FAME BREAKOUT SESSIONS

One of the highlights of the FAME conference was the breakout sessions following each session of talks. The conference participants divided themselves into discussion working groups. Each group was challenged with answering a question relating to the theme of the talks held in that session.

What follows is a compilation of the breakout questions that were discussed, and ideas that the groups came up with for addressing each question.

SESSION 1 Floundering in the Deep End: Strategies for Fisheries Management & Conservation ***AND***

SESSION 2 One Fish, Two Fish, Red Fish, Blue Fish: Assessment & Monitoring of Fish Populations

1. How do you find a balance between new assessment/monitoring techniques (e.g. submersibles, ROV, genetic tagging etc.) and more traditional approaches?
    a) What role should new technology play?
    b) What fisheries will gain the most from new stock assessment techniques? Why?

2. MPAs as a new tool in fisheries conservation. Are MPAs a band-aid solution?
    a) What are the benefits and challenges?
    b) What can we learn from the formation of terrestrial parks?
    c) Should we have an open ocean with closed MPAs or a closed ocean with open fishing areas?

3. Learning from others' experiences. How can communication be improved at different levels? I.e. Internationally, nationally, regionally, institutionally

4. Challenges and opportunities of incorporating the public and industry into population monitoring/assessment.
    a) Is it possible to collect reliable data using volunteers?
    b) What are the benefits above and beyond stock assessment? Do these benefits compensate for any decrease in data quality?

SESSION 3 Untangling the Red Tape: Incorporating Diverse Perspectives in Fisheries Management

1. What conditions are required for industry and local communities, including First Nations, to successfully collaborate in fisheries research and management? How does the management structure need to change?

2. How can international organizations be developed to provide sufficient incentives for all parties to cooperate in the responsible management of large scale fisheries?

SESSION 4 Cold Wet Cash: Economic Values of Fisheries Management & Conservation

1. How much funding should industry provide for fisheries stock assessment and research? How does industry funding differ between countries and why?

2. How can economic analysis be used in fisheries management? Under what conditions is it important to incorporate economic analysis into the management process?

SESSION 5 A Tale of Two Fishes: Ecology & Environmental Monitoring

1. What is the "natural" state in a changing world? How do we assess targets for recovery?

2. Species versus habitats: what do we monitor? Can ecosystems be "charismatic"?

3. What roles can regional or local environmental monitoring programs play in the context of large-scale climate effects? What are the major issues related to climate change?

4. Is it enough to manage for fishing pressure in the face of other anthropogenic forces that drive ecological change? Where should we focus our efforts?

SESSION 1 Floundering in the Deep End: Strategies for Fisheries Management & Conservation ***AND***
SESSION 2 One Fish, Two Fish, Red Fish, Blue Fish: Assessment & Monitoring of Fish Populations

1. *How do you find a balance between new assessment/monitoring techniques (e.g. submersibles, ROV, genetic tagging etc.) and more traditional approaches?*
    a) *What role should new technology play?*
    b) *What fisheries will gain the most from new stock assessment techniques? Why?*

The advantages of the incorporation of new technology into fisheries monitoring and stock assessment will greatly depend on the species and the current management goals of the fishery. For instance, if the conservation risk for a species is high – it may be more worthwhile to spend the extra money on new technology in order to improve the precision and quality of available data. Managers may also want to consider whether they are interested in achieving relative or absolute abundance estimates. Relative estimates are sometimes achievable through the study of fisheries trends. However, use of submersibles and ROVs, albeit on a small scale, can provide greater information on absolute abundance estimates while also permitting researchers to compile valuable data on behaviour and habitat requirements of a species.

Despite increased information provided by new research technologies, a shift towards such methods faces many challenges. For some fisheries, data series have been collected for years using the same standardized methods. A new monitoring method will require careful calibration with previous techniques before it can contribute to the time series of data. It may also be difficult to promote acceptance of new methods, and if new techniques are adapted they will have to be carefully communicated to members of the scientific, management and fishing communities. Perhaps most importantly, managers should remain flexible, and attempt to incorporate multiple techniques in their collection of monitoring and assessment data. New technology provides opportunities for improving methods of assessment, but may be limited due to small spatial scope and inhibitive costs. However, combining methods such as mark-recapture, submersible, and trawl surveys can provide a wealth of information about the status of a stock.

SESSION 1 Floundering in the Deep End: Strategies for Fisheries Management & Conservation *AND*
SESSION 2 One Fish, Two Fish, Red Fish, Blue Fish: Assessment & Monitoring of Fish Populations

2. MPAs as a new tool in fisheries conservation. Are MPAs a band-aid solution?
- *a) What are the benefits and challenges?*
- *b) What can we learn from the formation of terrestrial parks?*
- *c) Should we have an open ocean with closed MPAs or a closed ocean with open fishing areas?*

There are both social and ecological benefits of incorporating Marine Protected Areas (MPAs) into fisheries management. MPAs can be used as a community-based management tool when there is a high level of local involvement. For fishery-dependent communities, open areas for fishing in tandem with MPAs are required, so that communities can realize the benefits from stewardship of local resources. In this way MPAs can benefit harvesters in addition to fish populations and ecosystems. Ecologically, MPAs serve as a refuge from fishing, and allow higher spawning densities, creating a source of recruitment for surrounding areas, though MPAs are primarily beneficial for sedentary species.

A social challenge for MPAs lies in the question of resource rights. When ecosystem or species protection is placed above people, subsistence communities suffer from restricted access to the resources on which they depend. Likewise, in North America, First Nations communities have usually been left out of the planning process, and are opposed to government imposition of restrictions on their access to their traditional territories (in both marine and terrestrial environments).

Criteria for the selection of MPA locations depend on the objectives; are they meant to enhance fisheries or conserve biodiversity? If a self- sustaining population is an objective, one challenge is to determine how large an area is needed to ensure larval production within the area will produce sufficient recruitment for sustaining the population. If diverse ecosystems are the objective, then the delineation of natural systems is the primary challenge. One obstacle to achieving these objectives is excessive harvesting at the borders of MPAs. “Buffer” or “special management” zones around MPAs are one possible solution to this conflict.

Although terrestrial parks have traditionally been created primarily for the protection of aesthetic values, recent movements toward the goal of ecosystem conservation in terrestrial parks make the parallel with MPAs closer. Existence and aesthetic values are not the only ones important in forming terrestrial parks; in many countries, wildlife (like fish) are harvested for food, and parks are used for their protection.
The landscape-level approach of terrestrial park network formation (including movement corridors) can be useful for MPAs because it considers the needs of wide-ranging species, and large-scale ecosystem values. Marine conservationists similarly envision a network

of MPAs providing refuge for larger species as well as the habitats and prey that support them. The movement to include stakeholders in the management and planning of terrestrial parks is carried over to MPAs. A bottom-up element is needed to counteract and hopefully improve the top-down traditional management of parks.

SESSION 1 Floundering in the Deep End: Strategies for Fisheries Management & Conservation ***AND***
SESSION 2 One Fish, Two Fish, Red Fish, Blue Fish: Assessment & Monitoring of Fish Populations

3. Learning from others' experiences. How can communication be improved at different levels? I.e. Internationally, nationally, regionally, institutionally

A major impediment to cross-disciplinary communication is discipline-specific jargon. Despite conceptual similarities among disciplines and systems, differences in jargon and technical terms prevent meaningful communication. One suggestion from the group was to make basic education in various fields mandatory in fisheries management (e.g. in economics, social research, and biology).

Another suggestion is to hire communication experts to relay specialized biological advice to various stakeholders. This technical advice is often not available to them because of lack of education. The socio-economics of the audience needs to be accounted for (e.g. language, web-literacy). Professional facilitation was also advocated for communication between stakeholders.

Technology is playing an ever-increasing role in communication. For example, in Alaska the use of GIS and the Internet make "real-time" maps of fish and effort distributions available to managers across the state instantaneously. Once again, communication experts should be hired to facilitate this process (e.g. create easy-to-interpret visual displays in GIS). The "Sea Around Us" project at UBC represents another example of using GIS technology to map out global fisheries for the purpose of communication and analysis.

One suggestion to augment communication between scientists and the public is to change the incentive structure for academics. Not only do incentives not exist for academics to relay their discoveries to the public, but there is a disincentive because such communication would take away time from research and journal paper writing.

SESSION 3 Untangling the Red Tape: Incorporating Diverse Perspectives in Fisheries Management

1. What conditions are required for industry and local communities, including First Nations, to successfully collaborate in fisheries research and management? How does the management structure need to change?

Trust, transparency in the management process, accountability on the part of managers and government, and feelings of responsibility for involved parties are necessary conditions for successful collaboration in fisheries management.

Furthermore, a **collaborative attitude** must underlie collaborative actions. This means that involved parties must *truly want* to collaborate with each other, rather than simply going through the motions. A willingness to speak the same language is part of this collaborative attitude. Empowerment of groups participating, by making sure their input is acted upon, strengthens the collaborative attitude.

In addition, it is important to ensure that all stakeholders have equal input (e.g., no one group holds too much power over decisions and input), and that political pressure is controlled. For example, recently in the New England fishery political pressure was not controlled, resulting in too many fishermen exerting strong political pressure to overharvest.

Finally, special issues arise when considering collaboration with First Nations. Limited training and education, unemployment and social issues restrict their ability to focus on fisheries research and management. These unique challenges necessitate innovative strategies, tools, and cultural sensitivity for effective collaboration.

We suggest the following tools and strategies to achieve these collaborations among stakeholders:

- Workshops
- Develop definitions of rights and legalities around consultation developed
- For First Nations:
    - Hire fisheries biologists and economists, and involve them in fisheries management
- Expand communication and data sharing between managers and industry. This would result in a level playing field in terms of information and would reduce animosity among stakeholders.
- Create a basis for ownership of fisheries by communities and commercial harvesters. This would encourage good stewardship (e.g., in the Canadian sablefish fishery there is a sense of ownership and responsibility for a sustainable fishery). Although this can work well for small fisheries, it may not work for large fisheries

Management approaches for fisheries in Canada and the United States differ in several key ways. In Canada management decisions are concentrated in the federal Department of Fisheries and Oceans. In the US, the decision-making body is a council comprised of

representatives from each state and members nominated by governors (primarily to represent industry interests). The National Marine Fisheries Service (NMFS) has a final veto, but rarely exercises this power. Therefore, no one person or body is accountable for decision making, thus decisions involving long-term benefits with short-term costs, or those that are politically contentious, are rarely made. Furthermore, a recent PEW report on fisheries management in the US stated that fisheries management was too closely linked to industry limiting its effectiveness.

SESSION 4 Cold Wet Cash: Economic Values of Fisheries Management & Conservation

1. How much funding should industry provide for fisheries stock assessment and research? How does industry funding differ between countries and why?

The first point raised by the discussion group is that the level of funding provided by industry should depend on the size of the fishery, and the economic and societal value of the fishery. If large companies dominate a fishery, 100% of the funding should be provided by industry, whereas for artisanal fisheries, subsistence fisheries, and small fisheries in which the fleet is composed of small owner operated vessels, industry funding may not be feasible. In addition, fisheries for stocks that are depleted or economically unimportant will not be able to fund research. The value of the fishery to society should also affect the level of industry funding. In many cases public funds may be put to better uses than subsidizing fisheries research (e.g. health care, education). However, for many local fisheries, the benefits to society will exceed the economic benefits. In these cases, research should be subsidized by public funds.

The discussion also focused on the extent to which industry should be involved in fisheries stock assessment and research. It was questioned whether industry involvement should be limited to the provision of funding, or whether industry should also be involved in data collection and science. It was emphasized that industry should not be made solely responsible for science. Rather, industry should be made responsible for providing the necessary funds to government agencies or academics to conduct relevant research. The inclusion of industry in data collection however, was felt to have a huge potential to increase the level of ecological understanding among fishers, and to promote a greater feeling of ownership for the resource. Furthermore, industry has a much greater capacity than the public sector to collect fisheries data because they possess vessels, gear, and fishing expertise. Thus, fisheries management could be made more efficient by industry involvement at this level.

SESSION 4 Cold Wet Cash: Economic Values of Fisheries Management & Conservation

2. How can economic analysis be used in fisheries management? Under what conditions is it important to incorporate economic analysis into the management process?

Economic models have five key attributes that make them amenable to fisheries management. First, they can describe how commercial harvesters and fisheries consumers behave. Second, they can create incentives for political action (e.g., politicians will fund research that has apparent economic benefits). Third, they can create incentives for commercial harvesters to conserve, when the future economic benefits from conservation become apparent. Fourth, they can integrate many dimensions of value into a single analysis and output, as long as these values can be monetized. Finally, they can lead to transparency and accountability in the decision-making process.

There are several key challenges to applying economic models to fisheries management. Namely, they create the illusion of objectivity, when in fact they are as subjective as any other type of model (e.g., they often have many questionable assumptions). In light of this subjectivity, economic value may be more useful as a relative measure than an absolute measure (e.g. comparing one configuration of a fishery economically to another).

Although economic analyses have traditionally accounted for only financial values of fisheries, non-market values can be incorporated through various techniques such as contingency valuation or hedonic pricing. Alternatively, non-market values can be considered simultaneously with financial values in a multi-attribute analysis that does not reduce the value to a single number.

SESSION 5 A Tale of Two Fishes: Ecology & Environmental Monitoring

1. What is the "natural" state in a changing world? How do we assess targets for recovery?

"What is the 'natural' state in a changing world?" This is a value-laden question, as the definition of "natural" is a human construct, based on a combination of laws, government mandates and cultural values. Before we are able to assess if an area has returned to a natural state following a disaster (e.g. an oil spill), we must first find a way to define what qualifies as a natural or baseline state for the system. This might be achieved through surveys, by providing people with time periods or particular features of a system and asking them what they consider "natural". For instance, would rehabilitation of Pacific Salmon to their numbers and distribution in the 1850's be considered a return to an acceptable state?

There is also dispute as to whether a natural state is a feature devoid of human life and constructs. Are humans and our technologies part of nature? Can a historic village be described as natural? We are also faced with the challenge of a changing definition of natural state. As the term is closely linked to cultural influences, as our cultural values change, so to will our definition of natural. Perhaps in 50 years, a natural state for salmon will be those reared in ocean-based farms as opposed to land-based.

The hazy definition of baseline states can cause political and legal disputes. Who is to determine whether a system has recovered following some sort of perturbation? The U.S. tends to adapt a litigative approach to this type of decision-making process, while Canadians rely on government-passed legislation. Should stakeholders have a say in terms of what defines recovery, or should the final decision fall to an impartial third party? Perhaps the courts should make the call.

One suggestion is to start by making our best-guess as to what natural means. Perhaps we should define natural not as a specific end-point, but on a sliding scale - similar to the paradigm shift in the discussion of ecological equilibria. We should consider how far away we are from a natural state, and how close we want to get, rather than trying to achieve a specific end point.

It appears that the above question simply leads to more questions and uncertainty; however, it is apparent that we must come to some sort of agreement as to a definition of "natural" before we can come to a consensus on how to assess the recovery of a damaged system.

SESSION 5 A Tale of Two Fishes: Ecology & Environmental Monitoring

2. Species versus habitats: what do we monitor? Can ecosystems be "charismatic"?

Keystone species can be monitored as indicators of ecosystem health, as well as for species stock status. Species monitoring may be more valuable for species conservation than habitat monitoring, because habitat may not indicate healthy populations where populations are harvested, but habitat monitoring can be easier than monitoring the species itself.

While habitat monitoring is more useful for relatively sessile species such as rockfishes, a challenge arises for pelagic fish species that are less associated with physical habitat. In some cases, monitoring habitat and species can be synonymous. For example, protecting eelgrass in coastal areas also protects species for which eelgrass provides habitat. In other cases, oceanographic conditions can be monitored as a supplement to stock assessment data, if not as a proxy for stock status.

Before choosing indices for monitoring habitat quality, we need to gather baseline data in order to characterize the habitat associations for different species. Statistical tools can be used to focus numerous candidate indices for habitat monitoring to two or three key attributes. Natural variation and environmental shifts can affect habitat indicators, and the interpretation of these changes must be done cautiously.

Although habitat rarely has the public appeal of a charismatic species, ecosystems can be charismatic (e.g., Hecate Strait or Aleutian Islands coral reefs, or deep sea vents). Where the goal is to conserve ecosystems without a charismatic species, terrestrial parks are developing charismatic images for ecosystems, which is applicable to marine systems. For uncharismatic habitats or species, a little creativity and innovation is needed to create charisma and gain public support; it can be useful to focus on rarity, ecological value, or importance to humans.

SESSION 5 A Tale of Two Fishes: Ecology & Environmental Monitoring

3. What roles can regional or local environmental monitoring programs play in the context of large-scale climate effects? What are the major issues related to climate change?

The working group agreed that model predictions of both the direction and magnitude of climate change are inadequate, as are predictions of the effects of those changes. It was suggested that because of their smaller size, freshwater systems may be more appropriate than marine systems for climate predictions. A further problem with climate studies is the question of scale. How do we identify the relevant time and spatial scales of investigation? If the time scale relates to the lifespan of a species of interest, and the spatial scale relates to a species distribution, how can this be extrapolated to ecosystem-level impacts?

Although the predictive capacity of climate models remains low, the recent surge of climate-related fishery studies has not been without merit. What has resulted is a change in mindset within the fisheries community. Models based on a constant carrying capacity and constant population parameters are now (or should be) a thing of the past. We now acknowledge that the environment changes rapidly and these changes can affect fish stocks. What are required are adaptive policies that are robust to environmental changes. The ability of assessment and management procedures to detect these climate changes should be explored within a simulation framework.

Regarding the role of regional and community monitoring programs, because the causal relationships between the environment and fish are not well known, focusing local monitoring on biological metrics would be the best use of resources. In this way, traditional ecological knowledge can be used to identify exotic species that are important indicators of different climatic states.

SESSION 5 A Tale of Two Fishes: Ecology & Environmental Monitoring

4. Is it enough to manage for fishing pressure in the face of other anthropogenic forces that drive ecological change? Where should we focus our efforts?

The discussion group was in agreement that it was not enough to simply manage for fishing pressure without considering other factors that drive ecological change.

The discussion of how to focus our efforts began with a discussion of differences in current management of non-fishery impacts in freshwater and marine systems. In freshwater systems non-fishery impacts, such as pollution, land-use practices, introduced species, and dams, are the major drivers of ecological change, whereas, in marine systems fishery impacts play a larger role (e.g., fishing down the marine food chain).

Freshwater management has often tended to assume that fishing pressure has a negligible impact on freshwater ecosystems, and thus, management efforts have been focused on habitat restoration. It has only recently been recognized that fishing pressure can affect freshwater populations, and as a result, freshwater management practices can be expected to shift towards more fishery management.

In contrast, marine management puts a higher proportion of effort into managing fishing pressure compared to other anthropogenic impacts. However, factors other than fishing pressure are widely accepted to affect marine ecosystems (e.g. pollution, habitat degradation of coastal areas by land-use practices). It was also noted that fishery related impacts extend beyond fishing pressure to include habitat degradation from fishing gear. In light of the limited knowledge of how these factors can influence marine ecosystem change, the group concluded that in the short-term management should be made robust to these uncertainties and that information should be collected to enable for better management of non-fishery impacts in the long-term. The move towards ecosystem management will help us to move towards identifying and managing non-fishery related impacts.

It was acknowledged that the major obstacle to expanding the focus of management to include both fishery and anthropogenic effects is limited financial resources. This is especially true for developing countries, which often have little management capacity.