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/trainfishnmgr/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:

- **Institution setting, as outlined in the following model:**

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

- 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
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**—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.

<table>
<thead>
<tr>
<th>Science</th>
<th>Social science</th>
<th>Economics</th>
<th>Business/Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science basics</td>
<td>Human behavior</td>
<td>Resource economics</td>
<td>Global industry</td>
</tr>
<tr>
<td>Fisheries science</td>
<td>Socio-economic indicators (fisheries)</td>
<td>Fisheries economics</td>
<td>Business administration</td>
</tr>
<tr>
<td>- Stock assessment</td>
<td>History of fisheries</td>
<td>Specific concepts: externalities, market institutions</td>
<td></td>
</tr>
<tr>
<td>- Ecology</td>
<td>Stakeholder communities</td>
<td>Biostatics/econometrics</td>
<td>Seafood marketing</td>
</tr>
<tr>
<td>- Biology</td>
<td>Myth and belief structures</td>
<td>Economic management</td>
<td>Co-management—sharing management responsibility</td>
</tr>
<tr>
<td>Ecosystem science</td>
<td></td>
<td></td>
<td>with constituents</td>
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<tr>
<td>- Time, space</td>
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<td></td>
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<tr>
<td>- Species interactions</td>
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<tr>
<td>- Integrated marine ecology</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Environmental impacts</td>
<td></td>
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<tr>
<td>Marine and climate sciences (physical, biological, geological, and chemical oceanography, atmospheric sciences)</td>
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</table>

**Policy/Law - Legal framework of management**

<table>
<thead>
<tr>
<th>Policy/Law - Legal framework of management</th>
<th>Critical thinking, problem solving, decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law of the Sea (including enforcement)</td>
<td>Applies knowledge and experience</td>
</tr>
<tr>
<td>Legal/legislative process</td>
<td>Develops new approaches</td>
</tr>
<tr>
<td>Federal laws, regulations, and policies</td>
<td>Team decision making and planning</td>
</tr>
<tr>
<td>Compliance with regulations (to eliminate lawsuits)</td>
<td>Lateral thinking and acting processes</td>
</tr>
<tr>
<td>Applying institutional structures to enhance fisheries management objectives and outcomes</td>
<td>Analytical and integrative thinking</td>
</tr>
<tr>
<td></td>
<td>- Facts-based</td>
</tr>
<tr>
<td></td>
<td>- Complex relationships</td>
</tr>
<tr>
<td></td>
<td>- Big picture and small details</td>
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<tr>
<td></td>
<td>Timely</td>
</tr>
<tr>
<td></td>
<td>Recognizes level of authority</td>
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<td></td>
<td>Business/project/fish management planning</td>
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<tr>
<td></td>
<td>Strategic planning</td>
</tr>
<tr>
<td></td>
<td>Uncertainty</td>
</tr>
</tbody>
</table>

**Technical analysis skills**

<table>
<thead>
<tr>
<th>Technical analysis skills</th>
<th>Critical thinking, problem solving, decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geospatial statistics and data handling</td>
<td>Applies knowledge and experience</td>
</tr>
<tr>
<td>GIS design and implementation</td>
<td>Develops new approaches</td>
</tr>
<tr>
<td>Integration of remotely sensed data</td>
<td>Team decision making and planning</td>
</tr>
<tr>
<td>Competent computer skills</td>
<td>Lateral thinking and acting processes</td>
</tr>
<tr>
<td>Accessing fisheries oceanography and industry data</td>
<td>Analytical and integrative thinking</td>
</tr>
<tr>
<td>Population estimates</td>
<td>- Facts-based</td>
</tr>
<tr>
<td>Stock assessment methods</td>
<td>- Complex relationships</td>
</tr>
<tr>
<td>Assessment of noncommercial harvest</td>
<td>- Big picture and small details</td>
</tr>
<tr>
<td>Ecosystem modeling</td>
<td>Timely</td>
</tr>
<tr>
<td>Systems analysis—methodologies to assess effects of different management regimes and regulations (evaluation, real time)</td>
<td>Recognizes level of authority</td>
</tr>
<tr>
<td>Risk analysis and procedures</td>
<td>Business/project/fish management planning</td>
</tr>
<tr>
<td>Conducting socio-economic studies</td>
<td>Strategic planning</td>
</tr>
<tr>
<td></td>
<td>Uncertainty</td>
</tr>
</tbody>
</table>
Table 3.1. Pre-workshop survey: skills summary, continued

**PEOPLE SKILLS**—working with wide range of stakeholders and sectors.

<table>
<thead>
<tr>
<th>Consensus Building and Conflict Resolution</th>
<th>Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Facilitation</td>
<td>• Effective and clear with diverse audiences</td>
</tr>
<tr>
<td>• Mediation</td>
<td>• Translation/transformation and presentation of technical information/scientific knowledge for stakeholders, policy-makers, and the public</td>
</tr>
<tr>
<td>• Bargaining and negotiation</td>
<td>• Cross-cultural interpersonal skills—ability to interact with people whose beliefs/ actions are not determined on the basis of scientific information</td>
</tr>
<tr>
<td>• Team building/group process</td>
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<tr>
<td>• Inclusion—e.g., public involvement</td>
<td></td>
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<tr>
<td>• Community-based planning</td>
<td></td>
</tr>
<tr>
<td>• Willing to listen to all user groups</td>
<td></td>
</tr>
</tbody>
</table>

**LEADERSHIP SKILLS**—qualities in addition to above that make a good leader or executive manager.

<table>
<thead>
<tr>
<th>General leadership skills</th>
<th>Personal character/qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trust and respect within own company/user group</td>
<td>• Well-directed passion</td>
</tr>
<tr>
<td>• Ability to create positive change and enable others to support it</td>
<td>• Good judgment</td>
</tr>
<tr>
<td>• Building relationships (identifies key contacts, develops partnerships)</td>
<td>• Open minded</td>
</tr>
<tr>
<td>• Ability to pro-actively work collaboratively and draw upon resources and talents from people with a wide variety of interests, goals, knowledge, and skills</td>
<td>• Ability to find enjoyment</td>
</tr>
<tr>
<td>• Coherent delegation skills</td>
<td>• Ability to work under huge pressures and stress</td>
</tr>
<tr>
<td>• Strong organizational skills</td>
<td>• Unlimited patience and tolerance</td>
</tr>
<tr>
<td>• Ability to sell concepts</td>
<td>• Statesmanship and integrity</td>
</tr>
<tr>
<td>• Listening, understanding, and responding (communicates clearly, responds to concerns, motivates to action)</td>
<td>• Vision of the future and able to lead this vision</td>
</tr>
<tr>
<td>• Improved understanding of and ability to engage with members of an increasingly pluralistic society</td>
<td>• Proactive</td>
</tr>
<tr>
<td>• Success, even under difficult conditions</td>
<td>• Initiative—addresses current opportunities, manages crises, plans ahead</td>
</tr>
<tr>
<td></td>
<td>• Adaptability</td>
</tr>
<tr>
<td></td>
<td>• Creative and innovative</td>
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</table>

**Administrative skills**

| 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.

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>INDUSTRY</th>
<th>ACADEMIC</th>
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<tbody>
<tr>
<td><strong>Knowledge</strong></td>
<td><strong>Knowledge</strong></td>
<td><strong>Knowledge</strong></td>
</tr>
<tr>
<td>• Traditional disciplines:</td>
<td>• Fisheries and fish resources—Mix of theory and experiential</td>
<td>• Key management tools</td>
</tr>
<tr>
<td>- Economics</td>
<td>• Some basic knowledge of technical disciplines:</td>
<td>• Risk management</td>
</tr>
<tr>
<td>- Science</td>
<td>- Science</td>
<td>• Enforcement</td>
</tr>
<tr>
<td>- Law</td>
<td>- Policy</td>
<td>• Stock assessment</td>
</tr>
<tr>
<td>• Social sciences, value systems, and human behavior</td>
<td>- Law</td>
<td>• Basic biology</td>
</tr>
<tr>
<td>• Mechanics of fishing</td>
<td>- Society</td>
<td>• Economics</td>
</tr>
<tr>
<td>• Marketing</td>
<td>- Economics</td>
<td>• Law</td>
</tr>
<tr>
<td>• Business</td>
<td>• Politics</td>
<td>• Politics</td>
</tr>
<tr>
<td>• Governance frameworks</td>
<td>• Culture</td>
<td>• Culture</td>
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<thead>
<tr>
<th><strong>Planning/Decision making</strong></th>
<th><strong>Planning/Decision making</strong></th>
<th><strong>Planning/Decision making</strong></th>
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<tbody>
<tr>
<td>• Problem solving</td>
<td>• Policy development and implementation</td>
<td>• Problem solving</td>
</tr>
<tr>
<td>• Policy analysis</td>
<td>• Facilitate delivery of programs and policy</td>
<td>• Critical thinking skills</td>
</tr>
<tr>
<td>• Institutional analysis</td>
<td>• Think strategically and creatively</td>
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</tr>
<tr>
<td>• Rule making, codification</td>
<td>• Process and analyze information in best interest of fishery</td>
<td></td>
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<tr>
<td>• Government decision-making</td>
<td>• Develop strategic management options</td>
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<tr>
<td>• Strategic planning</td>
<td>• Knowledge of management process</td>
<td></td>
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<tr>
<td>• Manage change, recognize change drivers</td>
<td>• Policy development and implementation</td>
<td></td>
</tr>
<tr>
<td>• Process of management</td>
<td>• Facilitate delivery of programs and policy</td>
<td></td>
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<tr>
<td>• Project management</td>
<td>• Think strategically and creatively</td>
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<tr>
<th><strong>Technical management skills</strong></th>
<th><strong>Technical management skills</strong></th>
<th><strong>Leadership</strong></th>
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<tbody>
<tr>
<td>• Understand use of information technology</td>
<td>• Risk assessment and mitigation</td>
<td><strong>Communication skills</strong></td>
</tr>
<tr>
<td>• Monitoring and reporting</td>
<td>• Processing and analysis of information, information transfer</td>
<td>• Communication</td>
</tr>
<tr>
<td>• Decision support skills</td>
<td>• Decision support systems</td>
<td>• Conflict resolution</td>
</tr>
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<td></td>
<td>• Tools for decision making and planning</td>
<td>• Mediation</td>
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<tr>
<th><strong>Leadership</strong></th>
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<tr>
<td><em>Communication skills</em></td>
<td><em>Communication skills</em></td>
<td><em>Communication skills</em></td>
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<tr>
<td>• Conflict resolution</td>
<td>• Facilitation</td>
<td>• Communication</td>
</tr>
<tr>
<td>• Facilitation</td>
<td>• People skills</td>
<td>• Conflict resolution</td>
</tr>
<tr>
<td>• Negotiation</td>
<td>• Communication</td>
<td>• Mediation</td>
</tr>
<tr>
<td>• Communication</td>
<td>• Listening</td>
<td>• Interpersonal</td>
</tr>
<tr>
<td>• People</td>
<td>• Negotiation (negotiate collective outcomes)</td>
<td>• Teamwork</td>
</tr>
<tr>
<td>• Build/maintain consensus</td>
<td>• Multilingual</td>
<td></td>
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<td></td>
<td>• Public relations</td>
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<td></td>
<td>• Integrity</td>
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Table 3.2. Workshop groups: skills summary, continued.

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<tr>
<th>GOVERNMENT</th>
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<tr>
<td><strong>Leadership</strong></td>
<td><strong>Leadership</strong></td>
<td><strong>Leadership</strong></td>
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<tr>
<td><em>Integrative thinking</em></td>
<td><em>Integrative thinking</em></td>
<td><em>Integrative thinking</em></td>
</tr>
<tr>
<td>• Ability to integrate across disciplines</td>
<td>• Skills to integrate disciplines</td>
<td>• Synthesis</td>
</tr>
<tr>
<td>• Integrated marine resource management</td>
<td></td>
<td>• Comprehensive knowledge (via continuing education)</td>
</tr>
<tr>
<td>• Big picture</td>
<td></td>
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</table>

- Government: Leadership Integrative thinking • Ability to integrate across disciplines • Integrated marine resource management • Big picture
- Industry: Leadership Integrative thinking • Skills to integrate disciplines
- Academic: Leadership Integrative thinking • 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/trainfishmngr/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/trainfishmgnt/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 as 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/trainfishmngr/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/trainfishmngr/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)

   ![Graph showing Level and Minimum level for all = basics](image)

   • 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.