Canada's Approach to Ecosystem-Based Management

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Ecosystem-based Management (EBM)

Under the overarching objective of conservation of species and habitat, EBM is the implementation of defined objectives related to monitoring and maintaining ecosystem features:

- biodiversity,
- productivity, and the
- physical and chemical properties of the ecosystem.

Delegation of Resource Management Authority in Canada

- Canada: Management of habitat on federal land and of all living resources in the sea, from the high intertidal seawards.

- Province of British Columbia: Management of habitat on provincial land and of those marine species designated to the Province by the federal government (oysters, steelhead salmon and marine plants in British Columbia).

- Provincial land is defined by British Columbia as all land between “headland to headland”, and while this is accepted by the federal government, there is a difference of legal opinion as to what constitutes a “headland”. To date, this lack of clarification has not resulted in serious jurisdictional problems.

Fisheries Act

In Canada, the *Fisheries Act*, enacted in 1857, has been the prime legislative tool governing ocean usage, particularly fishing:

- It regulates the capture, holding and possession of all marine life, and
- It makes unlawful the harmful alteration, disruption or destruction of fish habitat.
- While periodically revised (most recently in 1991), the focus of the *Act* has been the conservation and protection of commercially exploited species and their habitats.

Oceans Act

- Canada enacted the *Oceans Act* in 1997, which outlined a new approach to managing oceans and their resources based on the premises that:
  - oceans must be managed as a collaborative effort amongst all stakeholders that use the oceans, and
  - new management tools and approaches are required.

- This *Act* has changed the legislative basis for ocean management and managers are now required to consider the impacts of all human activities on Canada's ecosystems in marine resource management plans.

Canadian EBM Approach

As a consequence of the *Oceans Act*, since 1997, there have been a number of initiatives through which Canada's approach to EBM is beginning to emerge:

- In 2002, the Canada Oceans Strategy was published, a key element of it being a nationally co-ordinated Integrated Management (IM) program.
- In support of the IM program, Fisheries and Oceans Canada (DFO) has established a national coordinating body, termed the Working Group on Ecosystem Objectives (WGEO), to facilitate the development of best practices for IM and to oversee regional pilot projects designed to test implementation of concepts.
- In 1998, a pilot IM project was established in DFO's Maritimes Region to facilitate EBM on the Eastern Scotian Shelf (ESSIM), with a Strategic Planning Framework recently produced.
- In 2002, DFO's Pacific Region initiated a pilot IM project on the Central Coast (CCIM).

Maps of CCIM and ESSIM

Ecoregions, and Large Ocean Management Areas (LOMAs)

- In response to the Canada Oceans Strategy, DFO is now in the process of defining scientifically-determined ecoregions. Given the complexity and our current poor understanding of marine ecosystems, ecoregions will best encapsulate ecosystem biodiversity and function.

- Ecosystem management areas, termed Large Ocean Management Areas (LOMAs), are typically nested within science-based ecoregions, and there may be more than one LOMA within an ecoregion.

- While ecoregion boundaries are still to be confirmed, a preliminary list of 19 LOMAs has been suggested using a combination of distinctive oceanographic features, bathymetry, physiography, biota and administrative boundaries.

Integrated Management

- Integrated management has been defined by DFO as “a continuous process through which decisions are made for the sustainable use, development, and protection of areas and resources”.

- IM acknowledges the interrelationships that exist among different uses and the environments they potentially affect.

- IM requires that management of all sectors (fishing, aquaculture, etc.) work towards commonly-defined goals that guide the activities of all industries within an area. This will put all sectors on the “same rules” basis.

Conceptual and Operational Objective Definitions

Management goals need to be considered at both the conceptual and operational level:

- Conceptual objectives are stated in broad, general terms intended to be understandable by a general audience, and they tend to be valid for long time periods, i.e., are often government policy statements e.g., maintain productivity).

- Operational objectives are the strategies by which conceptual objectives are actually implemented, i.e., are measurable interpretations of conceptual objectives. In Canada, an operational objective is defined to consist of a verb (e.g., maintain), a specific measurable indicator (e.g., biomass), and a reference point (e.g., 50,000 t), thus allowing an action statement for management (e.g., maintain biomass of a given forage species greater than 50,000 t biomass).

Conceptual and Operational Objective Linkages

- Each conceptual objectives needs to be “unpacked” into a “tree” of conceptual sub-components, with branching to whatever level is considered necessary through a defined participatory and open process.

- Unpacking involves considering each conceptual sub-component level and determining whether or not a final operational objective can be stated at that level. In other words, can a measurable indicator and reference point be associated with that sub-objective? This requires an understanding of the knowledge and information that is available at different points in the unpacking process upon which indicators and reference points can be based. If information at a particular level is deemed suitable, then the unpacking process can stop there and an operational objective associated with that conceptual objective can be defined.

The link between qualitative, conceptual objectives and quantitative, operational objectives

What We Desire		*What We Can Measure*
Conceptual Objectives	**Operational Objective**	**Indicators**
Objective ↙ objective ↙ …	Maintain Productivity ↙ Trophic Transfers ↙ Forage Species ↙ Target Escapement ↙ (Maintain) Biomass	Consists of a Verb, Indicator and Reference Point e.g.,Maintain Biomass of age 3 herring > 50,000 t	Abundance of age 3 herring

Habitat Unpacking example

High-level Policy Objective (e.g. maintain components)

Next level of specificity: Biodiversity Conservation Objective (e.g. maintain habitat structure and complexity within bounds of natural variability)

Next level of specificity: Habitat Conservation Objective (e.g. maintain critical rare and sensitive habitats)

Operational Habitat Objective: Relate to Indicators, Ref. Points (e.g. maintain 100% of eelgrass habitat undisturbed)

Conceptual objectives:

- The best management decisions come from consideration of the interrelationships between cultural, social, economic and ecosystem parameters. Community involvement and buy-in is most likely with the inclusion of social and economic indicators. However, there is as yet no consensus in Canada for conceptual objectives in all four of the above dimensions; consensus to date has only been reached for conceptual objectives in the environmental dimension.

Environmental Dimension

- **Conceptual Objectives:**
  - to conserve enough components (ecosystems, species, populations, etc.) so as to maintain the natural resilience of the ecosystem
  - to conserve each component of the ecosystem so that it can play its historical role in the foodweb (i.e., not cause any component of the ecosystem to be altered to such an extent that it ceases to play its identified historical role in a higher order component)
  - to conserve the physical and chemical properties of the ecosystem

Synopsis of Potential Components in Social & Cultural, Economic and Institutional Dimensions

Social and Cultural Dimension	Economic Dimension	Institutional Dimension
• Community Structure ➢ Ocean access ➢ Sharing ➢ Resource allocation • Community Behaviour e.g. Code of Conduct ➢ Best practices ➢ Responsible use ➢ Stewardship ➢ Compliance ➢ Safety & security	• Sector Valuation ➢ Economic Costs / Benefits ➢ Employment • Sector Resilience ➢ Economic self-reliance ➢ Pace of development	• Management approach ➢ Degree to which international, national, regional & local requirements / responsibilities met ➢ Decision-making e.g. collaborative, inclusive, transparent ➢ Adaptability ➢ Responsiveness • Acceptability of management approach e.g. co-management ➢ Benefit for administrative cost • Achievement of management approach ➢ Sufficiency of Institutional resources e.g. Commitment ➢ Compliance with system

Control: Assessment Activities

- In most traditional fishery situations, only one or two indicators are normally considered (e.g spawning biomass and fishing mortality).
- in EBM, many indicators and associated reference points must be considered in decision making.
- Alternatives to traditional assessment frameworks need to be developed until our state of our knowledge improves.

Desired Assessment Framework Characteristics

An assessment framework that incorporates multiple indicators in a 'mechanistic-free' environment is a short-term option. An appropriate framework would:

- allow inclusion of technically-based indicators as well as those related to Traditional and Local Ecological Knowledge (TEK and LEK),
- involve dependence on a suite of indicators, rather than just a few, and so would be more likely to detect degradation of the ecosystem.
- tend to be conceptually simple, easy to teach, potentially inexpensive, and easy to communicate.

EBM Framework Examples

- The Index of Biotic Integrity (IBI) and the Traffic Light Approach (TLA) are two such 'mechanistic-free' methods that have been used in Canadian habitat (Karr 1981) and fishery situations (Caddy 1999, Halliday et al. 2001). Others also exist.
  - The IBI rates broadly-occurring indicators on a simple numerical scale (e.g. 1, 3 5) in comparison to values observed in reference areas.
  - The TLA rates indicators as good (green), satisfactory (yellow) or bad (red) through an expert opinion (Delphic) process.

What indicators are most relevant and appropriate?

- Geography-based (CCIM) and industry sector (aquaculture and groundfishing) (ESSIM) workshops have been convened to suggest appropriate operational indicators
- Lessons learned:
  - broad discipline-based participation is essential to avoid potential bias by discipline.
  - an on-going dialogue between managers and scientists to develop a common language and understanding of EBM is needed; otherwise, a 'cultural communications gap' may form that would impede progress towards IM.
  - objectives and indicators that might eventually be adopted should be practical and pragmatic, repeatable, cost-effective, and helpful for management.

On-Going Activities

- Continue to :
  - develop and evaluate operational objectives for EBM, including the processes used to identify them
  - assess how much information on the relationship between biodiversity and habitat is needed to support robust decision-making for EBM
  - assess the level of model complexity needed to support robust decision-making for EBM