia/NZ	0	3	3	3	3	2	14

Figure 3. Degrees offered by 72 current fisheries academic programs in 2001 New Zealand workshop review.



A variety of degree options within a program can provide significant flexibility for students. European programs typically offer a Postgraduate Certificate, Postgraduate Diploma and Masters thesis or non-thesis options (e.g., M. Sc. or Mphil) depending on the number of courses the student completes and whether the student also completes a research project or “dissertation”. For example, the Centre for the Economics and Management of Aquatic Resources (CEMARE) at University of Portsmouth uses this model for their Fisheries Planning and Development and Fisheries Economics programs, but also offers a Ph.D. Australian Maritime College’s “MBA in Marine Resource Management” uses a similar flexible model, but also offers accelerated (e.g., 6-day residential) or distance courses—thus providing “flexible entry and exit, and flexible delivery” suitable for practicing managers (Australian Maritime College 2002). This level of flexibility would be useful when evolving a more traditional, academic program toward providing academic-based continuing education opportunities for industry or agency managers, as well as other stakeholders.

Academic degree flexibility among United States institutions appears somewhat more limited. Several programs offer both research (M.S. with thesis) and professional (non-thesis) masters options. A few programs offer certificates where students take a specialized series of courses in addition to, but at the same time as, their graduate degree (e.g., Natural Resources and Environmental Policy graduate certificate program at Utah State University), or formally created dual major programs (e.g., University of Michigan Corporate Environmental Management Program—dual MBA and M.S. in Natural Resources). None of the United States programs involved in the analysis sample advertise a postgraduate certificate or diploma with formalized flexibility similar to the European or Australian programs mentioned above. Academic-based

extension education, designed to translate research results for use by practitioners, is not exclusive to, but is common at United States institutions, and provides an interesting flexible delivery model that will be discussed further below under "Continuing Education."

Curriculum Strategy and Content

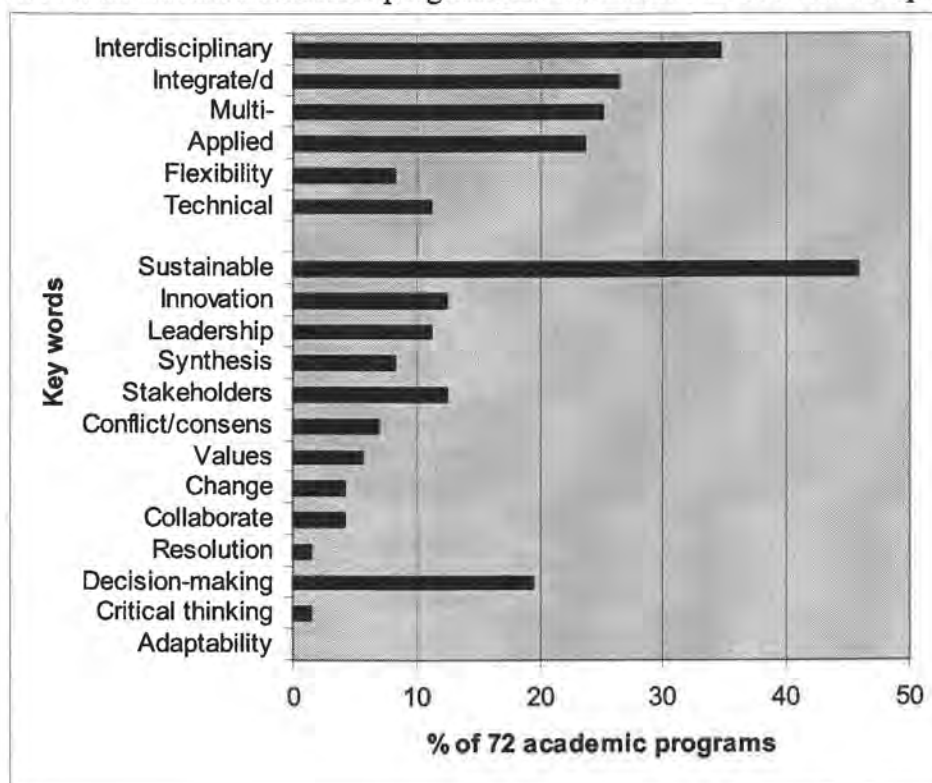
Fisheries management curricula vary by mission and goals, course requirements, and skill and disciplinary emphases. The key word search helped define the scope and emphasis of curricula.

- *Vision/Mission*

Program training goals range in focus, with the most common being *training for entry-level, professional positions* in areas of fisheries science and/or resource management and/or *providing a scientific foundation* for further graduate work leading to the Ph.D. degree. Some programs also include *developing scientists and professional resource managers capable of leadership and multidisciplinary problem analysis* in their goal statements.

Figure 4 shows the results of the key word analysis for mission and goal statements and helps characterize program philosophy about fisheries management curricula. Thirty-five percent of programs stress an interdisciplinary approach, and at least 25 percent stress an integrated or multi-disciplinary approach. The most common key word occurring in mission statements of the 72 programs was "sustainable" (45.8 percent). However, less than 15 percent of programs included the words such as "innovation" and "leadership." Unfortunately, not all programs have clearly identifiable mission or vision statements on their website.

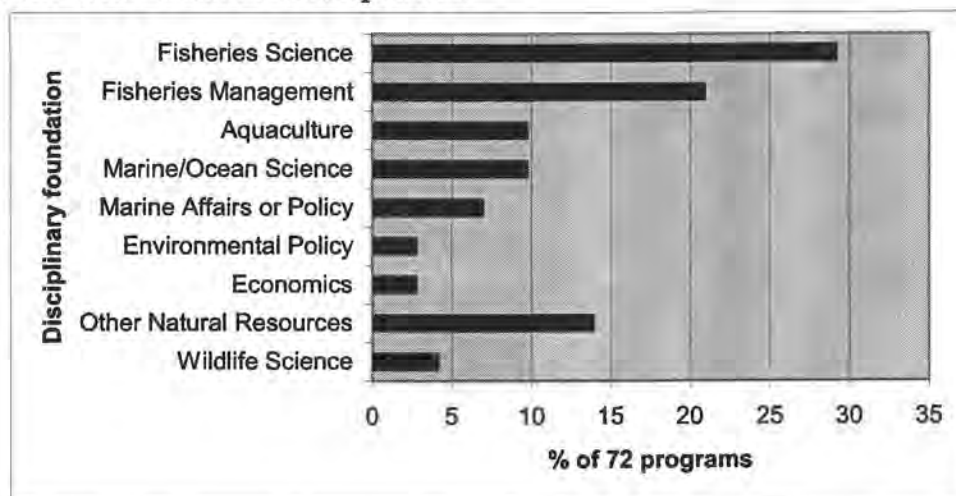
Figure 4. Presence of key words in vision/mission statements of web literature for 72 current fisheries academic programs in 2001 New Zealand workshop review.



- *Core course requirements*

Fisheries management programs are located in a variety of disciplines or academic homes, which typically influence curricula, particularly core course offerings and requirements. For example, a fisheries graduate program in a fisheries and wildlife department might have a core of general wildlife science and management courses with the option of taking electives in fisheries science or management. The disciplinary foundation of each of the 72 programs was identified by reviewing core course lists and other curricular information, and assigning each program to one of the disciplinary categories shown in Figure 5. "Fisheries science" was the most common and "economics" was one of the least common core offerings among these programs.

Figure 5. Core course emphases of current fisheries academic programs in 2001 New Zealand workshop review



- *Number of elective courses*

Programs vary in the number of elective courses available and allowed relative to required courses, which in turn affects the flexibility of the curriculum. Assessing the level of curricular flexibility involved assigning the 72 programs to categories (low: two-thirds or more required, medium: one-half required, high: one-third or less required) based on the relative number of required and elective courses making up the coursework for the academic program. Among the 72 programs, 34 percent fell into the low category and 21 percent of the programs fell into the high category. Curricular flexibility presumably affects whether the program is adaptable to student interests and goals, changes in resource management theory and science, and employment needs. Programs with a relatively high number of required courses may produce graduates with a guaranteed suite of skills and knowledge, but may or may not have the flexibility at the institutional level to readily adapt required curriculum to changing needs of employers and resources. Some of the European institutions, such as Wageningen University and Research Center in the Netherlands and University of Portsmouth in the UK, appear to have more flexibility to develop new, timely “courses”, which are actually degrees, based on the most current expertise and research focus at their institute.

- *Fisheries science or fisheries management focus?*

Among the 72 programs, the curricula of 30 percent are at least 75 percent management focused—including courses titled “management” or courses that provide management-related social science skills or knowledge. Seventeen percent have equal levels of science and management focus and 53 percent include only 25 percent or less management coursework.

Program literature and course lists (including electives) were reviewed for occurrence of more specific key words related to science and management related disciplines

(i.e., inclusion of one or more courses representing a specific discipline). The most common science-related key words were “fisheries biology”, “fisheries ecology”, and “economics” (Figure 6a). The most common management-related key word was “fishery management,” but at least 60 percent included policy, and about 50 percent included sociology and law. Interestingly, business occurs in 35 percent of these programs (Figure 6b). Business courses seem to occur more frequently in Japanese and other Asian fisheries academic programs as well as some aquaculture-focused curricula associated with agribusiness programs in United States institutions and elsewhere.

Figure 6a. Science-related key words occurring in web literature of 72 current fisheries academic programs in 2001 New Zealand workshop review.

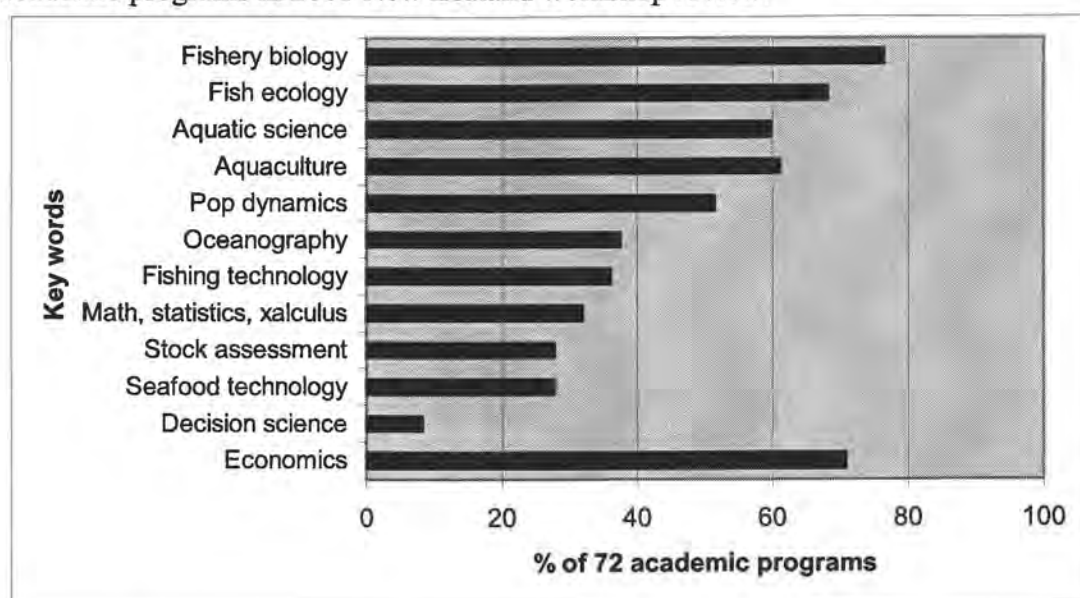
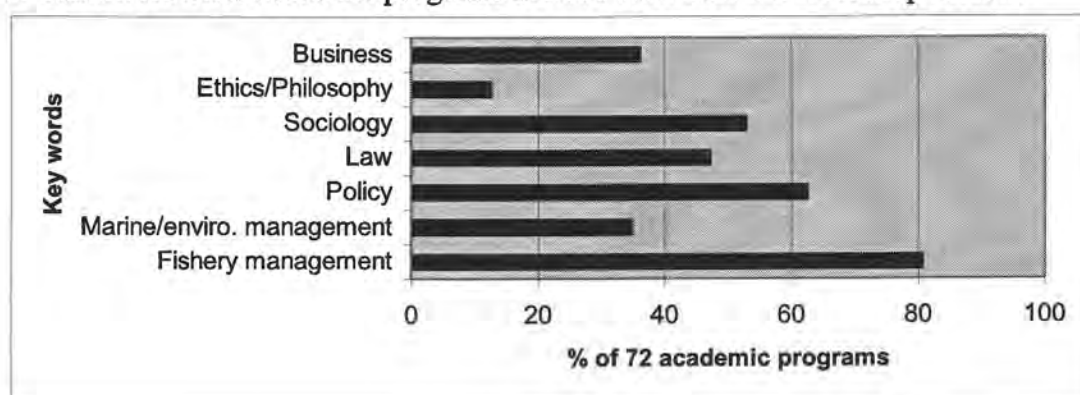


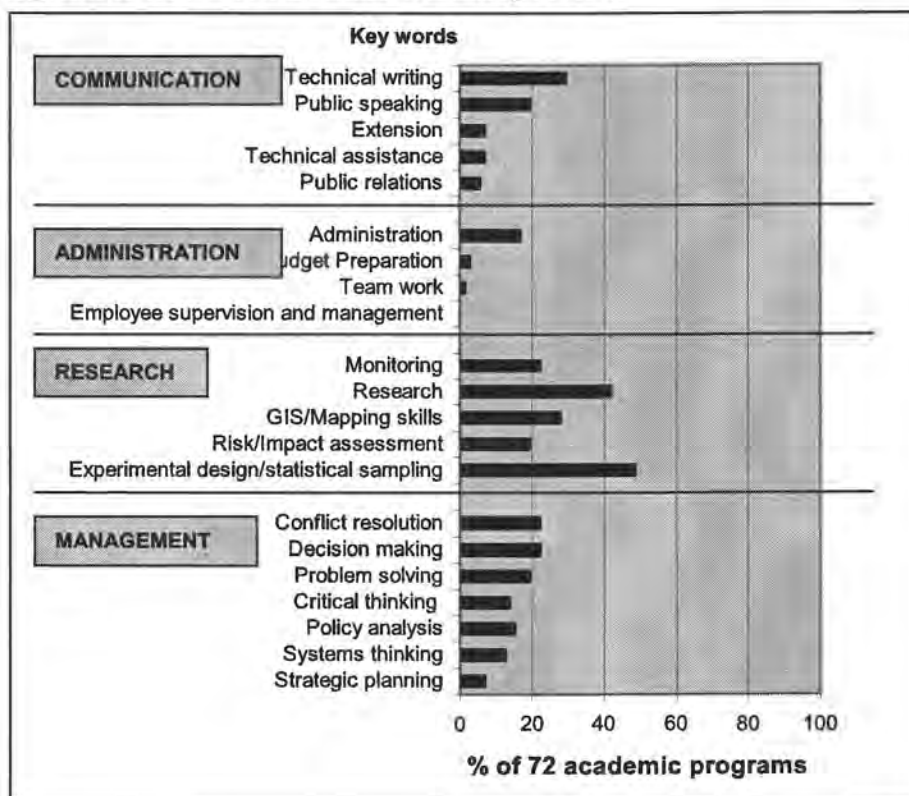
Figure 6b. Management or social science-related key words occurring in web literature of 72 current fisheries academic programs in 2001 New Zealand workshop review.



- *Skills emphasis*

Figure 7 shows occurrence of key words related to management skills. Most of the key words, selected from those listed by previous workshops, match skills listed by New Zealand workshop participants (see Tables 3.1 and 3.2).

Figure 7. Skill-related key words occurring in literature of 72 current fisheries academic programs in 2001 New Zealand workshop review.



Administrative skills, such as teamwork, employee supervision, and budget preparation, which are typically learned on the job, occur the least in academic program literature. Some of the skills that appear with low frequency may be integrated into specific courses (for example team work or group work could be used as a teaching strategy) and thus may not have been highlighted in website literature.

Quality indicators

Among fisheries management academic programs, indicators of program quality might include:

- Course quantity, diversity, and quality
- Opportunities for fisheries-related research/faculty performing fisheries-related research

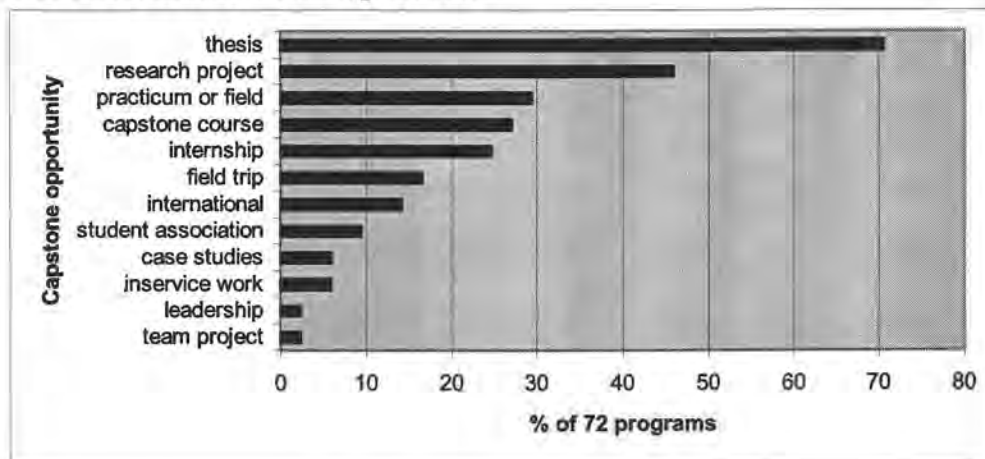
- Capstone or integrative synthetic courses or opportunities, including reality- based or real hands-on work
- Appropriate facilities, including availability, size, and proximity of a marine lab and
- access to a research vessel
- Proximity and access to the commercial fishing industry or other types of fisheries-dependent communities
- Partnerships and/or cooperative agreements at the local, national, or international level, with industry groups or associations, marine or aquatic resource management government agencies, other academic institutions, other degree programs or educational delivery programs (such as extension, outreach), research institutes, and other NGOs.

For many academic programs, the quality of course offerings may depend on other departments and strengths of these other departments within the academic institution. Of the 72 fisheries management academic programs reviewed, at least 46 percent are dependent on other academic departments for 50 percent or more of their course curricula. However, 39 percent have little or no dependence on other departments. An example of a more self-reliant program would be a program able to offer fisheries science as well as a variety of fisheries specific courses in management, law, policy, economics, and sociology. Conversely, some programs fully utilize the strengths of an academic institution by taking advantage of course offerings in a variety of other departments. Several of the multidisciplinary training programs (including several natural, environmental, or marine resource management programs not included within the review group) use this interdepartmental model, but their overall quality is ultimately affected by the strength of the participating departments and the strength of these partnerships. These relationships are likely more effective when departments cooperate on course scheduling, include fisheries or at least aquatic resource issues in their teaching and research programs, and cooperate on faculty hiring.

Of 46 institutions represented by the 72 training programs reviewed, at least 61 percent appear to be close to commercial fishing industry, 63 percent have some type of marine or aquatic lab associated with their program, and 54 percent have access to an oceanographic or coastal research vessel; at least 39 percent have all three.

Capstone courses or opportunities are those that provide a mechanism for the student to integrate his or her knowledge and skills. As shown in Figure 8, the most typical opportunity for a postgraduate/graduate program in fisheries is the research thesis or project; in contrast, use of case studies is much less common according to program literature.

Figure 8. Capstone opportunities occurring in current fisheries academic programs in 2001 New Zealand workshop review.



Academic institutions may want to develop more innovative capstone opportunities in addition to or in place of thesis work in an effort to improve their capacity to train managers capable of critical thinking and integrative problem solving.

Innovation in Ph.D. education is encouraged by the *Re-envisioning the Ph.D.* project, (Nyquist and Wulff 2001-2002) which involved a national study of doctoral education. Recommendations from this project include providing students with exposure to wide variety of career options, producing scholar-citizens who see their special training connected more closely to the needs of society and the global economy, and balancing the deep learning of the disciplinary doctorate with the variety of interdisciplinary challenges (Nyquist and Wulff 2001-2002).

Top business management and public administration programs are excellent resources for learning models that provide for integrative and interdisciplinary experiences as well as opportunities for developing management skills that may be appropriate for fisheries management training. For example, Harvard Business School's case study method brings real-life business problems into the classroom. According to Harvard, these case studies present the greatest challenges confronting leading companies today, complete with the constraints and incomplete information found in a real business situation and places the student in the role of the decision maker. Harvard's Kennedy School of Government also maintains a database of Public Policy and Management case studies. In addition, MBA and Public Administration programs are using team projects. For example, students in the Carnegie Mellon University's Heinz School of Public Policy and Management are required to participate in a Systems Synthesis Project. They work in a group for a real client and tackle a real issue that synthesizes their first year coursework in economics, statistics, management science, financial analysis, professional writing, and speaking. They are guided and challenged by a faculty advisor and an advisory board of professionals in the field. Students propose a project, frame the problem, conduct the analysis, make recommendations, and present their findings. This team project is specifically designed to prepare students with professional skills necessary for employment and long-term success.

The primary teaching methods and capstone experiences employed by the top MBA programs in the United States and non-U.S. institutions, listed by *Business Week*, 2001, are summarized in Appendix F.2. These teaching methods include case study and/or simulation, small learning teams (4-5 students and cohorts of teams), practitioners in the classroom, group projects or field studies where students work as a team solving a problem for a real client, internships, mentorships, and specialized leadership and global immersion programs. Several of the top MBA programs also advertise a move toward integrated curriculum, usually meaning integration of teaching with research and industry. Although there are few data on the value of these methods as learning tools, the prevalence among top MBA programs is an indicator of conventional wisdom.

Nevertheless, the business education literature indicates the need for improvements in these current teaching practices, particularly with regard to developing teamwork and communication skills. While companies are increasingly advocating use of crossfunctional or self-directed work teams, McKendall (2000) says MBA programs using study or project teams are not helping students understand how a good team functions. For example, Lamond (1995) suggests "action learning" exercises, in which students work in a team for a client, should also involve a stakeholder management approach, where "students are encouraged to see themselves as negotiators in a process with multiple preferred outcomes." Heinfeldt and Wolf (1998) cite increasing support from government and business for interdisciplinary programs, focusing on identifiable long-term problems in economy, society, and government, rather than department-based programs focusing on disciplinary paradigms. They also suggest the use of team-taught, stakeholder based curriculum, where teaching teams are focused around stakeholder types or specific introductory stakeholder focused courses (e.g., Customers and the Media, Stockholders and Bondholders). Some MBA programs such as INSEAD in Europe are working to develop 21st century globally competent business leaders by intentionally creating diverse study groups where students "learn to understand each other, utilize each other's experiences, and discover ways to work together" (INSEAD 2001).

Some fisheries and other resource management programs are already using interesting and innovative capstone opportunities, which may be helpful models for integrating industry and government into academic training programs. The University of Rhode Island's Department of Environmental and Natural Resource Economics has created a policy simulation laboratory using computer visualization technology (<http://www.uri.edu/cels/enre/SimLab/>) to examine the consequences of policy actions—this project has strong potential as a place where students, stakeholders, and policy makers can simulate consequences of policy decisions. The University of California, Santa Barbara, Donald Bren School of Environmental Science and Management, Master's of Environmental Science and Management (MESM) is a relatively new 2-year professional degree with an option for specialization in coastal marine resources management. In lieu of a master's thesis, students participate in a year-long group project that is capped off by a final oral and poster presentation in front of the Bren community, group project stakeholders, and local professionals. Proposals for group projects are submitted by various agencies locally, statewide, and nationwide. Wageningen University and Research Center in the Netherlands, through its M.Sc. in Agricultural Economics and Management and M.Sc. in Aquaculture, claims to have formed a "unique alliance between the university and "market-oriented research

institutes" that "combines fundamental and applied research with innovative education in the areas of food, agrotechnology, production systems, nature and the environment" (Wageningen 2001).

Some academic partnerships have been initiated by government. For example, NOAA Fisheries has developed fellowships and cooperative research programs with academia. The Joint Graduate Fellowship Program in Population Dynamics and Marine Resource Economics, sponsored by the National Sea Grant College Program and NOAA Fisheries, funds Ph.D. level students to work on thesis problems of public interest and relevance and to perform internships under the guidance of a mentor at participating NOAA Fisheries science centers, labs, or regional offices. This is an effort to meet their needs for more stock assessment and social scientists (Ocean Studies Board 2001). Oregon State University has the Cooperative Institute for Marine Resources Studies which is an academic collaborative research partnership between the NOAA and OSU for work in fisheries ecosystem studies, aquaculture, oceanography, and marine-resource technology and related fields. This program is a source of funded research projects suitable for graduate students in fisheries. Similarly, the Florida State University/NMFS Institute for Fishery Resource Ecology is an academic research partnership designed to address marine resource issues of the northeastern Gulf of Mexico that affect Florida, the southeastern United States, and the rest of the nation (NOAA 2001).

Some academic programs have formed tight partnerships with specialized funding agencies. For example, the University of Tromsø, Norwegian College of Fishery Science has an M.Sc. in International Fisheries Management (2-year), which features interdisciplinary education with economics and biology, technology, principles of organization, and law. The degree also requires a dissertation related to the student's home country. Since the focus is on attracting and training international students, Tromsø has formed partnerships with two scholarship programs: 1) the English Taught Quota Program, which provides scholarships for students in a study program specially designed for applicants from certain countries (primarily developing countries and some Eastern European countries) and 2) the NORAD (Norwegian Agency for Development Cooperation), which assists developing countries with the goal of lasting improvements in political, economic and social conditions for the entire population within the limits imposed by the natural environment and the natural resource base.

Most of the 72 academic programs in this review do not yet appear to be using many of these more unique types capstone opportunities.

Other Academic Programs

A variety of academic programs that are not fisheries specific already serve to provide appropriate resource management and policy-related training relevant to fisheries management by producing graduates with many of the necessary skills. These include programs in marine resource management, environmental management, environmental studies, conservation biology, environmental policy, resource economics, agribusiness, human ecology/human dimensions, and forestry; environmentally or socially oriented public administration, law, business, or management science programs; dual or joint degree programs between resource management and law, business, or public administration programs. Many of these programs are included on the

website associated with this report (<http://oregonstate.edu/dept/trainfishmngtr/training/TFM21.html>). Graduates of these programs who are employed as fisheries managers likely need additional on-the-job or continuing education training in fisheries, similar to specialists who are necessary for fisheries management, but not trained in fisheries (Ocean Studies Board 2001).

Continuing Education

Continuing education is an important component for building and maintaining fisheries management training capacity among working professionals. Typically, continuing education programs are more flexible and delivery methods and content are designed according to the needs of learners or organizations. Although continuing education programs were not the primary focus of this review, some programs were discovered. Most of these programs focus on training technicians (particularly in aquaculture) or mariners, or entry-level managers; however, there are a few programs suitable for mid- or upper level managers who have more responsibility for decision and policy making. Most of continuing education programs appropriate for fisheries management training appear to fall into the following four categories:

Academic-based

Postgraduate certificate, diploma or professional masters programs are forms of continuing education that require a more demanding time commitment than periodic workshops or short courses. Academic programs with more flexible learning options, such as the Australian Maritime College's Marine Resource Management program and University of Portsmouth's Centre for the Economics and Management of Aquatic Resources (CEMARE) programs mentioned above, are likely more accessible to working professionals. The Australian Maritime College has also developed short courses and distance education options as part of their diploma and certificate degrees to help alleviate the time availability issue for working professionals. These types of models may be useful for academic programs seeking to develop degree-granting, continuing education programs.

Many fisheries academic programs provide extension and outreach education, some of which is conducted through fisheries or marine institutes. Extension programs are oriented toward translating research into practice and are typically geared toward public education. For example, the OSU Extension program has the Master Woodland Manager Program and the Watershed Stewardship Education Program. The Woodland Owner training progresses through basic forestry short courses, resource management planning, and advanced woodland management to certification as Advanced Master Woodland Manager. This program also develops specialized training workshops based on the needs of private landowners, professional managers, and stakeholders (OSU Extension Service 2002, Cloughesy and Reed 2001). The Oregon State Watershed Stewardship program progresses through a series of eight basic training sessions that provide practical education (including science and policy, and skills in leadership, decision making and strategic planning) to watershed groups or councils, landowners, agricultural producers, nursery growers, foresters, planners, teachers, urban residents, and other interested groups and individuals (Oregon Sea Grant 2002). Some extension programs provide continuing education credits that may be suitable for professionals in fisheries.

Government

Agency in-house training is likely common, but difficult to identify. However, this current training review revealed a few government-sponsored training programs in the United States. The best example is the U. S. Fish and Wildlife Service, National Conservation Training Center that offers a multitude of courses including up-to-date technical training, aquatic and fisheries science, ecosystem management, statistical analysis techniques, conservation science, and leadership development focusing on administrative, supervisory, and team training. NOAA Fisheries employees are encouraged to use this training center in addition to professional development courses offered by the NOAA Office of Human Resources Management and special courses arranged with outside institutions at NOAA Fisheries regional offices and science centers (Ocean Studies Board 2001). The USDA Forest Service offers continuing education focused on aquatic and terrestrial scientific technical training or program leadership, which includes three workshops—Leadership and Communication, Natural Resource Policy, Values and Economics, and Program Management. The NOAA Coastal Services Center is committed to providing the training requested by the coastal resource managers in the United States—including courses in technology, coastal management, and process skills. Government training programs in all nations need to be identified, and these programs should all be examined further to determine if training capacity is sufficient or can be improved through additional partnerships or sharing of resources. For example, the Fisheries Department of the United Nations Food and Agriculture Organization works to develop partnerships to facilitate training, particularly in developing nations.

Industry

Training developed by and coordinated by industry based associations or trade groups has been developed for industry members to improve industry operations and in some cases, industry participation in fisheries management (particularly in nations where fisheries are governed by a quota management system). One of the most obvious examples is the New Zealand Seafood Industry Training Organization (SITO). SITO facilitates competence-based training across all areas of the industry, including both industry-specific training, such as seafood processing and more generic training, such as management and information technology skills. Using a needs-based model, SITO representatives work with individual companies to analyze and meet industry training needs. The relationship between existing industry training and the role of industry in various management systems should be explored as a component of a training gap analysis.

Private/non-profit/foundations

Some non-profit conservation or education groups offer courses suitable for training managers who are in or preparing for leadership and decision making positions. The Center for Creative Leadership is a non-profit education institution offering several open-enrollment and custom designed leadership training workshops to business, government, academia, and non-profits, and offers specialized courses in partnership with other organizations. Although the main office is located in Greensboro, North Carolina, this institution offers courses in Europe and throughout the United States. Professional societies offer advanced management training workshops. For example, the American

Fisheries Society is offering a leadership symposium. Research foundations or institutes are also offering advanced training, such as the Worldfish Center, a.k.a. ICLARM, Fisheries Co-Management workshop in 2002.

A survey focused on further identifying continuing education opportunities appropriate for fisheries managers should be conducted. This survey should include the full range of continuing education programs offered within the above categories.

Solutions

Participants in the December 2001 Queenstown workshop suggested that training needs could be met by a variety of academic and continuing education programs, including flexible learning opportunities and on-the-job training. This idea has been supported by a variety of workshops on training fisheries managers (e.g., Ocean Studies Board, 2001; Amidei, 1987; Smoker, 1981). Based on New Zealand workshop comments, our review of past workshops, and what we have learned thus far from examining current programs, the following is a sample of strategies for exploring and improving current capacity to train managers for 21st century fisheries.

Sector-based needs assessments

Collect input from employees, employers, and stakeholders on training needs and the suitability of training methods for different sectors and levels of management. Sectors might be defined by the role of the manager, but might also be defined according to the governance structure or unit, or the level of economic development, i.e., developing nations have some shared training needs that are not necessarily the same as developed nations. The outcome of these needs assessments could be used to develop certification standards and help students and employers evaluate suitability of certain types of training programs.

Formal survey of existing training programs

The review of current programs for the New Zealand workshop was only preliminary. A more in-depth survey of programs is necessary. This search should be expanded to include all possible training programs (including those without website literature in English): academic, continuing education, and inservice or in-house. Representatives of training programs (directors, faculty, and continuing education trainers) should be surveyed to gain more accurate information as well as contact information about graduates and employers of graduates. Employers and employees in government agencies, industry, and NGOs, graduates of academic programs, and educators (academic faculty and continuing education trainers) should be surveyed. One purpose of this survey would be to assist with categorizing programs according to their suitability for training different types of fisheries managers under the broader definition of fisheries manager. Ultimately, an online, easily updated database of training programs could be created with programs and courses identified as suitable training for certain sectors and management levels.

Gap analysis

To effectively evaluate training capacity, we need a more in-depth analysis of the gap between existing training and the skills and knowledge required for each class of manager. This can be accomplished through comparison of information from an expanded review of training programs and sector-based needs assessments. The gap analysis would strongly complement the needs assessment and program review. Analysis should include evaluation of programs in other natural resource, business, and public administration disciplines that might serve useful for fisheries management and should also identify redundancy in training within management sectors, thus indicating areas of potential partnership.

Curriculum flexibility

Existing academic programs should consider offering additional degree options and flexible learning options suitable to working professionals, particularly if certification or career advancement standards are developed which require professionals to receive periodic training. Academic programs should also explore developing more options for integrative learning, research, and reality-based or experiential training at the M.S. and Ph.D. levels.

Marketing and recruiting

This review of current programs was entirely based on information available on websites and, due to the large variability in this source of information, undoubtedly missed some programs (particularly without literature in English) as well as significant details about programs. The web is becoming the primary search tool for students and professionals seeking information on training and education opportunities. Thus, academic programs interested in recruiting more and higher quality students should critique their own website, and place priority on keeping online marketing up-to-date and professional looking. Web literature should detail how students gain specific skills and knowledge with a clear link to curricular goals, objectives, and philosophy. Suggestions for items to include are: rationale (philosophy, vision, objectives), program history, degree requirements and courses, testimonials from students and graduates, employment statistics, partnerships, facilities, faculty research and activities, and capstone opportunities. If applicable, consider using key words such as "sustainable," "leadership," and "ecosystem management," which reflect the most prevalent (popular) concepts in conservation and management. These steps will likely be useful in recruiting individuals who may discount fisheries management study under the mistaken belief that this discipline focuses solely on harvest of fishery resources to the exclusion of conservation, management, and scientific understanding of marine ecosystems (Ocean Studies Board 2001).

Using existing potential to build new capacity

Training institutions should continue to evaluate whether they can develop a new or stronger fisheries management training program by 1) more fully utilizing or enhancing existing capacity within their institution; 2) developing new cooperative partnerships with other training institutions or local, national, and international agencies, NGOs and other

groups in need of training; 3) providing flexible degree pathways and learning options; and 4) developing new advanced continuing education opportunities for professional managers and specialists.

Encouraging innovation

Funding should be available to encourage development of innovative curricula and capstone integrative opportunities, including case studies, simulation or modeling exercises, and team projects for real clients. Funding should also be available for developing innovative cooperative multidisciplinary or multi-institutional models for training partnerships between industry, government, and academia, including fellowships for professionals seeking advanced training or sabbaticals and cross-sectoral training and exchange opportunities.

Ultimately, for these strategies to be successful, all fisheries management sectors will likely need to make human capacity building and enhancement of training a priority in their strategic planning for the 21st century.

References

- Adelman, I.R., D.J. Schmidly, and Y. Cohen. 1994. Educational needs of fisheries and wildlife professionals: results of a survey. *Fisheries* 19(11):17-25.
- Adelman, I.R. 1990. Technical specialization and a broad foundation in an undergraduate fisheries degree. *Fisheries* 15, (5):26.
- Amidei, R. (ed.) 1987. Educating fisheries managers. Proceedings of a California Sea Grant Workshop, University of California, Davis, April 3, 1986. California Sea Grant College Program. <http://nsgl.gso.uri.edu/cuimr/cuimrw86002.pdf>
- Australian Maritime College. 2002. MBA in marine resource management. <http://www.gsmrm.amc.edu.au/MBA/mba.shtml>
- Business Week*. 2001. B-Schools 2001 profile update. *Business Week Online*. http://www.businessweek.com/bschools/01/full_time_rank.htm
- Cloughesy, M.J., and A.S. Reed. 2001. Flexible learning pathways: a forestry extension perspective on curriculum development for continuing professional education of natural resource managers. Training Managers for 21st Century Fisheries Workshop. Queenstown, New Zealand.
- Crawford, B.R., J. Stanley Cobb, and C.L. Ming. 1995. Educating coastal managers, Proceedings of the Rhode Island Workshop. University of Rhode Island, Coastal Resources Center, Narragansett, RI. <http://www.crc.uri.edu/comm/htmlpubs/ecm/index.html>
- Ellefson, P.V. 1991. Professional Education of Forest Resource Planners: Potential Responses to Future Challenges. In: *Pacific Rim Forestry – Bridging the World*. Proceedings of the 1991 Society of American Foresters National Convention, San Francisco, CA, August 4-7: 421-424.

Fritzell, Erik K. and Ira R. Adelman. 1992. Fisheries and wildlife Education in the 21st century. Pages 78-92 in: Tony J. Peterle, editor. 2020 Vision, Meeting the Fish and Wildlife Conservation Challenges of the 21st Century. Proceedings of a symposium held at the 53rd Midwest Fish and Wildlife Conference, Des Moines, Iowa, December 3, 1991.

Heinfeldt, J., and F. Wolf. 1998. Re-engineering the business curriculum: a stakeholder paradigm. *Journal of Education for Business*. 73(4):198-201.

INSEAD. 2001. MBA Programme. <http://www.insead.edu/mba/home/index.htm>

Kelso, William E. and Brian R. Murphy. 1988. University Fisheries Programs in the United States: Structure and Needs. *Fisheries* 13(2):9-15.

Lackey, R.T. 1979. Fisheries education in the 1980's: the issues. *Fisheries* 4(2):16-17.

Lamond, D.A. 1995. Using consulting projects in management education. *Journal of Management Development* 14(8/9): 60-73.

McKendal, M.A. 2000. Teaching groups to become teams. *Journal of Education for Business* 75(5):277-282.

National Academy of Public Administration. 2002. Courts, congress, and constituencies: managing fisheries by default. <http://www.napawash.org/publications.html>

National Oceanic and Atmospheric Administration (NOAA). 2001. NOAA and Academic Partnership Building Conference, Washington, D.C. November 13-14, 2001.

Nyquist, J., and D.H. Wulff. 2001-2002. Recommendations from National Studies on Doctoral Education. Re-envisioning the Ph.D. <http://www.grad.washington.edu/envision/index.html>

Ocean Studies Board, U. S. National Research Council. 2001. Recruiting Fishery Scientists: Workshop on Stock Assessment and Social Science Careers. National Academy Press, Washington, D.C.

Oglesby, Ray T. and Charles C. Krueger. 1989. Undergraduate Fisheries Education: Technical Specialization or Broad Foundation? *Fisheries* 14(5):17-21.

Oregon Sea Grant. 2002. Watershed Stewardship Education Program. http://seagrant.orst.edu/wsep/training_about.cfm

Oregon State University Extension Service. 2002. Master Woodland Manager. <http://osu.orst.edu/extension/mwm/>

Paulik, G.J. 1968. Fisheries education: A critical review and a look at the future programs. Pages 295-299 in de Witt Gilbert, ed. The future of the fishing industry of the United States—Studies at

a conference of fishermen [etc.] at the University of Washington, College of Fisheries, March 24-27, 1968. University of Washington Press.

Salo, E.O. 1968. History and structure of fisheries education in the United States. Pages 290-294 in de Witt Gilbert, *ed.* The future of the fishing industry of the United States—Studies at a conference of fishermen [etc.] at the University of Washington, College of Fisheries, March 24-27, 1968. University of Washington Press.

Sample, A.V., P.C. Ringgold, N.E. Block, and J.W. Giltmier. 1999. Forestry education: adapting to changing demands on professionals. *Journal of Forestry* 97(2):4-10.

Schmidly, D.J., I.R. Adelman, and J.S. Greene. 1990. Educational content of university fish and wildlife programs based on expressed needs of federal and state agency employers. Pages 133-143 in: Transactions of the 55th North American and Natural Resources Conference.

Sedjo, R.A. 1991. Forestry in the future: educating foresters and forests planners. Pages 407-411 in: Pacific Rim Forestry—Bridging the World. Proceedings of the 1991 Society of American Foresters National Convention, San Francisco, CA, August 4-7.

Smoker, W.W. (ed). 1981. Fisheries education in Alaska: creating a program of excellence. Proceedings, December 8-12, 1980, Anchorage. Alaska Sea Grant Report 82-4, 133 pages. <http://nsgl.gso.uri.edu/aku/akuw80003/akuw80003index.html>

UNESCO. 1981. Fishery science teaching at the university level. Report of UNESCO/FAO workshop on university curricula in fishery science, Paris, May 1980. UNESCO (United Nations Educational, Scientific and Cultural Organization) Reports in Marine Science 15, 75 pages.

Wageningen, 2001. <http://www.wur.nl/>

APPENDIX F.1.

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Management
Auburn University Alabama, USA	Fisheries Science	Emphasis		YES		YES	Master of Aquaculture	YES		NO, has Natural Resource Econ.	YES
Auburn University, Alabama, USA	International Center for Aquaculture & Aquatic Env	Workshops, Short courses	YES		YES					N/A	N/A
Cornell University New York, USA	Natural Resources	Concentration - Policy and Mgt or Fisheries and Aquatic Science (Interdisciplinary)		YES		YES	Masters of Professional Studies	YES		NO, has Natural Resource/ Environ. Economics	YES
Cornell University New York, USA	Graduate minor in Conservation and Sustainable Development	Interdisciplinary--w/ fisheries science/natural resources				YES	YES	YES		NO, has Resource/ Environ. Economics	YES
Colorado State Colorado, USA	Fishery Biology	Course/s		YES		YES		YES		NO, has Resource/ Environ. Economics	YES (Habitat Mgt.)
Florida State University Florida, USA	Biological Science with emphasis in Fishery Ecology	Course--general resource management				YES		YES		NO	NO
Humboldt State University California, USA	Fishery Biology	Courses		YES						NO, has Natural Resource/ Environ. Economics	YES
Humboldt State University California, USA	Natural Resources with Fishery Biology option	Courses				YES				NO, has Natural Resource/ Environ. Economics	YES

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
Ohio State Ohio, USA	Natural Resources w/ fisheries biology, ecology and management, or policy and social science	Research emphasis		YES		YES	MS	YES	Dual degree w/ Public Policy and Mgt.	NO; has Natural Resource/ Environ. Economics	YES
Oregon State University Oregon, US	Marine Resource Management w/ marine fisheries management	Concentration				YES	MS			YES	YES
Oregon State University Oregon, US	Fisheries Science	BS – option M. S. /Ph.D. – course, Research		YES		YES	YES	YES		YES	YES
Oregon State University Oregon, US	Agricultural and Resource Economics	BS – course, Economics and Policy Option MS/PhD – course, research		YES		YES	YES	YES		YES	YES
Texas A&M University Texas, USA	Wildlife and Fisheries Sciences	BS – course MS/PhD - course		YES		YES	M. Agr.	YES		NO	YES
University of Alaska Fairbanks & Juneau Center Alaska, USA	Fisheries Science	BS – course MS – emphasis PhD – course?		YES		YES		YES		NO; Resource Economics	YES
University of Arizona Arizona, USA	Fisheries Science	Interdisc. emphasis – e.g., natural resource policy and planning				YES		YES		NO; has Natural Resource/ Environ. Economics	YES (Habitat Mgt.)

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University of Arizona Arizona, USA	Renewable Natural Resources	BS – interdisc management major with option in fisheries science MS/PhD – interdisc with fisheries concentration?		YES		YES		YES		NO, has Natural Resource Economics	YES (Habitat Mgt.)
University of Delaware Delaware, USA	Marine Studies/Marine Policy PhD in Marine Studies with Concentration in Marine Policy; Master of Marine Policy, MS Marine Studies	Interdisc. emphasis, course (fisheries economics)			YES	MS Marine Studies; Master of Marine Policy		PhD Marine Studies; PhD Oceano- graphy	JD - MMP	YES	?
University of Florida Florida, USA	Interdisciplinary Ecology	Flexible interdisc. degree with concentration in fisheries and aquatic sciences; course				YES	YES	YES	JD – MS; JD - PhD	NO, has Natural Resource Economics	YES
University of Florida Florida, USA	Fisheries and Aquatic Sciences	Course; (Emphasis in Marine Fisheries Science)				YES	MFAS	YES		NO, has Natural Resource Economics	YES
University of Georgia Georgia, USA	Fisheries and Aquaculture (in School of Forest Resources)	Concentration				YES	MFR	YES		NO, has Natural Resource Economics	YES
University of Maine Maine, USA	Marine Biology	Course, Fisheries Science Research Emphasis				YES		YES		YES	YES
University of Maine Maine, USA	Marine Policy	Concentration ("Focus")				YES	?			YES	YES (5)

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University of Maryland Maryland, USA	Marine Estuarine and Environmental Sciences, Fisheries Science Specialization	Emphasis				YES		YES		NO, has Natural Resource Economics	YES
University of Massachusetts – Amherst Massachusetts, USA	Wildlife and Fisheries Conservation	Courses, Research				YES	YES	YES		NO, has Natural Resource Economics	YES (stock assess- ment)
University of Miami Florida, USA	Marine Biology and Fisheries	Courses, Research	YES			YES	YES	YES		YES (Soc. Econ and Mgt.)	YES (population modeling & mgt.)
University of Miami Florida, USA	Marine Affairs and Policy	Courses, Research				MAF	MAF		Joint MAF- JD degree option	YES (Soc. Econ and Mgt.)	YES (population modeling & mgt.)
University of Missouri – Columbia Missouri, USA	Fisheries and Wildlife Science	Course, Research				YES		YES		NO, has Natural Resource Economics	YES
University of Rhode Island Rhode Island, USA	Marine Affairs	Concentration				MA	MMA	YES		YES	YES (law and policy)
University of Rhode Island Rhode Island, USA	Environment and Natural Resource Economics	Emphasis/Research				YES	YES	YES		YES	YES (law and policy)

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University of Rhode Island Rhode Island, USA	Fisheries Science	Research				YES	YES	Environ. Sci. with Fish Sci. emphasis		YES, but not part of curriculum?	YES, but not part of curriculum?
University of Vermont Vermont, USA	Wildlife and Fisheries Biology	Specialization (Ecosystem Ecology and Mgt.); Course				YES	YES			NO, has Environ- mental Economics	YES
University of Vermont Vermont, USA	Natural Resource Planning w/ specialization in Wildlife and Fishery Biology	Course, Research?				YES	YES	YES		NO, has Environ- mental Economics	YES (policy/ admin.)
University of Washington Washington, USA	Aquatic and Fishery Science	Course, Research		YES		YES		YES		YES	YES (case studies)
University of Washington Washington, USA	Marine Affairs and Policy	Courses, Research				MMA				YES	YES (case studies)
Utah State University Utah, USA	Fisheries Biology	Specialization				YES	Master of Natural Resources	YES		NO, has Natural Resource Economics	YES
Utah State University Utah, USA	Natural Resources and Environmental Policy Program	Course			YES					NO, has Natural Resource Economics	YES (policy/ admin.)
Virginia Institute of Marine Science Virginia, USA	Marine Science/Fisheries Science	Emphasis (Commercial Fisheries Development)				YES		YES		YES, not part of curriculum?	YES, not part of curriculum?

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
Virginia Institute of Marine Science Virginia, USA	Marine Science/Coastal and Ocean Policy	Emphasis (e.g. , Marine Resource Economics)				YES	?	?		YES	YES
Virginia Tech Virginia, USA	Fisheries and Wildlife Sciences	Course				YES		YES		NO, has Environ- mental Economics	YES (planning, habitat mgt.)
University of Portsmouth UK	Coastal and Marine Resource Management	Course, research			YES	MSc				NO, has resource valuation	YES (Policy)
University of Portsmouth UK	Fisheries Economics	Course, research			YES	MSc				NO, has Marine Economics	YES (Policy)
University of Portsmouth UK	Fisheries Planning and Development	Major			YES	MSc				NO, has Marine Economics	YES (policy)
University of Portsmouth UK	Aquaculture Economics	Course, research			YES	MSc				NO, has Marine Economics	YES (policy, aquaculture mgt.)
University of Portsmouth UK	GIS and Fisheries Management	Major			YES	MSc				NO, has Marine Economics	YES (policy)
University of Portsmouth UK	Centre for the Economics and Management of Aquatic Resources (CEMARE)	Research				MPhil		YES		NO, has Marine Economics	YES (policy)

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University of Hull UK	Aquatic Ecology and Resource Management (AERM)/Hull International Fisheries Institute	Concentration			YES	MSc	?			?	YES
University of Hull UK	BSc (Hons) Aquatic Biology with Fisheries	Course		YES						NO	YES
Institute of Fisheries Management (IFM) UK	Fisheries Management, Fish Farming	Major	certificate, diploma		?					NO	YES
University of Stirling UK	Aquaculture	Specialization in "Fisheries" or "Env. Management"	YES	YES	YES	YES		YES		NO, Business	YES?
University of Aberdeen Scotland, UK	Marine and Fisheries Science: Sustainable Management of Living Marine Resources	Major			YES	MSc (vocational) MRes (research)				YES (part of Exploitation Module)	YES (part of Exploitation Module)
University College – Cork (National University of Ireland) UK	Fisheries Management, Development and Conservation	Major			YES	YES				NO, has Food Econ. w/ Fish focus	YES

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University College – Cork (National University of Ireland) UK	Aquaculture Development Centre (ADC) - Aquaculture	Course?	YES		YES	YES				?	?
University of Tromso Norway	International Fisheries Management	Major			YES	YES				YES	YES
Wageningen University and Research Center Netherlands	Aquaculture – Fish Culture or Fisheries (= Fish Management)	Major				YES				NO? has Environ- mental Economics	YES
University of the Azores Portugal	Marine Biological Science	Course (fishing techniques; primarily ocean science)				YES (courses for other universities)		YES (courses for other univers- ities)		NO	?
Dalhousie University Nova Scotia, Canada	Marine Management, Marine Affairs Program	Concentration					Master of Marine Mgt.			NO, has Resource/ Environ- mental Economics	YES
Memorial University of Newfoundland Canada	Marine Studies - Fisheries Resource Management	Major					Master of Marine Studies			YES	YES (business oriented)
Simon Fraser University British Columbia, Canada	Resource and Environmental Management	Courses, research				YES Master of Resource Mgt.	YES Master of Resource Mgt.	YES		NO, Env. Econ. YES	YES

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
University of British Columbia Canada	Fisheries Centre/ Resource Management and Environmental Studies	Courses, research				MA, MSc		YES		NO, Resource Econ YES	YES
University of British Columbia Canada	Fisheries Centre/Zoology	Courses, research				YES		YES		NO	YES
Diponegoro University Indonesia	Fisheries and Marine Science – undergraduate	Major (Aquatic Resources Management or Fisheries Resources Utilization Specialty		YES						?	?
Shanghai Fisheries University China	Fisheries Resource and Environmentor International Fishery and Policy or Fishery Economics and Management	Specialty		YES		YES		YES		?	?
National Fisheries University Japan	Fisheries Science and Mechanical Engineeringor Resource Management and Food Science – masters	Major		?		YES				?	?
Tokyo University of Fisheries Japan	Fisheries Resource Management	Major		YES		YES		?		YES	YES
Hokkaido University Japan	Fisheries Science	Emphasis				YES		YES		YES	YES

APPENDIX F.1. , continued

Current Academic Fisheries Training Programs in New Zealand Workshop Analysis Sample

Institution	Program Title	Highest Level of "Fisheries Management" (course = class offering)	Degree Level							Course focused on?	
			Continuing Education	Bachelor	PgC or PgD	Masters thesis (YES = MS)	Masters non-thesis	PhD	Other	Fish Economics	Fish Manage- ment
Kagoshima University Japan	Faculty of Fisheries – (Masters w/ Marine Social Science Emphasis or Fishery Biology	Emphasis		YES		YES				YES	?
Australian Maritime College Australia	Fisheries and Ecology - postgraduate studies - Applied Science	Emphasis			YES	YES	YES	YES?		YES	YES
Australian Maritime College Australia	Marine Resource Management – Fisheries Management	Option?		YES			YES			NO, has Marine Economics	YES
Australian Maritime College Australia	Marine Policy	Emphasis or Course/Elective			YES	YES	YES	YES		YES	YES
Curtin University - Muresk Branch Australia	Agribusiness (Aquaculture/Seafood Technology)	course, focus, research		YES	YES	YES		YES		NO, has Agri- business Economics	YES
Southern Cross University Australia	Bachelor of Applied Science	Major – Fisheries and Aquaculture Management		YES						NO, has Natural Resource Economics	YES
		TOTAL	4	16	16	61	25	42	3		

APPENDIX F.2

Teaching Methods Used by *Business Week* 2001* Top MBA Programs

(*Source: *Business Week*. 2001. B-Schools 2001 Profile Update.

Business Week Online. http://www.businessweek.com/bschools/01/full_time_rank.htm.)

RANK	United States	Teaching methods/Capstone experiences or features
1	Wharton, Pennsylvania www.wharton.upenn.edu	<ul style="list-style-type: none"> • Small learning teams • Laboratory in collaborative leadership • Global immersion overseas study tour
2	Northwestern/ Kellogg, Illinois www.kellogg.northwestern.edu	<ul style="list-style-type: none"> • Group assignments centering on serving as consultants to businesses and organizations • Global Initiatives in Management (GIM) program (intensive global business leadership course designed by students, teams of Kellogg classmates plan and facilitate a challenging 10-week curriculum with a faculty advisor, and coordinate a 2-week international field experience) • Learning through Experience and Action Program (LEAP)—a capstone course, when most first years complete their core courses, focus throughout the class is on solving the problems faced by the client organizations, students expected to work directly with their corporate and non-profit clients to understand, analyze, and solve their problems in a variety of areas
3	Harvard, Massachusetts www.hbs.edu/mba	<ul style="list-style-type: none"> • Case Method (Harvard case studies = 80% of all case studies used in MBA programs) • Field studies conducted by teams of three or more students who work closely with a sponsoring organization and a faculty advisor; Business Plan contest • Entrepreneurial Leadership Internship Program—allow students with an interest in smaller, entrepreneurial ventures to take a job at such a company without the usual financial sacrifice • Integrated team teaching
4	MIT/Sloan, Massachusetts mitsloan.mit.edu	<ul style="list-style-type: none"> • Student study teams—teams grouped into cohorts of 60 students • MIT \$50K competition • Core curriculum—perspective based approach, a market-centered or economic approach, a data-centered or modeling approach, and an organizational or behavioral approach • Professional seminar—practitioners in the classroom; field trips; committed to fostering a close association between academic research and management practice
5	Duke/Fuqua, North Carolina www.fuqua.duke.edu	<ul style="list-style-type: none"> • Emphasis on teamwork • Simulations, case presentations • Yearlong Individual Effectiveness course • Flexible teaming: study groups, project groups and case teams
6	Michigan www.bus.umich.edu	<ul style="list-style-type: none"> • Mix of lectures, case studies, and project work; common for papers, presentations, case studies, and sometimes exams to be done as part of a team • Multidisciplinary Action Projects (MAP) built around demanding real-time, real-world in-company assignments, cross-functional teams and involves working with a cross-disciplinary team of faculty, who review students' work and provide guidance at crucial points during the project. Teams also work closely with a consultant on team effectiveness and project management, as well as host-company executives. At the conclusion of MAP, student teams present findings and recommendations for action to both faculty and their sponsoring companies; last 7 weeks of the first year of the MBA program
7	Columbia, New York www.gsb.columbia.edu	<ul style="list-style-type: none"> • Clusters of 60 students in first year • 500 practitioners in the classroom each year

RANK	United States	Teaching methods/Capstone experiences or features
8	Cornell/Johnson School, New York www.johnson.cornell.edu	<ul style="list-style-type: none"> • Immersion Learning curriculum—Students work on real-world problems under real-world time pressures; evaluated as they would be on the job; on the road and see more companies, up close, in a semester than most executives have seen in a lifetime • Leadership skills courses/workshops • Opportunities to create business plans, meet venture capitalists and business owners and get a vivid sense for the process and pitfalls of growing a new business
9	Darden, Virginia www.darden.edu	<ul style="list-style-type: none"> • Case method and integrated curriculum • Business projects • Global business experience—take classes at partner business schools, visit local companies, and meet with the country's business and political leaders; learning teams • Internship
10	Univ. of Chicago gsb.uchicago.edu	<ul style="list-style-type: none"> • Discipline-based approach focuses on principles, trends, and analysis—not case-specific details • Leadership Effectiveness and Development (LEAD) develops these skills through role playing, team building, and a host of other creative activities and experiences. Students are grouped in cohorts of about 50 and participate in all of these activities together.
NON – U. S.		
1	INSEAD, France www.insead.fr	<ul style="list-style-type: none"> • Study groups • Team-based examinations • Case study • Simulation
2	London Business School www.london.edu	<ul style="list-style-type: none"> • In-depth company projects—Second Year Project that involves students undertaking a consulting-type project for a client organisation • International exchange • Shadowing opportunities/shadowing report • Internships
3	Navarra/IESE Business School, Spain www.iese.edu	<ul style="list-style-type: none"> • Corporate internship • International best-practice cases • International exchange
4	IMD International, Switzerland www02.imd.ch	<ul style="list-style-type: none"> • Intensive building blocks combined with practical, “real world” projects • Personally coached leadership program: <ul style="list-style-type: none"> ○ New venture team projects (Teams of about 6 participants support one of 15 start-up companies in developing their business plans for specific next steps) ○ International consulting projects (e.g., 1-week trip to Bosnia and Herzegovina, a European country disrupted by conflict and trying to get its economy back on track—participants work with government departments in the specific area of attracting foreign investment)
5	Ivey, Canada www.ivey.uwo.ca	<ul style="list-style-type: none"> • Primarily case method—“second largest producer of cases in the world”
6	Rotterdam, Netherlands www.rsm.nl	<ul style="list-style-type: none"> • Internship, exchange; international immersion; in-company project
7	Rotman, Toronto www.rotman.utoronto.ca	<ul style="list-style-type: none"> • Team learning—self-managed study team • Computer simulations • Multi-media learning techniques • Case studies • Role playing • Team and individual projects

APPENDIX G

Flexible Learning Pathways: A Forestry Extension Perspective on Curriculum Development for Continuing Professional Education of Natural Resource Managers

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Introduction

In this paper, we approach the topic of curriculum development for continuing education of natural resource managers through the lens of Forestry Extension. We include a list of what we feel are some elements of a successful educational program for 21st century fisheries managers. However, we first will describe forestry extension, give you some idea of our history at Oregon State and nationwide, and our involvement with educating natural resource professionals. We then will elaborate one model of curriculum development. We will illustrate this model with some examples of successful natural resource curricula, especially from Oregon forestry extension. Finally we will enumerate the elements of a successful educational program.

Description of Forestry Extension and Outreach Education in Oregon

Forestry extension programs vary widely in scope and scale among U.S. organizations. Over 350 forestry extension professionals support Extension programs. The state of Oregon has the largest such program in the United States, with about 29 million acres of forest land, and employs around 30 extension foresters through Oregon State University (OSU). Educational programs are grouped into primary themes of public understanding of forestry, forest resource stewardship and sustainability, and productivity and profitability of forestry enterprises. Extension education approaches include use of volunteer woodland owners to help educate their peers; conferences, workshops and field demonstrations; publications including newspapers, magazines and electronic media; broadcast radio and television; and targeted mailings (Reed et al. 1996).

Extension workers typically work with specific audiences to deliver extension education. These audiences are quite diverse and may include non-industrial, private forest owners; professional foresters and engineers; youth involved in forestry education programs in schools and their teachers; professionals in land management agencies; loggers and forestry services contractors; owners of forestry businesses; forestry consultants; other professionals dealing with forestry issues; policy makers at various governmental levels; and others. Extension programs are motivated by expressed issues and needs of the audiences served.

Various mechanisms help to establish the priority of extension projects. Beyond systematic planning, one of extension's real strengths is its flexibility to meet short-term priority needs of its clientele as in the case of an insect outbreak, new market opportunities, or changes in institutions that affect clients, e.g., taxes, new regulations, subsidies, safety problems, etc. The order of the following list of extension projects does not signify importance or use:

- Local advisory groups or committees on a geographic or subject area basis
- Statewide program initiatives tied to local needs
- Federal program initiatives offering financial support for involvement

- Requests from cooperating organizations who help define problems and support delivery to particular audiences (may be in the form of grants or contracts)
- An agent's or specialist's assessment or an individual's passion and expertise for a topic
- "Market" demand from audiences, e.g., many requests for similar needs
- Financial resource availability to engage in a potentially successful educational program versus attempting "high risk" programs
- Development efforts, e.g., to establish relationships with specific individuals or organizations
- Capacity building activities for groups or individuals, e.g., computer updating, business management, policy interactions, etc.

History of Forestry Extension and Outreach Education's Involvement in Natural Resource Training

Forestry Extension in Oregon developed as a means to educate woodland owners starting in the 1970's. Woodland owners were seen by policy makers as a possible source of increased timber harvest to meet a projected upcoming shortage. Forestry Extension was part of a statewide response to help woodland owners manage their lands more productively and sustainably. At around this same time the OSU College of Forestry established the Conference Office to centralize support to faculty who were developing training for natural resource professionals. In the early 1990's, Forestry Extension evolved to include Public Policy Training for woodland owners and professional foresters. In the late 1990's, needs assessments told us of an opportunity to develop watershed trainings for watershed councils and associated landowners.

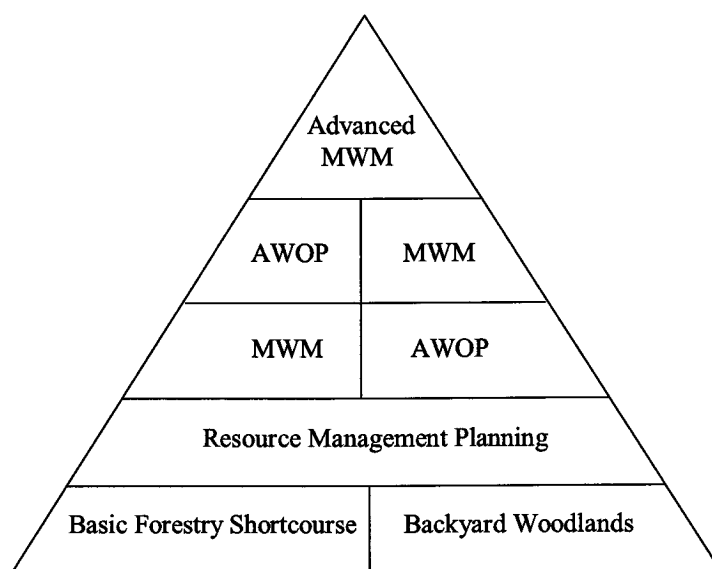
- **Woodland Owner Training.** The OSU Forestry Extension program was established to provide training for small woodland owners to manage their forest resources profitably and sustainably. As the program grew over the years it evolved from a predominantly timber-oriented program to a multiple resource management program focusing on sustainability. Figure 1 shows Forestry Extension's Woodland Owner Education Pyramid. Some of the courses shown in the pyramid are still under development, but we include it here to demonstrate the concept of flexible pathways in continuing education.

As shown in the pyramid, the initial educational experience for most landowners is the Basic Forestry Short Course (BFSC). The objectives of the BFSC are to familiarize landowners with the basics of a wide range of forestry topics. Following the BFSC, a woodland owner may proceed on different pathways of development consistent with his or her personal goals and ambitions. The Master Woodland Manager (MWM) program, which trains advanced woodland owners in improved resource management, management planning, and service to the forestry community at the state and county level has typically been the next step after the BFSC. Over time, the BFSC was improved and standardized and the Resource Management Plan (RMP) training was developed to precede the MWM program. Soon an improved MWM program will focus on volunteer service and public education while relying on knowledge, skills, abilities, and attitudes developed in the BFSC and the RMP. Backyard Woodlands is a new Forestry Extension program to familiarize owners of very small forest parcels with the basics of forest management. The Backyard Woodlands course takes the same entry-level position on the pyramid as the

BFSC. After revising the MWM program, our next steps are to develop an Advanced Woodland Owner Planning Program and an Advanced Master Woodland Manager Program.

The OSU Forestry Extension program is known for its group project planning process that has led to the development of these distinctive curricula for woodland owners. The cornerstone of this planning process is periodic formal needs assessments to make sure that programs are developed to meet the needs of identified clientele (Reed et al. 1996).

Figure 1. Forestry Extension's woodland owner education pyramid.



- **Natural Resource Professional Training.** The Conference Office of the College of Forestry coordinated natural resource professional training by the College's faculty. However, it did little to identify needs and develop specific programs to meet those needs. In 1998, the program's leadership was assigned to a senior extension faculty member in an attempt to "extensionize" the renamed Outreach Education Office. One of the first projects was to conduct a thorough needs assessment of past and potential clientele along with the Forestry Extension program. This assessment also examined incentives and barriers among faculty to provide outreach education. The assessment led to a revision of the College's formal policy in order to remove barriers and emphasize incentives. It also provided the first step in development of a formal Outreach Education curriculum.
- **Public Policy Training.** As the Forestry Extension program and our clientele developed, a need for training beyond technical forestry was identified. One such area that has been addressed is that of Public Policy Training. Woodland owners and foresters realize that

public policy is impacting their lives and livelihoods, but they have little knowledge of the process or skills to affect it. The curriculum model that Forestry Extension has relied on for years was put into practice to develop public policy training for woodland owners and foresters. An offshoot of this training saw the development of a workshop on media skills for foresters (Adams 1997).

- **Watershed Council Training.** As the Forestry Extension program developed further, a new target audience for integrated training in the area of watershed management was identified. Watershed councils are community-based, collaborative discussion and decision-making bodies. Oregon's more than 85 such watershed councils have a great potential to influence policy and management regarding Oregon's watersheds, but they lacked expertise in watershed science, management, and working together as groups. Forestry Extension's curriculum development model was put to work to answer this call and develop a broad new interdisciplinary curriculum that focused on the skills of leadership, meetings management, group decision making, and strategic planning (Cloughesy et al. 2001b).

A Model of Curriculum Development

Forestry Extension personnel come from diverse backgrounds and most of us have had little formal training in educational methods. We have generally come from a technical perspective, but have developed a great deal of experience in developing curricula for private woodland owners and natural resource professionals. The model in the literature that seems to come closest to what we have done in practice is postulated by Verduin (1980). Verduin's model was developed to document and guide a system of curriculum development that was used in urban adult education centers. It recognizes the peculiar needs of adult learners. It works to take them from where they are in life to where they need to be according to their individual perspective.

Verduin's model has five major elements: rationale, outside political forces, goal identification, instructional activities and organization, and evaluation. These elements all have sub-elements. We will describe Verduin's model in terms that relate to curriculum development for natural resource managers.

- **Rationale.** Verduin's first element of program planning is that of rationale, or explaining why an educational program is being developed. In Forestry Extension, we take our rationale directly from the audience. One of the core beliefs that is a hallmark of good curriculum development is that we develop long-term relationships with clients to move them through an educational stream. The OSU Forestry Extension Curriculum Pyramid, where learners start with the Basic Forestry Short Course and move through Resource Management Planning and onto Master Woodland Manager training epitomizes this idea. A successful curriculum takes learners where they are and moves them to where they need to be to meet their goals.

This rationale has two steps: target audience identification and needs assessment.

- **Target Audience Identification.** It is critical to identify the primary audience or audiences you wish to reach with your educational program. The more you know about your target and the more specific your target is, the better you are able to craft curricula to meet their needs. We in Forestry Extension have dealt with woodland owners and forestry professionals for quite some time, but when we needed to develop a curriculum for watershed councils, the first step was to get to know this audience and to understand their motivations for learning. Often educational programs will target two or more diverse audiences. It is then important to understand the differences between the audiences and design educational programs to meet both sets of needs. For example, a program may be aimed at natural resource managers and policy makers. The resource managers may have a great deal more technical experience and it may be necessary to bring up the level of technical expertise of the policy makers without wasting the time of the natural resource managers. Whenever possible, we recommend that very different audiences be targeted by different educational programs, but this is not always possible or desirable.
- **Needs Assessment.** Needs assessments can be formal or informal. We in Forestry Extension often have such a close relationship with our traditional clientele that we only need to conduct an informal needs assessment. However, it is periodically advantageous to conduct formal needs assessments. When working with a new group such as watershed councils, it is mandatory to conduct a formal needs assessment. Informal needs assessments can be conducted by keeping one's ear to the ground, visiting with members of the target, and frequenting meetings that they frequent. Forestry extension often conducts informal needs assessments of our clientele by speaking with them on a day-to-day basis, visiting their tree farms to see what their issues are, and by regularly attending woodland association meetings. Formal needs assessments can take the form of personal or telephone surveys, open-ended questions on workshop evaluations, and focus groups. In Forestry Extension, we have used all of these. Surveys seem to work especially well with the woodland owners and professional forester audiences.
- **Outside Political Forces.** Verduin brings in outside political forces to act as modifiers between rationale and goals. This is particularly appropriate for natural resource management where the identified target audience needs must be tempered with the desires of powerful outside forces. Three types of outside forces operating on the curriculum development process include government agencies, private organizations, and non-governmental organizations. We will address each separately.
 - **Government Agencies.** You don't have to look very far to see the impact of government agencies and regulations on curricula for natural resource professionals. The Endangered Species Act, Clean Water Act, and other environmental laws have promulgated a tremendous need for education at the federal, state, and local levels. Licensing and professional certification programs commonly are accompanied by a requirement for continuing education. These

continuing education requirements generally specify the amount of training that professionals must receive and often specify content areas. Finally government agencies are a major employer of natural resource professionals and play a major role in the demand for continuing education by their budgets, hiring practices, and culture.

- **Private Organizations.** Curricula for continuing education can be affected by private organizations in a variety of ways. Private organizations can set the technical standards associated with a certain skill set. For example, private log scaling and grading bureaus establish and enforce the standards that govern the ways that forest products are measured. A training program in forest measurements needs to account for these rules, and the need for new training programs may arise when new rules are promulgated. Market forces can be significant factors in the need for and type of educational program developed. Market forces are generally expressed through private companies by the prices they pay and the range of products they purchase. Private consultants and professional organizations can also be significant providers of continuing education and thus affect curriculum development by being competitors, collaborators and customers. Private companies are also major employers of natural resource professionals and can impact demand for continuing education ways similar to government agencies.
- **NGOs.** Non-governmental organizations such as environmental groups can have major impacts on the demand for continuing education programs. One example of this is through the establishment of sustainable development criteria that drive much present-day management. Other NGOs are important for funding continuing education programs, particularly for under-served audiences. NGOs can also be competitors, collaborators, and customers for continuing education programs.
- **Goal Identification.** The most important element in a curriculum development model is often identified as goal identification. Learning activities are developed as specific responses to goal statements. The defining of goal statements determines what will be taught and what will not. It also determines how easy it will be to evaluate what is learned. Goals give curriculum developers targets to shoot for. Learning activities are attempts to hit those targets and evaluations are measures to see how many targets were hit. Curriculum goals need to be developed at three levels: general, intermediate, and specific.
 - **General Level (Abstract).** These goals are the guiding principles behind large-scale educational programs. For instance, the Watershed Stewardship Education Program (WSEP) developed by OSU Extension for watershed councils has three main goals: Working together to create successful groups, understanding and enhancing watershed ecosystems, and understanding resource management in watershed ecosystems. All modules in the WSEP were developed in order to

achieve these broad abstract-level goals. To further emphasize these goals, we organized our learning guide into three sections, one for each program goal (Cloughesy et al. 2001). These general goals are difficult to measure quantitatively, but educators and learners often are able to evaluate their accomplishment at an instinctive or anecdotal level. These goals are often related to the mission or vision statements of a program.

- **Intermediate Level (Course/Module Level/Measurable Objectives).** These goals are generally responsible for driving an educational program at the course or module level. They are generally simple statements of what program participants will learn. Verduin (1980) says that it is very important to state these goals in measurable terms. This can be done by making them active imperatives with the learner as the subject and a statement of quality as the ending. For example: Learners will be able to estimate the volume of timber in a stand by taking plots to measure height, diameter, and number of trees per acre, using diameter tapes, clinometers, loggers tapes as tools, using the VARPLOT computer program to perform their calculations and be within 5 percent of the instructor's estimate. A mid-level goal such as this might cover several class sessions or even a mini-module, or it could serve a higher-level goal of learners being able to manage their timber sustainably. It could also be served by specific-level goals of learning to measure tree height and diameter, learning to use fixed-area plots, and learning to use the VARPLOT computer software.
- **Specific Level (Class Session Level/Measurable Objectives).** These are very task-oriented goals and relate to small discrete pieces of learning that must take place to achieve mid-level goals. These goals are often not enumerated in detail, but are left to be intuited from the mid-level goals. An example of a specific-level goal would be to learn to identify the three particle sizes used in soil classification of sand, silt, and clay.
- **Instructional Activities and Organization.** The development and organization of instructional activities is where the rubber hits the road. This is the meat of curriculum development. If a developer is thorough in her goal development, then the selection, development, and organization of instructional activities is a fairly straightforward process. Often when developing these activities, new specific-level goals will be discovered and others may be discarded. There is much more to be said about developing and organizing instructional activities than can be covered in this brief paper. However, we want to make a few comments that we feel are important.
 - **Develop or use specific learning experiences to achieve goals at all three levels.** Like goals, learning experiences are hierarchical. Specific learning experiences that will cover a class session or two are the building blocks of curriculum and serve specific-level goals. Together these specific-level experiences make up the learning experiences of a module or course and serve a series of mid-level goals.

- **Need to recognize hierarchy of knowledge, attitudes, skills, and abilities (KASA).** Learning covers different sorts of material. Knowledge learning requires acquisition of knowledge or facts. Knowledge learning is the basis of all learning. Ability learning involves manipulation of knowledge through synthesis and prediction. Ability learning is a higher order learning than knowledge learning, because knowledge is a first step to developing abilities. Skills learning is the practical application of knowledge and ability learning. Skill learning is very hands-on and is viewed by some as being basic. However, skill learning is synthetic in that it requires knowledge and ability as its base. For example, in measuring trees we start with the basic knowledge of a definition of diameter. We use this with our definition of height and volume to develop the ability to calculate volumes of specific example trees. Only with these abilities in hand can we learn the skill of actually measuring trees and calculating their volumes.
- **Need to know or assume entry-level of KASA performance to design appropriate instruction.** Each module or class in an educational program needs to assume an entry level of KASA. Knowing or assuming where students are allows us to design instructional activities to take them where they need to be. This point needs to be taken into account when organizing instructional activities in sequences. In the previous example, students needed to learn how to use tools before they could be expected to measure trees and calculate volumes.
- **Use prerequisites to try and get entry-level KASA performance.** In continuing education, students are not always long-term learners as they would be in a college program. Therefore, it is very important to use definition and communication of prerequisite classes or skills to ensure entry-level KASA performance. For example, if a class on taxation assumes that students have a knowledge of timber and land evaluation, this needs to be made very clear to students before they sign up for the class.
- **Adjust through feedback from formative evaluation.** Since many learning activities are sequential, we need to use formative evaluations to assess learning and feedback into the instructional process. To use our forest measurements example again: if testing shows us that students are not yet skilled in measuring individual trees, it is unreasonable to expect them to be able to accurately calculate the volume of a stand. An instructor who really wants to ensure the skill level of students will adjust the schedule to allow for additional skill building in tree measurements, before moving into volume estimation. At this point it is important to recognize that students learn at different rates and individualized progress or tutoring may be necessary if all students are to achieve a minimum KASA level.

- **Evaluation.** The final step in our model of curriculum development is evaluation. This can be used to measure student and teacher achievement, to give feed back to learning activities, and to determine the effectiveness of broad educational programs.
 - **Measure goal achievement.** Goals that are well developed and described in measurable ways are fairly easy to evaluate. As described later in this paper, the Oregon Forest Institute for Teachers was developed using well-defined specific-level goals. The achievement of these goals by learners was measured using a pre- and post-test. The results of this evaluation were used to improve this program (Cloughesy et al. 2001a). In another setting, these results could have been used to grade learners.
 - **Formative evaluation.** Formative evaluations are done during an educational program with a goal of improving program decisions. As stated earlier, formative evaluations are often used to measure intermediate student achievement of learning objectives. Often, this is done to adjust the educational activities mid-stream to ensure that objectives are being achieved. A mark of an excellent educator is his or her ability to assess the KASA level of each student and adjust learning activities appropriately to ensure that maximum progress toward learning objectives is achieved. In a perfect world adult education would be very personalized with formative evaluations at each step dictating the design of the next educational activity. Formative evaluations tend to be informal and are used to describe and monitor program activities, identify potential problems, and measure progress (Hobbs et al. 1993).
 - **Summative evaluation.** Summative evaluations are more formal and seek to evaluate program effectiveness. This is frequently done by assessing achievement of program objectives and program impact (Hobbs et al. 1993). Various levels of summative program evaluation are used. These levels comprise a hierarchy; the higher the level achieved in a summative evaluation, the more information we will have on program effectiveness:
 - Inputs—level one evaluation looks at the resources necessary to conduct a program.
 - Activities—level two consists of listing the activities involved in conducting the program.
 - Involvement—level three lists the number and type of participants in a program.
 - Reactions—level four characterizes the response or reaction of learners to a program and the instructor.
 - KASA change—level five attempts to measure changes in the knowledge, attitude, skills, and abilities of the students.
 - Practice change—level six looks at behavior changes in the learners because of an educational experience.

- End results—level seven attempts to see if the overall broadest program objectives are met. In other words, is the world a better place because of this educational program?

Continuing education programs in natural resources typically make use of summative evaluations at the first four levels. Nearly all programs measure the amount of instructor time and money invested, the number of events taught, the number and type of students, and some kind of a “feel-good” index to assess reaction of learners to programs. Level five and six evaluations to measure actual KASA and practice change are less common, but are being used more as program accountability expectations are increased. Level seven evaluation is probably not possible in most natural resource settings. The world and our learners are very complex and it is difficult to explain ultimate end results by an educational program.

Examples of Successful and Planned Natural Resource Curricula

Many natural resource curricula have been developed in Oregon and elsewhere using a model similar to the one we have described. We now will list some example programs and discuss briefly what makes each unique in terms of curriculum development.

- **Master Woodland Managers (OR).** The Oregon Master Woodland Manager’s program trains experienced woodland owners to serve as volunteers for Forestry Extension. Trainees receive 85 hours of training in exchange for 85 hours of volunteer service. The original curriculum developed for this training program in 1986-88 was driven by clear goals and performance objectives. This development was guided by the use of a lesson plan template, which specifically called for listing of goals, performance objectives, prerequisites, content, and evaluation. The goals were broad and somewhat abstract. The performance objectives outlined specifically what a participant would learn and related directly to achieving a goal (Fletcher and Reed 1995).
- **Natural Resources Institute (WA and OR).** The Natural Resources Institute was developed as a training program for professional resource managers with federal land management agencies. These managers include silviculturists, fisheries and wildlife biologists, range managers, fuels management specialists, hydrologists, and others who work as part of multidisciplinary teams. The training features four 2-week modules sponsored by the University of Washington (two modules), Washington State University, and Oregon State University. The modules focus on understanding forest ecosystems, understanding the resources within these ecosystems, and understanding individual and group decision-making processes that guide the management of these ecosystems.
- **Basic Forestry Short Course (OR).** The BFSC has been taught by forestry extension agents in Oregon for years. Each county agent taught a different version of the course and the quality varied based on the expertise of the individual educator. Since the BFSC is a prerequisite to the Master Woodland Manager training, it was thought to be important

that this course be standardized and that it develop a level of KASA commensurate with entering the Master Woodland Manager training program. In the early 1990's a curriculum development effort was undertaken to standardize and improve the BFSC. Goal statements were developed at the high and middle levels for a series of 10 modules. The BFSC also made use of a template for layout of PowerPoint slides to standardize the course. The final BFSC contains presentations (slide sets and PowerPoint files), scripts, handouts, and exercises. These prescribed learning activities allow a local forestry extension agent, who is a generalist, to teach a broad ranging but basic short course without the assistance of campus-based specialist or outside experts. A Pre-test/Post-test evaluation was also developed to measure the achievement of mid-level objectives and document the learning of the students.

- **Resource Management Planning (OR).** The Oregon Resource Management Planning program trains experienced woodland owners to write a stewardship plan for their woodlands. The curriculum development process undertaken in 1999-2000 was similar to the Master Woodland Manager program except it was tied to a set of stewardship planning guidelines and a stewardship plan template. The overall goal of the program is to give woodland owners the knowledge, skills, and abilities to develop their stewardship plan. All of the objectives of each module were tied to learning specific skills needed to develop a stewardship plan. (Cloughesy 2001).
- **Watershed Stewardship Education Program (OR).** The Watershed Stewardship Education Program trains landowners and members of watershed councils to understand the workings of watersheds, the implications of their management and restoration, and the processes of planning and decision making that must take place within watersheds to achieve restoration. The curriculum development process undertaken in 1998-99 was similar to the Master Woodland Management Program. However, in addition to scientific and technical goals and objectives, the WSEP program also addressed goals and objectives related to leadership development, decision making, strategic planning, and meetings management (Cloughesy et al. 2001b).
- **Minnesota Sustainable Forests Education Cooperative (MN).** The MSFEC is a cooperative among public and private natural resource organizations and the University of Minnesota. Members join, pay an annual fee based on the number of training participants, have input into the curriculum development process, and participate in trainings. Initial funding was through a grant, but the MSFEC hopes to become self-supporting. Courses offered by the MSFEC are in direct response to needs identified by members and, to date, fall in the following categories: Basic Forest Management, Exotics in Forest Management, Forest Ecology and Management, Forest Management Guidelines, Landscape-level Planning, Natural Resource Policy, Productivity, Recreation Management, Resource Assessment, and Technology Transfer (Coffin et al. 2001).
- **Oregon Forest Institute for Teachers (OR).** The OFIT is a week long in-residence institute to allow K-12 teachers to learn about forest management, experience the forestry curricular material available, and to develop their own educational units using what they

learn at the institute. OFIT used a curriculum design process that began with broad forestry education goals developed by a national task force of the Society of American Foresters. These goals formed the basis for intermediate level and specific objectives. The summative evaluation includes a pre- and post-test with questions addressing the specific knowledge objectives. This summative evaluation has been a powerful tool in improving OFIT over its 3-year history. An example of a specific learning objective and its corresponding test question are as follows: objective—illustrate changes in forest systems over time. Pre- and post-test question: List four ways that a forest system changes over time (Cloughesy et al. 2001a).

- **Forest Products Management Development Short Course (OR).** The FPMDS is a weeklong short course targeted at mid-level executives in the Forest Products Industry. The OSU Forest Products Department and the College of Business lead the short course. The goal is to build leadership, planning, team building, financial management, human resources, problem solving, strategic planning, time management, marketing, and decision-making skills in technical people whose positions are changing to become more management-level. The uniqueness of this course is the focus on leadership and business skills for a group of learners who have mainly technical backgrounds.
- **Growing Natural Resource Leaders for the 21st Century (OR).** The GNRL is still in the developmental stages. It will be a weeklong institute sponsored by the Pacific Northwest Regional Forestry and Range Continuing Education Coordinating Committee. The CECC is composed of federal natural resource agencies (Forest Service, Bureau of Land Management, United States Geological Survey, Environmental Protection Agency) and the three natural resource universities (OSU, Washington State University, and University of Washington). The GNRL will provide leadership training for managers based primarily on the modules developed by Cooperative Extension under the Kellogg Foundation grant. The goal is to give technical specialists some of the KASAs they need to be effective managers as their careers evolve and they move into management positions.
- **International Institute and Certificate for Sustainable Natural Resources (OR).** This International Institute for Sustainable Natural Resources is being developed as a 10-week summer program to bring natural resource managers from developing countries to Oregon to learn to apply sustainable natural resource management in their home country. One important aspect of this institute is that students will work on a project from home to apply the knowledge, skills, and abilities developed in the coursework. This institute is also offering students the means to achieve a Certificate in Sustainable Natural Resource Management from OSU. Certificate programs allow students to tie their continuing education to a recognized program that means something to them and their employers.
- **Professional Forest Resource Management Curriculum & Certificate (OR).** This planned effort by the OSU College of Forestry will develop a Professional Forest Resource Management Curriculum to meet the needs of forestry professionals in Oregon. It will be based on a thorough needs assessment that examines the needs of the

professionals and their employers. It will rely on the development of high-, middle-, and specific-level objectives. The planned certificate in Forest Resource Management will allow baccalaureate foresters to upgrade their KASAs in areas in which they were not previously educated and in areas that have changed since their graduation.

Elements of a Successful Educational Program for 21st Century Fisheries Managers

In conclusion, we will share what we feel are 10 elements of successful continuing education programs. These are drawn from our experience in Forestry Extension. Some of these are exemplified in the examples above, but some are elements that we rarely if ever have achieved.

1. **Develop demand-driven educational programs.** Many or most natural resource continuing education programs are supply-driven. A faculty member or department has a research and knowledge base around a particular topic, so they put together a continuing education program on that topic. If people register for the course, it was a good idea and it is taught. If subscription is below an acceptable level, we look for another idea. Demand-driven offerings take their cue from the potential learners. An audience is identified, their educational needs are assessed, and an offering is developed to meet those needs.
2. **Clearly identify and describe the target audience for the educational program.** The key for a demand-driven program is to have understanding of whose demands are being met.
3. **Conduct a formal needs assessment.** A good needs assessment of a clearly identified target audience will raise educational issues, which lead directly to educational goals or objectives.
4. **Develop clear goals and objectives at all three levels.** Clear high-level goals can be checked to assess whether the curriculum is meeting them. Clear and measurable mid-level objectives can lead to modules that achieve the programs goals and can be appropriately sequenced with other modules. Clear and measurable specific objectives can lead to learning activities that achieve the modules and overall curriculum goals.
5. **Develop or use specific learning activities and experiences to achieve goals at all three levels.** The whole purpose of developing learning objectives is to drive learning activities. If some learning objectives are not addressed, they either need to be dropped or additional learning activities need to be added. If there are learning activities present that are not supported by learning objectives, they either need to be dropped or additional learning objectives need to be developed.
6. **Use formative and summative evaluations to measure goal achievement.** Clearly and thoughtfully written educational goals are measurable. Measurable goal statements can easily be transformed into questions for evaluations that can be used to measure goal achievement.

7. **Adjust learning activities through feedback from formative evaluations.** If the students are not learning the material and achieving the learning objectives then adjustments in the teaching need to be made.
8. **Summative evaluations should be of level five or six, if possible.** Too often educators stop with level four evaluations. Although these reactions to teaching are easy to measure, they do not address whether the learning objectives are achieved.
9. **Develop long-term relationships with clients to move them through an educational stream.** The OSU Forestry Extension Curriculum Pyramid where learners start with the Basic Forestry Short Course and move through Resource Management Planning and onto Master Woodland Manager training epitomizes this. A successful curriculum takes learners where they are and moves them to where they need to be to meet their goals.
10. **Allow multiple or flexible pathways or tracks for students.** A successful program recognizes that one size does not fit all. It also recognizes that needs of professionals change over the course of their careers. This is shown by the Forestry Extension Curriculum Pyramid, where students are able to chart their own course, through the courses.

We hope the lessons we have learned in developing curricula for continuing education prove useful to you as you develop programs for fisheries managers. Thank you for the opportunity you have provided us to share our ideas. We wish you all the best in your curricular endeavors.

References

Adams, P.W. 1997. Extension programs for landowners, foresters, and decision makers on forest resource policy. Presented at International Union of Forestry Research Organizations Extension Working Party, S6. 06-03 Symposium, Sept. 30-October 4, 1996, Freising, Germany.

Cloughesy, M. 2001. Forestry extension's role in stewardship planning for woodland owners. Presented at Fifth IUFRO Extension Working Party Symposium: Forestry Extension: Assisting Forest Owner, Farmer and Stakeholder Decision-Making; Lorne, Victoria, Australia; November 2001.

Cloughesy, M., D. Zahler, and M. Rellergert. 2001a. Using pre- and post- tests to evaluate achievement of short course learning objectives. *Journal of Extension* 39(2) 4pp.

Cloughesy, M., F. Conway, D. Godwin, and T. Nierenberg. 2001b. Watershed stewardship education program—a multidisciplinary extension education program for Oregon's watershed councils. *Journal of Extension* (In press).

Coffin, B.A., L. Yount, and S.D. Laursen. 2001. Sustainable forests education cooperative: An experiment in collaborative continuing education. *Journal of Forestry* 99(9):26-30.

Fletcher, R.A., and A.S. Reed. 1995. Extending forest management with volunteers: the Master Woodland Manager project. Presented at International Union of Forestry Research Organization—World Congress, August 1995, Tanport, Finland.

Hobbs, S.D., A.S. Reed, and B.B. Hobbs. 1993. Technology transfer: putting research into practice. *Journal of Forestry* 91(10):12-14.

Reed, A.S., J.J. Garland, and L.E. Biles. 1996. Extension forestry organizational processes, programs, and policies. Presented at International Union of Forestry Research Organizations Extension Working Party, S6. 06-03 Symposium, Sept. 30-October 4, 1996, Freising, Germany.

Verduin, J.R. 1980. *Curriculum building for adult learning*. Southern Illinois University Press/Carbondale and Edwardsville. 167 pp.

APPENDIX H

Revolutionizing Fisheries Management Training: Putting Workshop Ideas Into Action

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Participants in the Training Managers for 21st Century Fisheries workshop (Queenstown, New Zealand, December, 2001) heard many times that new approaches to training fisheries managers are required to match fundamental changes in the structures and institutions of fisheries management that mark the beginning of the 21st century. In many parts of the world, public officials and government agencies are no longer the fishery managers—commercial, recreational, indigenous fishermen, and coastal communities are increasingly being granted opportunities, privileges, and rights for managing and co-managing fishery resources. In some jurisdictions, such as the European Union, Australia, and New Zealand, this process has been formalised in legislation. In other jurisdictions such as the United States and parts of Canada, industry-based co-management has occurred despite impediments limiting authentic industry and stakeholder involvement in fishery management and research.

As a new disciplinary field, education for fisheries managers is poorly supported. Compared to forestry and agricultural fields, fisheries management training lacks at a country and international level, the flexible learning pathways, learning and management institutions, and leadership necessary to meet the needs of fisheries managers in the 21st century. Alarmed at the detrimental impact that this situation will have on the professional development of fisheries managers and management, workshop participants resolved the following actions to revolutionise fisheries management training:

- Develop and implement flexible learning pathways responsive to the needs of all participants in the management process.
- Reform both learning and management institutions to better recognise the individual and collective needs of successful fishery managers.
- Management and learning institutions must show domestic and international leadership in the creation, implementation, dissemination, and coordination of training programmes and related material.

Note that the “consensus” strategies and actions described in this section are a synthesis of multiple suggestions for training strategies. Records of discussions and working group summaries are contained in Appendix E (available online only at <http://oregonstate.edu/dept/trainfishmngr/report.html>).

Individual training needs and flexible learning pathways

Individual needs

A tendency towards isolation in its relationship with other resource management disciplines means that there are many examples of proven training practices and philosophies from other fields that fisheries management can draw upon.

A key lesson from the forestry management experience in the United States, coastal community development in Denmark, and vocational training in New Zealand is that training is first and foremost an activity that individuals undertake. Individuals, whether in a government agency, a non-governmental organisation, or vessel owners engaged in management processes, require flexible learning pathways that match their individual and institutional needs.

Individual training needs depend on the level at which an individual is involved in fisheries management processes and whether his or her role is a specialist adviser or more generalist synthesiser. The level of needs is contingent on the management context in which an individual is operating. This will vary within a jurisdiction depending on the management question and process at hand and also across jurisdictions.

Ideally it is possible to benchmark an individual's current level of knowledge, attitude, skills, and ability (KASA) against an idealised KASA profile for his or her particular current and/or potential role in the fisheries management process. For example, a line manager may assess a hypothetical fishery agency official as follows:

KASA	Score	Profile Score	Comment
RATING KEY: 1 = Training, 2 = Developing, 3 = Competent, 4 = Advanced, 5 = Expert <i>Fisheries Management Specific KASAs</i>			
Knowledge of Stock Assessment	1	2-3	Limited formal training in stock assessment or related discipline. Key training need.
Cost benefit analysis skills	3	3-4	Sound innate skills, overall score restricted by limited knowledge/experience of formal analytical methodologies, e.g. , multi-criteria analysis.
Communication skills	3	4	Good skills, require taking to next level to be persuasive and influential communicator.
Fisheries law	3	3	KASA equivalent to required profile.
Leadership ability	2	4	Needs training and opportunities to be able to lead diverse groups through to successful outcomes. Particular emphasis required on transformational leadership skills.
Project management	1-2	3	No tradition of project management in agency for non-technical staff. KASA would develop quickly with training.
Team work	4	4	Great member of a team, already strong KASA will be enhanced as other competencies develop.

KASA	Score	Profile Score	Comment
RATING KEY: 1 = Training, 2 = Developing, 3 = Competent, 4 = Advanced, 5 = Expert			
<i>Fisheries Management Specific KASAs</i>			
Understanding government	3	4	Needs rounding out with knowledge and experience of non-agency public institutions.
<i>Management Team Competencies</i>			
Achieve results	2-3	4	Needs development so that the drive is there to push projects through to completion.
Communicate openly	4	3	Strong KASA
Focus on clients and quality	3-4	5	As an advisory unit, exceeding clients' expectations is key to our success and ability to influence outcomes.
Maintain professional relationships	3-4	4	Well respected but perhaps need to develop recognition and respect as agency officer. Will develop rapidly as KASAs evolve.
Promote agency business and values	4	4	Strong KASA.

The first column identifies the KASAs appropriate to the individual's role in the management process. The second column benchmarks for each KASA the individual's KASA score against a KASA profile score for the position/role in the third column. The final column provides contextual comment to the individual and potential training providers.

Many potential KASAs were identified during the course of the workshop. Only a few are listed in the hypothetical example above. More extensive listings are contained in Appendix E.

This individualised approach to training needs makes two major assumptions:

- Institutions carry out individualised training assessments for their staff and external participants involved in fisheries management processes.
- Profile KASAs can be identified and developed specifically for the management processes being followed.

Without the appropriate institutional commitment to individualised training of fisheries managers, any collective training initiative is dead in the water.

Flexible learning pathways

Having identified the "KASA" approach as a potentially effective way to assess individuals and identify their fisheries management training needs, the workshop noted that suitable training pathways for individuals must also exist.

Suitability refers to meeting both an individual's learning need and also fitting with an individual's work environment and life style. Only offering 2-year residential degree programmes cannot meet the training needs of the vast majority of participants in management processes.

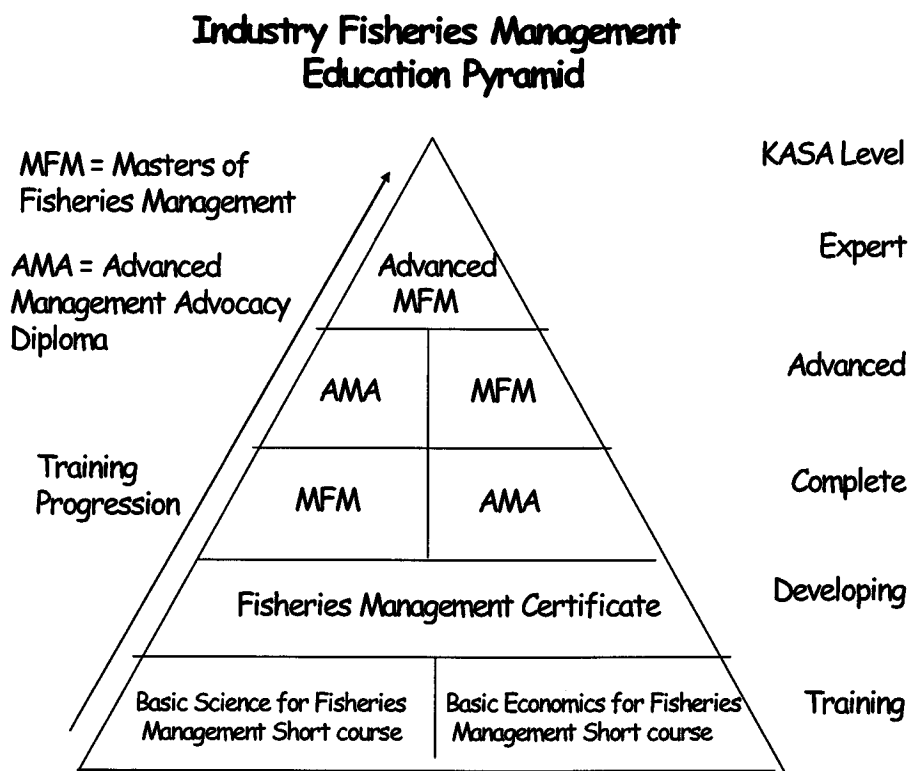
Multiple academic and continuing education pathways are required to be delivered in a variety of locations and modes. This need challenges the conventional training provider programme targeted at people engaging in tertiary education straight out of secondary education, or people already in employment seeking to change careers or enhance promotion prospects.

Training providers in the 21st century must meet the need for:

- Academic training to be formally integrated with life and work experiences.
- Multiple, transferable learning pathways.
- Demand-driven training provision where users design training structures and curricula.

For example, users might determine that the training structure identified in Figure 1 is useful for commercial fisher representatives engaged in fisheries management activities. The pyramid shape represents the number of industry participants at each level, the potential number of training providers, and the more specialist nature of advanced training needs.

Figure 1. Industry fisheries management education pyramid created after Cloughesy and Reed (Appendix G).



At the “training level” basic two day scientific and economic concept courses are taught to fishers involved in their local associations. At the developing level, regional fisher

representatives are encouraged to undertake a modular certificate in fisheries management taught in evenings at regional colleges. Recognition for up to two-thirds of course credits in the certificate is given for work experience.

The diploma in advanced management advocacy is aimed at the professional employee of industry associations or senior industry representatives who are regularly engaged in management processes and consists of courses, short-term secondments to industry bodies and companies, and peer assessment of leadership skills and attitude to collaborative management. Masters programmes are intended to be programmes providing for different fisheries management specialisation (e.g., enforcement, research, co-management, etc.). They would be offered by universities and require either an undergraduate degree or completion of the fisheries management certificate. They are 1-year full-time or 2-year part-time courses and are offered to industry advisers and managers and non-industry individuals such as government officials. The advanced Masters degree may require a dissertation.

Although hypothetical in its structure, the industry-training pyramid exemplifies the comprehensive, integrated yet flexible approach to fisheries management training espoused by workshop participants.

Revolutionary changes in training and management institutions

Effective demand-driven, individually focused training delivered through multiple pathways must be supported by changes to both training and fisheries management institutions according to workshop participants.

Training providers and academic institutions have to become demand driven rather than supply focused. Courses cannot be designed around the skills of existing tenured staff or the latest large budget research grants. Nor can potential "bums on seats" be a major factor in determining the funding of a course if an institution has a genuine commitment to training fisheries managers. In many instances private sector or small public training providers will have the flexibility in staffing and programme delivery to fill specialised training niches that large institutions cannot. Nevertheless, despite potential institutional inertia, large training providers and academic institutions have the experience and resources to develop, coordinate and deliver comprehensive fisheries management programmes.

Just as training providers and academic institutions must change so must the attitudes to training of agencies and participants in fisheries management processes. Continuing education through training and professional development must be provided for and rewarded. Processes have to be established and people assigned to work with training providers and academic institutions. Working together, managers and providers can ensure that training meets the needs of fisheries managers and that sufficient trainees take part in courses, activities, and programmes to justify institutional investment in fisheries management training.

If on-the-job learning is to be formally recognized, management agencies will need to be actively involved in the assessment of work-based/life achievements against standards. Culturally

appropriate assessment is required for skills and experiences that have been derived from outside western management and scientific paradigms.

Fisheries managers and participants in management processes will have to actively engage in training activities as teachers, mentors and role models. Meaningful secondment opportunities and internships have to be offered to individuals who may lack fisheries experience or work for traditionally opposed sides in management debates.

Having undertaken training, people must be able to utilise their new-found skills and be rewarded. This can be done by:

- Improving salaries in recognition of training development
- Giving stretch assignments, allowing individuals to use and refine new knowledge and skills.
- Opening up career advancement to individuals in any position if they show aptitude and promise in promoting good fisheries management outcomes.
- Reinforcing formal training with practical experience and continued mentoring by role models.

For non-professional participants in the management process, special attention has to be given to ensuring training and participation is rewarded. Too often fisheries management processes are seen as litigious win-lose or lose-lose games. Proactive, constructive participation is discouraged while votes or enhanced standing with peers rewards political grandstanding. Unfortunately, the changes creating a positive external environment for fisheries management negotiations and debates are fundamental and long-term. Gains will be incremental, assisted by positive training initiatives that improve fisheries management knowledge, attitudes, skills, and management ability.

Leadership in the creation, implementation, dissemination, and coordination of training programmes

Collective leadership from training providers, management agencies, and participants in management processes is a prerequisite for the successful training of fisheries managers in the 21st century. This leadership, determined by workshop participant, needs to manifest itself in an international training network with a defined structure in which the roles of partners and delivery mechanisms for training initiatives are clearly articulated.

At the highest level, having an international organisation such as the FAO or World Bank as a sponsor is seen as desirable. The role of the sponsor is to:

- Provide the initiative with a significant international profile.
- Attract new international partners to the initiative.
- Provide seed funding and support for external funding.

Irrespective of the presence of an international sponsor, a coordinating body is essential to the success of the initiative. The body would facilitate and coordinate the development, implementation and dissemination of:

- Core training curricula incorporating:
 - biological sciences
 - social sciences including cultural anthropology
 - development of transformational leadership skills in individuals
- Assessment standards
- Moderation processes
- Best training practices
- Secondment, internship and other professional development opportunities

The coordinating body would also actively seek new partners and new training opportunities in different parts of the world in recognition that fisheries management is increasingly global in context. Periodic review of the coordinating body's progress could occur in conjunction with international conferences such as the World Fisheries Congress and the International Institute for Fisheries Economics and Trade Conference.

The coordinating body or institution should give effect to the collective wishes of its partners. These partners include government agencies, agencies representing the interests of commercial, recreational, and indigenous fishers, environmental NGOs, and other groups with a participatory role in fisheries management.

Partners, including training providers and management agencies in the training network:

- Commit to training excellence in their own management agencies or to meeting the needs of agencies if a training provider.
- Provide input to the development of training curricula, assessment systems, and moderation standards.
- Submit examples of their own successful training curricula/programmes, assessment and/or moderation material to the coordinating body.
- Use the resources of the network to implement effective training practices within their organisations, whether provider or purchaser of training.
- Commit, within the resources of the organization, to providing internships and secondment opportunities.
- Resource within their own organisation a contact person for the training network.
- Are responsible for developing fisheries management training opportunities at a national and regional level in their own jurisdictions.

Workshop participants discussed at length the tools available to the coordinating body and international training network. Key methods of co-ordination the development and dissemination of training material included:

- Websites
- Electronic lists

- Case study library (written and video in digital form)
- Special journal issues
- Links and memorandums of understanding with World Bank Fisheries initiatives, FAO, and regional fisheries management organisations and professional organizations, such as the American Fisheries Society and International Institute for Fisheries Economic and Trade.

Summary

Education for fisheries managers is poorly supported. Fisheries management training lacks the flexible learning pathways, learning and management institutions, and leadership necessary to meet the needs of fisheries managers in the 21st Century. Three key changes are required.

First, training must be recognised as an activity that individuals undertake. People require flexible learning pathways that match their individual and institutional needs. The level of need depends on the management context in which an individual is working. This will vary within a jurisdiction depending on the management question and process at hand and also across jurisdictions. Without institutional commitment to individualised training of fisheries managers any collective training initiative is likely to fail.

Second, effective demand driven, individually focused training delivered through multiple training pathways must be supported by changes to both training and fisheries management institutions. Courses cannot be designed around the skills of existing tenured staff or the latest large budget research grants. Continuing education through training and professional development must be provided for by employers and rewarded.

Third, collective leadership from training providers, management agencies and participants in management processes is a prerequisite for the successful training of fisheries managers. This leadership must manifest itself in an international training network with a defined structure in which the roles of partners and delivery mechanisms for training initiatives are clearly articulated.