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An Assessment of Multi-Species Recovery Strategies and Ecosystem-Based Approaches for Management of Marine Species at Risk in Canada

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Executive Summary

Effective recovery planning is critical for ensuring the long-term survival of marine species at risk. Recovery planning can occur at a variety of scales, from single-species to landscape-based. In Canada, recovery planning consists of two phases, the first being formulation of a recovery strategy (within a short timeframe), and second, development of an action plan. Under the Species at Risk Act (*SARA)* there are strict requirements for recovery strategies to include species-specific information and recovery objectives for each listed species at risk, whether addressed by individual, multi-species, or ecosystem-based recovery strategies.

The purpose of this report was to assess the applicability of multi-species and ecosystem-based approaches for management of marine species at risk, as well as methodologies for applying multi-species recovery planning. The report reviewed approaches and criteria used for recovery planning for multiple species and identified their strengths and weaknesses. Examples of recovery planning from Australia, the United States, the United Kingdom and Canada were examined and compared.

This report concluded that: 1) the effectiveness of multi-species recovery planning has yet to be sufficiently assessed; 2) the primary criticism is the lack of adequate attention or detail being paid to individual species within multi-species plans; and 3) in marine systems, knowledge gaps and complexities associated with ecosystem level research are so considerable that ecosystem recovery strategies may not be possible or practical.

The decision to embark on a single, multi-species or ecosystem-based recovery strategy will be specific to each situation. It is recommended that development of a multi-species recovery strategy, if feasible, should be considered at the onset of planning. Alternatively, single species strategies could be developed first, followed by multi-species and/or ecosystem-based action and management plans.

The application of multi-species recovery planning is in its infancy and thus there are no clear criteria for when and where to apply the approach nor are there well developed methodologies for grouping of species. Various grouping techniques have been applied but further testing and comparisons among them are required.

Decisions on whether to apply multi-species recovery strategies require further empirical research. An evaluation of case studies will help to determine their effectiveness for species at risk recovery. Research is also required for the creation of an effective and efficient management model for recovery planning as part of the Integrated Management framework for Canada's oceans.

Introduction

As larger numbers of species are being assessed and listed as 'at risk', recovery planning to effectively rebuild these populations is growing in importance as many species and populations are in danger of becoming extinct. Effective recovery planning will identify specific recovery goals for species at risk, and will outline the most appropriate process for reaching these goals. The species at risk issue is of global concern and significance, and various forms of recovery planning are being undertaken in many ecosystem types around the world. Recovery planning can function at a variety of scales, from individual species to landscapes. There are benefits and drawbacks associated with approaches used at different scales. In the marine realm recovery of species at risk is a relatively underdeveloped field of work, with less research effort expended on the effectiveness of different approaches, particularly for multi-species or ecosystems.

Recovery planning in Canada consists of two phases: a recovery strategy and an action plan (including implementation). The first phase involves developing a recovery strategy for species listed under Schedule 1 of the *Species at Risk Act* (*SARA*, 2002) to address threats to the survival of the species. It establishes the framework for development of the recovery action plan and implementation. "It sets out a recovery program (not a research program) or approach based on biological considerations including Aboriginal traditional knowledge. Socio-economic considerations are brought into the implementation phase of recovery, as identified in the recovery action plan" (National Recovery Working Group, 2004).

The recovery strategy sets out short-term recovery objectives and long-term recovery goals for protection and recovery of species at risk (Department of Fisheries and Oceans (DFO), 2004). According to Section 41 of *SARA* (2002) the recovery strategy must include:
- a description of the species and its needs;
- an identification of the threats to survival of the species and threats to its habitat, and a description of the broad strategy to be taken to address those threats;
- an identification of the species' critical habitat, and examples of activities that are likely to result in its destruction;
- a statement of the population and distribution objectives that will assist the recovery and survival of the species, and a general description of the research and management activities needed to meet those objectives;
- a statement about whether additional information is required about the species;
- and a statement of when one or more action plans in relation to the recovery strategy will be completed.

Action plans summarize the projects and activities needed to meet recovery strategy objectives and goals, and include information on critical habitat, proposed measures to protect critical habitat, a statement of steps to implement the recovery strategy and

when they are to take place, and an evaluation of the socio-economic costs of the action plan and any implementation benefits (DFO, 2004; National Recovery Working Group, 2004). Both recovery strategies and action plans can be modified over time; however, Subsection 42(1) of *SARA* (2002) states, "the competent minister must include a proposed recovery strategy in the public registry within one year after the wildlife species is listed, in the case of a wildlife species listed as an endangered species", and within two years for species listed as threatened or extirpated. The proposed recovery strategy is then subject to a 60-day public comment period, and must be finalized within 30 days after that. This rigorous timeline impacts on the potential for implementing multi-species or ecosystem-based recovery strategies for marine species at risk.

Also, if a species is listed as special concern under *SARA*, the *Act* requires that a management plan be developed for the species and its habitat within specified timelines (National Recovery Working Group, 2004). Section 65 of *SARA* (2002) states: "The plan must include measures for the conservation of the species that the competent minister considers appropriate and it may apply with respect to more than one wildlife species". Section 67 notes that a multi-species or ecosystem-based approach may be taken in preparing management plans if the "competent minister" considers it appropriate to do so.

SARA (2002) states, "the competent minister may adopt a multi-species or an ecosystem approach when preparing the recovery strategy…" (Subsection 41(3)); however, neither of these terms are defined in the *Act*. Although some authors use "multi-species" and "ecosystem-based" interchangeably when talking about recovery strategies, we consider them to be distinct approaches. For the purposes of this document multi-species recovery strategies are defined as those that address recovery for more than one listed species at risk. Ecosystem-based recovery strategies are defined as those that address all relevant species, interactions among species, habitats and processes in an ecosystem in formulating recovery goals for one or more listed species at risk in that ecosystem. In general, one of the biggest constraints is the lack of clear, widely accepted definitions of these terms, or guidelines for their use. Also, some authors and countries distinguish between "ecosystem" and "landscape" approaches, with landscape being the bigger scale.

The purpose of this report is to assess the applicability of multi-species and ecosystem-based approaches for management for marine species at risk, as well as methodologies for applying multi-species recovery planning. The report reviews approaches used internationally and domestically for recovery of multiple species, identifies strengths and weaknesses associated with these different approaches, examines potential criteria for use in determining applicability of multi-species or ecosystem-based approaches, and various ways of grouping species.

International and domestic examples of multi-species and ecosystem-based recovery planning

In Canada a number of terrestrial and freshwater examples of multi-species and ecosystem-based recovery strategies exist, but these were established pre-*SARA*, and some are now criticized for not being perfectly compliant with the legislation. In Canada we are limited in some ways by *SARA* requirements, and therefore, international marine examples may not be transferable to the Canadian context. These constraints are discussed in more detail below. There are some Canadian marine examples currently under development, but none completely approved and functioning for marine species under *SARA*.

International

In Australia, species listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act* (1999) are managed by the Department of Environment and Heritage (DEH). They currently have many multi-species plans for terrestrial and freshwater species at risk, including plants, frogs, turtles, and bats. Australians have marine multi-species plans for six species of sea turtles, and for albatross and giant-petrel together. Currently they are developing multi-species recovery plans for ten species of seabirds, and for blue, fin and sei whales together. Drafts of these plans have just gone through a public review process, as required under their *Act*, after which the plan will be revised and then adopted by the minister (DEH, 2004). They also have, and are developing more, ecosystem-based recovery plans for distinct terrestrial habitats and regions, including wetlands and islands, but there are none yet for marine systems (DEH, 2004).

In the United States, species listed under the *Endangered Species Act* (1973) are managed either by the U.S. Fish and Wildlife Service (USFWS), or by the Office of Protected Resources, which is part of NOAA Fisheries (the National Marine Fisheries Service); this office is also responsible for species listed under the *Marine Mammal Protection Act* (1972). The USFWS has developed many multi-species recovery plans for terrestrial species, the biggest and best known being the South Florida Multi-Species Recovery Plan (MSRP). There are 14 multi-species or ecosystem-based recovery plans for, or which include, aquatic species. These include the Mobile River aquatic ecosystem plan in Alabama, and the Ash Meadows ecosystem plan in California, both of which include freshwater fish species. There are currently no multi-species or ecosystem-based recovery plans functioning for listed marine species in the U.S. (USFWS, 2005).

In the U.S., a multi-species plan for fin and sei whales has been developed however, it has remained in draft form since 1998 (NOAA Fisheries, 2004). In 1984 NOAA developed a recovery plan for five species of marine turtles but as more was learned about these individual species throughout the 1980s, it was eventually decided to separate them. It was concluded that the threats and recovery actions for each species

were different enough to warrant individual plans for each of the five turtle species (NOAA Fisheries, 2004). There has been some limited discussion around employing multi-species recovery planning for groups of seal or coral species as there are expected listings among the species.

Ecosystem-based approaches to conservation and species at risk recovery have been developed independently in the U.S., particularly around salmon populations. For example in 2000, a federal caucus made up of members from various government departments, released a document titled, 'Conservation of Columbia Basin Fish: Final Basinwide Salmon Recovery Strategy' (U.S. Federal Caucus, 2000). This document presents the federal government's recommendations for salmon and steelhead recovery in the Columbia River basin (U.S. Federal Caucus, 2000), and it serves as an ecosystem-based multi-species recovery plan for these two anadromous fish; however, it has not been adopted by the USFWS or NOAA, even though neither agency has recovery plans for salmon or steelhead.

In the United Kingdom (U.K.), species at risk recovery planning is heavily influenced by the U.K.'s inclusion in the European Union, and the related roles and responsibilities associated with this make it quite different than in Australia, the U.S. or Canada. In 1992 the European Community (EC) adopted Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (EC Habitats Directive). This Directive is the means by which the European Community meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The provisions of the directive requires member states to introduce a range of measures including the protection of species listed in the annexes, to undertake surveillance of habitats and species, and produce a report every six years on the implementation of the directive.

The 189 habitats listed in Annex I of the directive and the 788 species listed in Annex II, are to be protected by means of a network of sites. Each member state is required to prepare and propose a national list of sites, which will be evaluated in order to form a European network of Sites of Community Importance. These will eventually be designated by member states as Special Areas of Conservation, and along with Special Protection Areas classified under Council Directive 79/409/EEC on the Conservation of Wild Birds (EC Birds Directive), form a network of protected areas known as Natura 2000 (EUROPA, 2004). The directive was amended in 1997 by a technical adaptation directive. The annexes were further amended by the environment chapter of the Treaty of Accession 2003.

In the U.K., species are listed under the *Wildlife and Countryside Act* (1981), which consolidates and amends existing national legislation to implement the EC Habitats Directive and EC Birds Directive. The U.K. Department for Environment, Food and Rural Affairs leads implementation of the *Act*. The protection afforded by the *Act* to animals and plants listed on Schedules 5 (marine species) and 8 extends throughout the U.K., and to adjacent territorial waters, which currently extend 12 miles out to sea. The aim is to designate Natura 2000 sites for annexed habitats and species, which will

contribute to the "ecologically coherent" network of Natura 2000, which reflect and represent the natural biodiversity in the E.U. marine area. The focus is on functional habitats rather than on individual species although it still needs to be clarified to what degree the habitats directive should also protect commercial fish species such as cod, salmon, and eel, beyond what is afforded to them through habitat protection.

Under the U.K. Biodiversity Action Plan (U.K. BAP), Priority Species Action Plans, Grouped Species Action Plans, or Habitat Action Plans have been established however, these are not limited to listed species, but instead, "set priorities for nationally and locally important habitats and wildlife" (U.K. BAP, 2004). In total, ten Grouped Plans have been established, which are more like multi-species action/management plans as opposed to strict 'recovery' plans. Of these ten, six are for marine species groups, including: baleen whales, toothed whales, small dolphins, marine turtles, commercial marine fish and deep-water fish however, the commercial marine fish and deep-water fish plans have yet to be applied since the U.K., like all EU members, manage fisheries through the Common Fisheries Policy. Under the U.K. BAP Habitat Action Plans have been developed for many terrestrial systems, as well as wetlands, rivers, and even *Lophelia pertusa* (cold-water coral) reefs (U.K. BAP, 2004). These action plans in the U.K. however, are not supported by binding legislation since a specific Act requiring development and implementation of recovery plans does not exist. Therefore, for members of the E.U. recovery planning occurs primarily through implementation of the EC Habitat Directive.

Domestic

In Canada, responsibility for species listed under *SARA* is shared between two Federal Ministers. The Minister of Fisheries and Oceans is responsible for aquatic species listed under *SARA* while the Minister of the Environment (through Parks Canada and the Canadian Wildlife Service) is responsible for all other species and the overall administration of the Act. However, because the provinces and territories are the management-authorities for species on their lands, federal-provincial jurisdictional complexities exist. Recovery strategies can be either single-species, multi-species, ecosystem- or landscape-based (National Recovery Working Group, 2004). Currently there are ten ecosystem- or landscape-based recovery strategies functioning in Canada. They range in coverage from two to 20 species. Of these, six are terrestrial, and the remaining four are for river ecosystems, perhaps the most well known of which is the Sydenham River (southwestern Ontario) recovery strategy. As of yet, none have been developed for marine ecosystems (National Recovery Working Group, 2004).

There are 14 multi-species recovery strategies in Canada, which range in coverage from two to eight species. Of these, two are near completion for marine species: the first for the northern and spotted wolffish in Atlantic waters, and the second for the resident and northern populations of killer whales in the Pacific (National Recovery Working Group, 2004). Also in development on the west coast is a multi-species recovery strategy for large cetaceans, which will include blue and sei whales. This plan should

have included the Pacific right whale as well, however a single-species recovery strategy for it has already been developed. It is likely that all three whale species will be addressed in a common, multi-species action plan. The whales are grouped because they are facing common threats and their habitats overlap.

Although single-species recovery strategies far outnumber multi-species or ecosystem-based strategies in Canada, in general there has been a shift towards taking an ecosystem approach for all recovery planning. By considering the ecosystem and all its components (e.g. species, habitats, interactions and processes) in an individual species strategy, broader ecological protection and conservation outcomes can be achieved. For example, the eastern Canadian Arctic bowhead whale recovery strategy is a single-species strategy, but takes an ecosystem approach. In other words, although recovery objectives are only identified in the strategy for a single species, the bowhead whale, the strategy does consider the role and interactions of this species within its wider ecosystem context, and recognizes the importance of sustained ecosystem-quality for long-term recovery and conservation of the species. This is also the case for Pacific sockeye salmon and leatherback turtles, where an ecosystem-approach is taken in their individual strategies. In general, these strategies take a broader, ecosystem-based view of individual species recovery needs, and identify ecological requirements for reaching single-species recovery goals.

Comparison of recovery planning initiatives among countries

All national plans among the countries reviewed include a species description and needs, an identification of threats, habitat requirements and information gaps and development of recovery objectives for those species included in the plan.

In contrast, the main differences between the plans of other nations and those of Canada are that plans in other countries include:
- actions and management priorities and practices embedded within the plan (whereas in Canada those are addressed in separate action plans);
- criteria to measure the performance of the plan;
- information on the duration and cost of recovery actions in the plan;
- an identification of the affected "interests".

The Australian national program is most similar to that of Canada's, whereas the U.K. approach to species at risk recovery is the most dissimilar because of its inclusion in the E.U. The European Community has adopted a purely ecosystem-based approach to species recovery in their implementation of the EC Habitats and Birds Directives, through establishment of the Natura 2000 protected areas network.

In Australia, the U.S., and the U.K., action plans are contained within their recovery plans. In Australia they have their own version of action plans, but these are for groups of species (e.g. "cetaceans" and "seals") and are not required under their *EPBC Act*. In fact, most were put together before the *Act* came into force and are more similar to Canadian management plans. Also, in Australia, even single-species recovery plans

address non-target species and the broader ecosystem, which is starting to occur in Canada as well (e.g. bowhead whale recovery strategy). A further important aspect of the *EPBC Act* involves classification of activities as 'key threatening processes', which then triggers the development and application of Threat Abatement Plans. These plans can be used to address specific threats, and environmental impact issues that may be related to the species classified as threatened under the *EPBC* criteria.

In the U.S., recovery plans are intended as guidelines and are not legally binding. There is not as much accountability for development and implementation as in Canada. Also, they do not have strict, legislated timelines for recovery plan development. In the U.S., for some species, their 'critical habitat' is actually designated as they become listed, although attempts are made to ensure species listing and critical habitat designation occurs at the same time, this isn't always possible. If this does occur, and critical habitat is designated before recovery plans are established, then critical habitat should be addressed in the plan. Finally, although in the U.S. the 'action plan' component of recovery planning is usually included in a species' recovery plan, in some cases an implementation plan is also developed, to specifically identify who is to do what, and when. These are often developed with other interest groups, such as the American Zoo and Aquarium Association. Implementation plans are most useful for species with multiple associated threats, players, and interests involved.

General Observations

In Australia, the U.S., the U.K. and Canada, the single-species approach to recovery planning has been the norm. The ecological benefits of multi-species or ecosystem-based approaches have only been considered more recently, when recovery practitioners, researchers, and academics began questioning the appropriateness of the single-species approach in some cases. In areas where multiple species at risk are present, the ability of multi-species and ecosystem-based recovery plans to simplify the recovery planning process was acknowledged, principally in the U.S. (e.g. Hawaiian plant species). However, this broader type of recovery planning has been attempted on relatively few occasions in the U.S. and Canada, especially with regard to marine species at risk. Historically, multi-species or ecosystem-based recovery planning wasn't as "visible" an option in the marine realm. Also, in general, there are far fewer marine species listed, compared to terrestrial or even freshwater species, and often less is known about the marine species that are listed.

For all marine nations, common challenges associated with marine species at risk recovery include the large geographic range of many listed species, such as whales and turtles, and the increased complexity and uncertainty around marine ecosystems' structure and function. Until now, most countries have only developed marine multi-species recovery strategies for large-bodied, migratory and charismatic megafauna. This is not a coincidence as these are often the first marine species to be listed under endangered species legislation. They have high public appeal, groups of taxonomically similar species (large cetaceans for example) may share habitats and be perceived as

experiencing similar threats within territorial waters, and multi-species recovery strategies may appear to be logistically more efficient and save resources

There are a number of multi-species and ecosystem-based fisheries management (EBFM) discussions underway nationally and internationally (e.g. Livingston et al., 2005; Pikitch et al., 2004; Zabel et al., 2003; Gislason et al., 2000; Witherell et al., 2000); however, this is a large body of research, and reviewing it is outside the scope of this paper. In general, EBFM should be considered in species at risk recovery planning, when developing recovery strategies for marine fishes at risk, and also when looking at marine species at risk for which by-catch, as well as indirect fishing effects, are threats (Pikitch et al., 2004).

Weaknesses and strengths of multi-species and ecosystem-based approaches

Multi-species and even ecosystem-based approaches seem intuitively to be a more logical and holistic way of approaching species at risk recovery, especially in the new era of integrated management and landscape-level conservation. A number of advantages and disadvantages can be attributed to multi-species or ecosystem-based recovery plans, relating both to the theory behind these approaches, and to analyses of plans currently being implemented (Table 1).

The largest study to evaluate multi-species recovery planning was by Clark and Harvey (2002) as part of a larger project by the U.S. Society of Conservation Biology (SCB) (Hoekstra et al., 2002). Hoekstra et al. (2002) reviewed a large representative sample of USFWS recovery plans, which included multi-species recovery plans. Moore and Wooller (2004) then evaluated three types of Australian recovery plans – landscape (ecosystem), multi-species and single-species (see Table 1).

Table 1: A summary of strengths and weaknesses of multi-species and ecosystem-based approaches to recovery planning as raised by researchers involved in this field.

STRENGTHS

- Multi-species approaches can:
  - ➤ Address common threats in a concise and focussed manner (Boyes, 2001);
  - ➤ Streamline the public consultation process;
  - ➤ Reduce duplication of effort in describing the habitats of, and threats to, each species;
  - ➤ Provide a good format for environmental impact statements;
  - ➤ Promote thinking on a broader scale;
  - ➤ Reduce conflicts between listed species that occur in the same area;
  - ➤ Benefit other species not at risk;
  - ➤ Provide an approach that can restore, reconstruct or rehabilitate the structure, distribution, connectivity and function upon which a group of species depends.
  (Canadian Wildlife Service, 2002);

- Landscape plans are the most effective at minimizing costs per species in the long-term (Moore and Wooller, 2004), and multi-species plans can reduce information redundancies, improve administrative efficiency and generate financial savings (Cunnington et al., 2003; Lessard, 2002);

- There are too many species to address on a species-by-species basis. This would exhaust time, financial resources, societal patience, and scientific resources. Ecosystem and landscape approaches are the only way to conserve numerous species at risk, especially when assessing smaller, lesser-known, or unknown species, particularly invertebrates, plants, fungi, and even bacteria (Franklin, 1993);

- Species that are not yet at risk can benefit from improved habitat conditions associated with ecosystem recovery (Cunnington et al., 2003; Staton et al., 2003; Tear et al. 1995);

- An ecosystem approach that addresses the recovery of numerous species and their habitats helps prevent multiple types of habitat degradation in the ecosystem (Staton et al., 2003; Carroll et al. 1996);

- Multi-species plans in the U.S. were more consistent than single-species plans in monitoring threats, which is a more holistic approach to recovery (Brigham et al., 2002);

- Multi-species plans facilitate adaptive management, as they allow for lessons learned with one species to be readily applied to others covered by the same plan (Moore and Wooller, 2004);

- Multi-species plans can reduce conflicts between listed species that occur in the same area (Jewell, 2000);

- Multi-species plans get more stakeholders involved, and therefore make a wider range of information available to practitioners. Also, more active public involvement "ensures" more effective recovery of species at risk (Lessard, 2002: p.7);

- Landscape plans may encourage a broader engagement and stewardship in conservation whereas multi-species and single-species planning focuses awareness on species at risk (Moore and Wooller, 2004);

- "The advantage of a local, multi-species or regional approach is that it can focus efforts on specific populations of animals and plants and can develop local community campaigns to help implement the necessary recovery actions. Further benefits include the avoidance of duplication, great efficiency and cost-effectiveness, and the ability to bring together a broader range of interested groups and individuals" (Environmental Australia 2000; p.5);

- "Either a multi-species or an ecosystem approach, if carried out effectively, should provide improved cost-effectiveness and greater opportunity for long-term success by broadening the scope of recovery to operate within the context of surrounding land uses and species and habitat relationships" (LaRoe, 1993 In Tear et al.1995: p.192-3).

WEAKNESSES

- Multi-species planning can be a very complex, time-consuming, and expensive undertaking. (Canadian Wildlife Service, 2002);

- The effectiveness of multi-species plans may be limited because less money (and time) is spent per species (Boersma et al., 2001) and they are often poorly resourced (Boyes, 2001);

- Multi-species, and especially ecosystem-based approaches, increase the difficulty and complexity in defining species' critical habitats [a requirement under *SARA*] (Lessard, 2002; Boyes, 2001), and often single-species plans include more details about habitat requirements than multi-species or landscape plans (Moore and Wooller, 2004);

- In general, practitioners' level of knowledge about individual species won't be consistent across all species addressed in an ecosystem-based recovery plan, and this may cause unacceptable delays in the planning process;

- The utility of multi-species plans is questionable if species are not appropriately grouped yet, no clear guidelines for grouping exist in the U.S. (Clark and Harvey, 2002) or in Canada;

- In the past, some species in the U.S. were lumped together simply because of a lack of sufficient information to draft single-species plans (Clark and Harvey, 2002). This may have resulted in the following two weaknesses (Leonard, 2003)
  - On average multi-species plans exhibit a smaller spectrum of ecological and biological information about their respective species than single-species plans (Moore and Wooller, 2004; Clark and Harvey, 2002)
  - Species included in multi-species plans were four times less likely to be improving in status compared to species in single-species plans (Boersma et al., 2001);

- Multi-species plans were implemented more slowly compared to single-species plans in the U.S. and therefore, were less effective (Lundquist et al., 2002);

- Multi-species plans were less effective for generating the information necessary to assess species recovery compared to single-species plans in the U.S. (Brigham et al., 2002);

- Multi-species approaches require the involvement of more "stakeholders", which can increase administrative complexity and lead to methodological complications (Lessard, 2002)

> - Some Canadian researchers consider multi-species strategies as just "doubling the workload," because of legislation structured around individual species. As a result, developing multi-species or ecosystem-based recovery strategies may be too challenging a task to accomplish within the timelines set out in *SARA*

The U.S. study by Clark and Harvey (2002), and the Australian study by Moore and Wooller (2004), evaluated their countries' plans to date and are not necessarily an accurate reflection of the appropriateness or effectiveness of the different plan types in general. Instead, these studies highlight challenges from the past, which can help inform SAR practitioners in the future, and help draw attention to potential pitfalls. Leonard (2003) states, "the USFWS views the findings of the SCB study as identifying issues of endangered species recovery planning that bear closer evaluation, rather than a direct measure of cause and effect" (p.656). Thus, these studies should not determine if or when different plan types are implemented in the Canadian marine environment, particularly since the plans included in both studies were only for terrestrial or freshwater species.

The key criticism in both the U.S. and Australian studies is that multi-species plans do not focus enough on single-species requirements for recovery, and are therefore sometimes less effective as single-species recovery plans. Boersma et al. (2001) state, "as multi-species and ecosystem plans are developed, careful attention must be paid to ensure that efficiency is not achieved at the expense of thoroughness or explicit science" (p.648).

In Canada there is no consensus among SAR practitioners and researchers on whether grouping lesser-known species, because they are lesser known, is a good or bad thing. Some argue that this is a strength of multi-species plans, where species we don't know enough about are afforded protection in a precautionary way, at least until enough is known to separate them if need be. The alternative is to spend time and money to research, and gather enough information to begin a single-species plan. Although this process should occur eventually, the reality for some species is that it will not happen soon enough to ensure survival or prevent further decline.

In contrast, others state that grouping lesser known species is a major weakness, because the recovery strategy might attempt to mitigate common threats, but miss the key or critical threats impacting individual species. Threats may or may not be shared within the group or, a more vulnerable species might not get sufficient attention within the group of similar species facing similar threats, and thus may be placed a greater risk. This approach may "look good" while doing nothing for species recovery. Also, there is concern that once these lesser-known species are in a grouped plan they may never be adequately researched.

The National Recovery Working Group's draft recovery handbook, ROMAN (2004), identifies this same concern. There is a risk with multi-species approaches that the recovery program will help many species to some extent, but not actually reach recovery goals for any of them. Clark and Harvey (2002) agree, stating that what is

important is, "striking a balance between completing recovery plans quickly and making them detailed enough to be effective management tools, particularly when writing a plan for multiple species" (p.660). Striking this balance may be especially difficult in Canada, where *SARA* lays out strict guidelines requiring species-specific information to be included in recovery strategies, and a rigorous timeline for completing recovery strategies for newly listed species.

A recovery strategy or action plan developed for more than one species may not cover the entire range of each of the species, and thus will not meet legal requirements [under *SARA*] for a recovery strategy or action plan for the species (National Recovery Working Group, 2004: p.23). Tear et al. (1995) note, "if a shift away from a focus on single species is to be effective, it is imperative that the ills we have identified in the single-species plans be corrected first (such as setting biologically defensible recovery goals). Otherwise the added complexity of greater numbers of species over potentially larger and more complex landscapes and political jurisdictions will merely proliferate problems rather than provide solutions" (p.192).

Finally, recovery planning in Canada slowed slightly during the transition from the Recovery of Nationally Endangered Wildlife Program (RENEW) alone, to its functioning under *SARA*. For example, the Sydenham River ecosystem-based recovery strategy, originally developed under RENEW, does not deal with the full range of species as the *SARA* legislation dictates and therefore, it will have to be amended.

The *SARA* is very rigorous. It requires recovery strategies to cover the full species range, and for recovery objectives to be developed for each species at risk addressed in the strategy. This can be difficult for practitioners trying to develop ecosystem-based strategies, particularly in the marine realm where species are often migratory with large geographic ranges, the environment is fluid, and in general is very complex with numerous unknowns. Some SAR practitioners feel that multi-species or ecosystem-based recovery strategies are advocated by some because they "feel good" and people think it's the right thing to do. This may cause misdirected pressure because currently there are some real logistical limitations with this type of recovery planning in Canada.

A major challenge for SAR practitioners is the timelines set out in *SARA*. In some cases, this constraint has resulted in strategies being developed that are not necessarily the most effective. It is especially difficult when timelines vary between species that logically should be grouped together in a recovery strategy. Therefore, in choosing which species to assess and when, The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is inadvertently contributing to the decision-making around which approach is taken for recovery strategies. For example, loggerhead and leatherback sea turtles are two species that could have been grouped, as has been done elsewhere. The leatherback turtle is currently listed as endangered under Schedule 1, and a recovery strategy must be established for it within three years. However, the loggerhead turtle is not yet listed, but is currently being assessed by COSEWIC. Therefore, developing a recovery strategy for loggerheads is not a priority. In this case, time and resource constraints have impeded SAR practitioners from being

proactive, addressing both current recovery priorities and future needs at the same time, which in the long run would likely have been more efficient and more effective. However, this constraint might simply be an artefact of the current backlog in developing recovery strategies under newly established *SARA* guidelines, and may or may not work itself out over time.

COSEWIC is now beginning to move towards dealing with groups of species, and listing them at the same time. This will be very helpful for practitioners, giving them the option to pursue multi-species or ecosystem-based recovery strategies where appropriate. For example, COSEWIC will complete assessments of a number of shark species by May 2007 and thus, they will likely be considered for *SARA* listing simultaneously.

Key diagnostic criteria used to determine applicability of multi-species and ecosystem-based recovery strategies

Jewell (2000) identified two questions to determine which recovery strategy is most appropriate for a given situation:

1) "do two or more species of the same genus of the same geographical areas, share a common threat?" If so, then a multi-species recovery plan is most appropriate;

2) "do several listed members of a shared biotic community rely on protection and/or restoration of their ecosystem to reach recovery?" If so, then an ecosystem-based recovery plans is most appropriate (p.30).

Angermeier and Williams (1994) recommend for aquatic taxa the following: "where multiple listed and/or candidate species occur, recovery plans should be developed for communities or ecosystems rather than for single species. This approach would provide a larger-scale focus and perhaps avoid the need to list some candidate species" (p.28).

In Canada, multi-species or an ecosystem-based approach may be adopted when preparing the recovery strategy if the competent minister "considers it appropriate to do so" (*SARA*, 2002: Subsection 41(3)). To determine when it is "appropriate to do so", ROMAN provided guidelines for selecting the scale of recovery (e.g. single-species, multi-species, ecosystem- or landscape-based scales), and provided a decision tree format to help Canadian practitioners in choosing an approach (National Recovery Working Group, 2004). The selection of scale "is mostly based on biological, inherent qualities of the system", such as geographic distribution, species characteristics and threats. However, there may be other considerations that influence selection of an approach, such as limited availability of expertise" (National Recovery Working Group, 2004: p.23). Table 2 below has been slightly modified from ROMAN (National Recovery Working Group, 2004: p.24).

Table 2: Summary of considerations for selection of scale of plan extracted from ROMAN (National Recovery Working Group, 2004)

Approach (scale)	Some considerations for selection of recovery plan approach	Example
Single Species	- distinct species with respect to habitat requirements and threats - only listed species in geographical area	- Vancouver Island marmot - North Atlantic right whale
Multiple species at risk or threat abatement*	- two or more species at risk in same taxonomic group or same geographical region - species share a common threat	- Acadian flycatcher & hooded warbler, American badger (*jeffersonii* & *jacksoni* subspp.) - leatherback and loggerhead turtles or Atlantic sharks
Ecosystem-based*	- deals with select sites of the same ecosystem type, not necessarily contiguous within an ecologically defined area - considers the integrity of the ecosystem as a whole; is not limited to species at risk (i.e., is broader than RENEW's mandate)	- Garry Oak Ecosystems (B.C.) - St. Margaret's Bay (N.S.)

Landscape-based*	- deals with a range of ecosystems contiguous within a given geographically defined area - is not limited to species at risk (i.e., is broader than RENEW's mandate)	- South Okanagan-Similkameen Conservation Program - Scotian Shelf

* Species-specific goals and objectives still need to be identified and addressed in order to be able to evaluate recovery progress.

ROMAN notes that "flexibility is key" (p.23), and decisions about which approach is most appropriate is dependent on the specifics of each individual situation (National Recovery Working Group, 2004). ROMAN also recommends that when developing multi-species recovery strategies, background information should be grouped to the extent possible, but species-specific goals and objectives still need to be provided, as this is a legal requirement under *SARA* (National Recovery Working Group, 2004).

Section 41 of *SARA* (2002) lists a number of species-specific aspects that must be included in the recovery strategy, including a description of the species, an identification of threats to the survival of the species and to its habitat, and an identification of the species' critical habitat. Therefore, in assessing which approach to take in recovery planning, it may be appropriate to first provide a preliminary answer to these questions for any species at risk that may be candidates for multi-species or ecosystem-based recovery planning. If species overlap in critical habitat or identified threats, then they may be good candidates for multi-species or ecosystem-based recovery strategies. This is consistent with Moore and Wooller (2004) who concluded that "multi-species plans are best when there are similar threats and/or species in close proximity, of the same taxonomic group, with similar management requirements or that can be managed by the same agency/group" (p.10).

In the marine realm, for species with a high degree of overlap in threats and/or biology, but a lesser degree of overlap in habitat, such as migratory sea turtles, multi-species strategies may be more efficient than ecosystem-based strategies. Ecosystem-based strategies may be more efficient for species with a high degree of overlap in habitat, and perhaps threats as well, but a lesser degree of overlap in biology, such as in ecosystem-based watershed recovery strategies (e.g. the Sydenham River in Ontario).

From their study of Australian recovery plans, Moore and Wooller (2004) conclude that landscape plans are best for threat abatement activities across a landscape however, these plans often have limited capacity to implement and are not focused singularly on species at risk recovery. To be effective and meet *SARA* requirements, ecosystem-based recovery strategies need to consider the full range of species' distributions within the ecosystem, and thus may be more feasible in terrestrial environments, and in particular watersheds, compared to the marine realm. This is because terrestrial species' habitats, and terrestrial ecosystems in general, are often easier to define and delineate, and the linkages and interactions between them have been better studied and are better known. Watersheds in particular are often home to endemic species, or species with relatively small ranges (easier to address under *SARA*) and high levels of habitat overlap, which as a result, experience similar threats and are therefore good candidates for ecosystem-based recovery strategies.

Moore and Wooller (2004) recommend single-species plans "when there are numerous, diverse threats to a species and/or the cause of the threat is unknown" (p.10). Section 38 of *SARA* (2002) states, "if there are threats of serious or irreversible damage to the listed wildlife species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty". Therefore, where a species has specialized requirements, or where there are specific and/or immediate threats to an individual species, and a lack of scientific understanding of the commonalities or interactions with other species in the ecosystem, it may be more appropriate to implement a single-species recovery strategy.

A panel of SAR practitioners support this approach stating, "species that are particularly rare, species with unique threats, or ones identified by a "fine-filter" approach, may become extirpated unless individual plans are prepared (Cunnington et al., 2003). Jewell (2000) and Lessard (2002) also support this approach, as do Clark and Harvey (2002), who acknowledge that single-species plans should continue to play an important role in recovery planning, even if the weaknesses of multi-species recovery plans are mitigated. In ROMAN, the National Recovery Working Group (2004) also identifies an important role for single-species recovery strategies, stating, "as a default, and especially in the case of emergency listing and other urgent situations, starting with a single-species approach will usually be faster and more effective in the short-term than pursuing one of the more complex approaches" (p.23).

For example, if a keystone species (i.e. one that plays a "pivotal ecological role in maintaining the biodiversity and balance of the food web" (Wilkinson et al., 2003: p.1)) is at risk, a single-species recovery strategy would likely be most appropriate, because recovery of this critical ecosystem component should be given very high priority. Single-species recovery for keystone or umbrella species (i.e. species who's effective conservation results in "protection of a whole suite of species that share the same habitat" (Wilkinson et al., 2003: p.1)) would likely have a positive trickle-down effect on the rest of the ecosystem, while avoiding adding complexity to the recovery planning process (Wilkinson et al., 2003; Simberloff, 1998; Rohlf, 1991).

Placing a priority on conserving long-lived top predators or keystone species (e.g. Pacific halibut) may actually turn out to be an effective multi-species or even ecosystem-based recovery approach. However, there is often disagreement on the use of the terms "keystone" and "umbrella" species due to a lack of agreed upon definitions (Wilkinson et al., 2003), and controversy over how species are chosen as "keystone" or "umbrella" species. In some simple systems the keystone species may be quite obvious, but in more complex marine food webs there has been a tendency to simply label the top predator as the keystone species, without sufficient scientific support. This can make the decision-making process and subsequent implementation problematic for government agencies and others who may be bound by deterministic language in legislation and regulations.

Approaches to grouping species for which common recovery strategies and/or management actions can be developed.

Theory

There are a number of approaches for grouping species at risk. "In some instances, it [grouping] can identify species which share virtually the same suite of characteristics and hence could be treated as a single unit for recovery planning" (Seburn and Seburn, 2000: p.1). Seburn and Seburn (2000) preliminarily grouped Canadian threatened and endangered species by geographic distribution, habitat and threats, using cluster analysis. Determining how closely species match within groups, and over what factors they cluster, can help inform decision making on which recovery approach would be most appropriate for a given situation, group, or individual species. They found that few groups were closely matched and therefore most of the species at risk were quite different from one another. However, their proposed groupings were tentative in nature and based only on one grouping technique. Also, there were a number of correctable errors in the information database used in the study. Therefore, further investigation into the usefulness of cluster analysis to group species at risk should be considered (Seburn and Seburn, 2000).

Lessard (2002), studied "variants" – species grouped "on the basis of two major non-exclusive factors: interspecies synergies (sympatry, taxonomic proximity and/or a common threat); and resolution of interspecies management conflicts" (p.1). Lessard attempted to identify when a multi-species approach might be considered appropriate, and the report was meant to be a tool for species at risk managers to use in identifying which approach to pursue under different circumstances.

Lessard's (2002) detailed analysis included assessing the advantages and challenges of the different possible variants (i.e. sympatry, taxonomic proximity, common threats, and grouping based on interspecies management conflict resolution). Sympatric species were defined as those, "whose ranges overlap, in whole or in part, at least during the breeding season." This variant would require defining a spatial range common to the species addressed in the plan. Lessard (2002) stated, "sympatry of the species at risk appears, in fact, to be the essential grouping factor" (p.10), however, it is suggested that because of increased administrative and ecological complexity associated with grouping based on sympatric species alone, this variant should be combined with other grouping factors.

Lessard (2002) stated that although grouping taxonomically-related species has similar disadvantages in terms of increased complexity, these are significantly reduced by the fact that species are related and there are fewer stakeholders involved. Also, this variant helps eliminate the information redundancy associated with developing multiple single-species strategies, which could allow a multi-species recovery strategy to be prepared more rapidly. This will generate financial savings however, in doing so, care must be taken to ensure the specific needs of each species are not ignored. "This variant appears to retain much of the simplicity of single-species plans" (p.13). Lessard

(2002) recommends that if a number of species at risk occupy the same area (i.e. have high sympatry), then it may be prudent to form taxonomically-linked subgroups of species, "to permit more narrowly defined and hence more efficient recovery actions" (p.13).

Lessard (2002) also looked at grouping species based on similarity of threats, and found recovery strategies can be focused, aimed at reducing a particular threat, and thus may be more effective at promoting recovery of the species. However, the relationship between the species and the threat must be clearly established in order to ensure that reducing the threat will indeed contribute to recovery of the species. By grouping common threats, "monitoring becomes easier, since what we are looking for is a precise cause and effect relationship between reduction of the threat and recovery of the species concerned" (Lessard, 2002: p.14). Also, this variant offers certain advantages in terms of public perception. Although, grouping based on threat similarity alone may be too focused in some situations, "the effectiveness of this type of recovery strategy will be enhanced if the species are sympatric" (Lessard, 2002: p.15).

The second factor for species grouping that Lessard (2002) examined was grouping based on interspecies-management conflict resolution. For example, "when the actions proposed by the recovery plans for two (or more) species are contradictory, this approach makes it possible to resolve these conflicts by seeking a compromise between management strategies" (Lessard, 2002: p.16). To be effective this type of multi-species plan must include a detailed study of the relationship between species and with their environment. If a compromise that is favourable to all species involved cannot be reached, it is conceivable that a value judgement would need to be made, and to facilitate this it would be necessary to establish action priorities (Lessard, 2002). This may be a costly recovery approach, and would require a high degree of monitoring. If single-species recovery strategies are developed for each species, "it may be useful to incorporate them in a single action plan" (Lessard, 2002: p.17).

Clark and Harvey (2002) argue that grouping species based on threats is the key to successful multi-species recovery planning. They state that, "prudent use of multi-species plans may be the most effective strategy when listed species face similar threats…grouping species based on taxonomic and geographic similarity may allow plans to be developed for a greater number of species, but the main concern should be threat similarity" (Clark and Harvey, 2002: p.661). Moore and Wooller (2004) support this position, stating, "multi-species plans appear best for managing threats" (p.6). A panel of SAR practitioners agree, stating that although "all methods of grouping are viable…it is important to consider or analyze the commonality of identified threats in the grouping, to ensure efficiency in recovery actions" (Cunnington et al., 2003).

Clark and Harvey (2002) explain how grouping species according to threats helps practitioners resolve conflicts between species early in the recovery planning process; however, there is some debate as to when these conflicts can be effectively mitigated within a multi-species recovery plan and when single-species plans would be more appropriate. To illustrate, Clark and Harvey (2002) give an example of U.S. water

management plans potentially pitting snail kites against wood storks, which require different and conflicting water levels. In this case, "the USFWS successfully addressed the threats facing both species through a multi-species recovery plan (Jewell, 2000 in Clark and Harvey, 2002). Conversely, the case of sea otter and abalone recovery on the west coast of Canada illustrates an instance where practitioners felt multi-species recovery planning would not work. Sea otters are a keystone species (Wilkinson et al., 2003); however they feed on abalone, another species at risk. Although a multi-species recovery strategy may seem appropriate here, individual recovery strategies were developed for both sea otter and abalone because attempts at combining them proved to be too complex and not efficient for recovery, since their needs and threats are so different

Clark and Harvey (2002) recommend that the USFWS develop a quantitative tool for evaluating when and how individual species should be included in multi-species recovery planning, and they suggest using a modified version of their Threat Similarity Index to do so. They recommend adapting already existing quantitative algorithms for forming groups that maximize similarity within groups (such as Pielou, 1977 in Clark and Harvey, 2002), to define groups of species that could be managed as units within larger plans (Clark and Harvey, 2002). They explain that by carrying out threat similarity analysis on the large number of species in the U.S. without recovery plans, this will help determine where species should or should not be grouped, and how. In conclusion Clark and Harvey (2002) state "implementation of multi-species recovery plans will only be simpler and more cost effective if species are grouped into plans, or management units within larger plans, to efficiently mitigate or eliminate common threats" (p.661).

In a thematic mapping exercise of species at risk within Large Ocean Management Areas (in Canada), Thaumas Environmental Consultants (2004) employed an integrated planning and management approach to species at risk protection. Core areas for listed species were mapped to find any overlap, and thus identify priority areas for protection. The exercise identified assemblages of species within the same core habitats, and recommended multi-species management of these areas. They note, "there are great management efficiencies in dealing with groups of species in the same ecotype vs. species by species. Habitat protection for the assemblage simplifies guidelines and EA [Environmental Assessment]". Also, a multi-species management approach is most appropriate since integrated management takes an ecosystem-approach to planning. This is because "stock" management alone does not result in species recovery, and consideration has to be given to both trophic balance and food webs, as well as a broad range of stressors (Thaumas Environmental Consultants, 2004). This approach to core area identification is another type of tool with potential for use in recovery planning for marine species at risk

Practice

A number of SAR practitioners, as well as academics and biologists, have noted various species groupings for which multi-species or ecosystem-based recovery strategies may

be appropriate. Multi-species recovery strategies have been recommended in future recovery planning for:

- shark species currently being assessed by COSWIC;
- four Atlantic skate species, of which two are currently being assessed by COSEWIC and two are listed as high priority on the COSEWIC candidate list;
- nine Pacific rockfish species listed as high priority on the COSEWIC candidate list (COSEWIC, 2005).

A strategy for Atlantic skate species might even include cod, or other marine fish likely to be listed in the future, as they are often by-catch in the skate fishery and therefore share somewhat similar threats.

Researchers also suggested that co-occurring groundfish at risk might make good candidates for multi-species recovery strategies since fisheries for these stocks can overlap, and they are currently under the same management structure. However, multi-species strategies would likely only be appropriate for taxonomically similar groundfish species and not all will have similar habitats or life histories.

There are much stronger correlations found within taxonomic groups, as for example within skates or gadids (family Gadidae). One possibility is to combine species within the same taxonomic group, up to family, within one multi-species plan, since within family, genus, and species, they maintain strong enough commonalities to be considered as having similar life history strategies, thus they will react to threats in a comparable manner. But then some species vary significantly enough, even within genera, to make combining them based on shared taxonomy alone completely inadequate. Therefore the importance of taking both taxonomy and biology into account, especially with species we do not know much about, was emphasized by researchers.

Ecosystem-based recovery strategies are recommended for coastal watersheds containing anadromous fish species at risk, as has been undertaken at various locations in the U.S. Also, recent attempts at identifying spatially distinct marine regions, such as World Wildlife Fund's marine landscape mapping initiative (WWF and CLF, 2004) or Kostylev's (2004) benthic classification scheme, could be used to define "ecosystem" boundaries. Species at risk found within these boundaries could be grouped within a single ecosystem-based recovery strategy. Finally, for marine species it may be more appropriate to focus recovery efforts where migratory species congregate, e.g. spawning, feeding and nursery grounds. In doing so this may make multi-species strategies, or even ecosystem-based strategies more effective and efficient.

There is potential for inclusion of multi-species, and particularly ecosystem-based recovery strategies, in ecosystem-based management in the marine realm, particularly in places where Fisheries and Oceans is already engaged in Integrated Management (IM) initiatives, such as ESSIM (Eastern Scotian Shelf Integrated Management). In IM initiatives, mechanisms are being established to spatially organize activities and conservation efforts within defined boundaries.

There are also sociological aspects to consider in recovery planning, including who are the "stakeholders", how many groups need to be consulted, and the potential for conflict. The IM structure helps facilitate and coordinated the various "interests" that would need to be involved in developing effective and efficient ecosystem-based recovery strategies. It should be a priority of SAR practitioners to make recovery strategies as user-friendly as possible, which may be easiest to accomplish, especially for multi-species and ecosystem-based recovery planning, within the IM framework.

An alternative "multi-plan" approach

In an effort to avoid the complexity sometimes associated with multi-species or ecosystem-based recovery plans and experience in a few freshwater initiatives (e.g. the Sydenham example), some SAR practitioners and researchers have suggested an alternative approach to recovery planning. A number of sources have recommended doing initial and more cursory single-species *recovery strategies* for listed species (being careful to address all *SARA* requirements), and then combining overlapping species in a multi-species, ecosystem-, or landscape-based *action plan*.

This approach would be especially useful with highly migratory marine species or those with highly variable life histories, characteristics that are hard to incorporate in multi-species or ecosystem-based recovery strategies. For example, some marine fishes (e.g. sharks) have highly variable life histories even within the same family, thus a multi-species strategy to address similar threats may inadequately address the critical or key threats to individual species, or the needs of the most vulnerable species in the group. Thus, the benefits of this alternative approach are that individual species needs can be addressed, and species-specific goals set out quickly within the recovery strategy (as is required by *SARA*) but, where there is overlap in species' range and/or threats, the commonalities and interactions between these species, and with their ecosystem, can be addressed together in a common action plan. ROMAN (National Recovery Working Group, 2004) acknowledges this possibility stating, "the scale may differ between recovery strategy development, action plan development and recovery implementation" (p.23).

The idea of using more than one plan type is supported by Moore and Wooller (2004), who recommend that the benefits of using multiple plan types be considered, especially where critically endangered species are involved. They believe there is value in, "having landscape plans within which are embedded multi- and/or single species plans for high priority species" (p.11). Lessard (2002) also supports this idea, as do Clark and Harvey (2002) who state, "seriously endangered species might best be served by their inclusion in both a multi-species plan, in which the threats they face are addressed in context of other species and/or the ecosystem, and a single-species plan, in which more detailed information peculiar to recovery of that species can be presented" (p.661). They identify the Florida panther as a good example of this approach, where this endangered cat has its own recovery plan while also being included in the South Florida MSRP.

This approach would also allow SAR practitioners to be more proactive in recovery planning. As species are listed, practitioners could produce *SARA*-compliant single-species recovery strategies within the required timelines. At the same time, practitioners could be developing multi-species action plans, which may even include species still being assessed by COSEWIC. If species under assessment share similar threats, taxonomy and habitat with currently listed species then their recovery should be addressed together, and in this situation could be done within a multi-species action plan.

Another option is single-species recovery planning followed by ecosystem-based management, including management plans developed for species listed as Special Concern. An example of this is the sea otter and abalone, where each species has an individual recovery strategy and individual action plans, their management is highly integrated, as well as with that of killer whales. This approach may fit nicely within DFO's integrated management initiatives, where resources are being allocated towards ecosystem-based management, and where there are strategies in place for incorporating various management needs.

Conclusions

1) There are very few multi-species recovery plans for marine species at risk. Those that do exist are relatively new and are primarily for megafauna, therefore, criteria for deciding when to embark on multi-species recovery planning, grouping of target species and determining the effectiveness of the approach has yet to be properly assessed.

2) The primary concern of SAR practitioners and researchers is that multi-species recovery plans may result in an insufficient level attention paid towards individual species within the plan. In fact, multi-species plans in the U.S. and Australia have in some cases been shown to be less effective at species recovery compared to single-species plans. In part, this perception may be biased as there has been a tendency to group lesser-known species with better-known species therefore diluting the overall effectiveness. This concern is less relevant in Canada as the Species At Risk Act (2002) requires species-specific information on: biology, life history, and species' needs; identification of threats and critical habitat; as well as a statement on population and distribution objectives. Nevertheless, care must still be taken to ensure the key or critical threats facing each individual species are identified and mitigated by the strategy.

3) Ecosystem-based recovery strategies are defined as those that address all species, habitats, and interactions in an ecosystem, but only identify recovery goals for species listed at risk in that ecosystem. Given the urgency to develop strategies for those species at risk, an ecosystem-based recovery strategy may impose an undue burden of effort that could, in many situations, impact on the quality and time to develop the strategy. In marine systems knowledge gaps and complexities associated with ecosystem level research are so considerable that recovery strategies, based on this approach may not be possible or practical. An alternative approach may be to first develop a thorough single-species recovery strategy followed by multi-species or ecosystem-based action plans and management plans, as appropriate.

Recommendations

1) Decision sequence for recovery planning

The decision to embark on a single, multi-species or ecosystem-based recovery strategy will be specific to each situation. The following is a recommended general sequence of steps in the decision process, based on our review and consultations.

- Provide an assessment of the state of knowledge on the individual species at risk, the associated ecosystem, and the overlay of threats in an initial evaluation stage.
- Determine the appropriateness of applying a multi-species recovery strategy (e.g. when threats and habitats are shared and species are taxonomically similar) such that risk assessment for each species is not compromised.
- Develop a multi-species recovery strategy if feasible at the onset or, alternatively, develop single species strategies first, followed by multi-species and/or ecosystem-based action and management plans.

2) Methodologies for Recovery Planning

The application of multi-species recovery planning is in its infancy and thus there are no clear criteria for when and where to apply the approach nor are there well developed methodologies for grouping of species. Various grouping techniques have been applied (e.g. cluster analysis, threat similarity index) but further testing and comparisons among them are required.

Decisions on whether to apply multi-species recovery strategies require further empirical research. An evaluation of case studies will help to determine their effectiveness for species at risk recovery (see Boersma et al. 2001; Clark and Harvey, 2002; Moore and Wooller, 2004). Research is also required for the creation of an effective and efficient management model for recovery planning as part of the Integrated Management framework for Canada's oceans.

References

Angermeier, P.L. and J.E. Williams. 1994.Conservation of imperiled species and reauthorization of the Endangered Species Act of 1973. Fisheries. 19(1): 26-29.

Boersma, P. D., P. Kareiva, W.F. Fagan, J.A. Clark and J.M. Hoekstra. 2001. How good are endangered species recovery plans? BioScience. 51(8): 643-650.

Boyes, B. 2001. Multi-species local recovery planning: benefits and impediments. Community Biodiversity Network: Projects. (http://nccnsw.org.au/member/cbn/projects/LifeLines7.1/Bioreg_Sp.html).

Brigham, C.A., A.G. Power and A. Hunter. 2002. Evaluating the internal consistency of recovery plans for federally endangered species. Ecological Applications. 12(3): 648-654.

Canadian Wildlife Service. 2002. Special report: custom-designing recovery. Recovery: an endangered species newsletter. Canadian Wildlife Service. (http://www.speciesatrisk.gc.ca/publications/newsletter/june02/rec21e.pdf).

Carroll, R., C. Augspurger, A. Dobson, J. Franklin, G. Orians, W. Reid, R. Tracy, D. Wilcove and J. Wilson. 1996. Strengthening the use of science in achieving the goals of the Endangered Species Act: an assessment by the Ecological Society of America. Ecological Applications. 6(1): 1-11.

Clark, J.A. and E. Harvey. 2002. Assessing multi-species recovery plans under the endangered species act. Ecological Applications. 12(3): 655-662.

Committee on the Status of Endangered Wildlife in Canada. 2005. COSEWIC homepage. (http://www.cosewic.gc.ca/eng/sct5/index_e.cfm).

Cunnington, D.C., D.M. Poll and P.C.F. Shepherd. 2003. Approaches to multi-species recovery planning: species at risk workshop summary. In Making ecosystem based management work: proceedings of the fifth international conference on Science and Management of Protected Areas (SAMPAA V), May 11-16, 2003; Victoria, B.C. (http://www.sampaa.org/PDF/ch10/10.1.pdf).

Department of Environment and Heritage (Australia). 2004. Recovery plans. Biodiversity: Threatened species and threatened ecological communities. (http://www.deh.gov.au/ biodiversity/threatened/recovery/index.html).

Department of Fisheries and Oceans. 2004. Species: recovery planning. Aquatic species at risk. (http://www.dfo-mpo.gc.ca/species-especes/species/species_recoveryPlanning_e.asp).

Environment Australia. 2000. How to go about preparing a recovery plan. Recovery plan guidelines for nationally listed threatened species and ecological communities under the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 In Boyes, 2001.

EUROPA. 2004. Nature and biodiversity homepage. European commission: environment. (http://europa.eu.int/comm/environment/nature/).

Franklin, J.F. 1993. Preserving biodiversity: species, ecosystems, or landscapes? Ecological Applications. 3(2): 202-205.

Gislason, H., M. Sinclair, K. Sainsbury and R. O'Boyle. 2000. Symposium overview: incorporating ecosystem objectives within fisheries management. ICES Journal of Marine Science. 57: 468-475.

Hoekstra, J. M., J.A. Clark, W.F. Fagan and P.D. Boersma. 2002. A comprehensive review of Endangered Species Act recovery plans. Ecological Applications. 12(3): 630-640.

Jewell, S.D. 2000. Multi-species recovery plans. USFWS Endangered Species Bulletin. 25(3): 30-31.

Kostylev, V.E. 2004. Habitat management template for Scotian Shelf habitat mapping. In Arbour, J., Chairperson. 2004. Proceedings of a Benthic Habitat Classification Workshop Meeting of the Maritimes Regional Advisory Process: Maintenance of the Diversity of Ecosystem Types -- Benthic Classification and Usage Guidelines for the Scotia-Fundy Area of the Maritimes Region. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2004/004.

Leonard, P. 2003. Letter to the editor. Conservation Biology. 17(3): 656.

Lessard, I. 2002. The multi-species approach to species at risk recovery: analysis of the different variants. Prepared for Giles Seutin, National Coordinator, Species at Risk Program, National Parks Branch, Parks Canada.

Livingston, P.A., K. Aydin, J. Boldt, J. Ianelli and J. Jurado-Molina. 2005. A framework for ecosystem impacts assessment using an indicator approach. ICES Journal of Marine Science. Article in Press.

Lundquist, C.J., J.M. Diehl, E. Harvey and L.W. Botsford. 2002. Factors affecting implementation of recovery plans. Ecological Applications. 12(3): 713-718.

Moore, S.A. and S. Wooller. 2004. Review of landscape, multi- and single species recovery planning for threatened species. WWF Australia.

National Recovery Working Group. 2004. Recovery handbook (ROMAN). Working draft. Recovery of Nationally Endangered Wildlife (RENEW), Ottawa, Ontario.

NOAA Fisheries. 2004. Recovery Plans. Office of Protected Resources: Species information. (http://www.nmfs.noaa.gov/pr/PR3/recovery.html).

Pikitch, E.K., C. Santora, E.A. Babcock, A. Bakun, R. Bonfil, D.O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E.D. Houde, J. Link, P.A. Livingston, M. Mangel, M.K. McAllister, J. Pope and K.J. Sainsbury. 2004. Ecosystem-based fishery management. Science. 305: 346-347.

Rohlf, D.J. 1991. Biological shortcomings of the Endangered Species Act. Conservation Biology. 5(3): 273-282.

Seburn, C. and D. Seburn. 2000. Grouping species at risk for recovery planning: final report. Report to Endangered Species Division, Canadian Wildlife Service.

Simberloff, D. 1998. Flagship, umbrellas, and keystones: in single-species management passé in the landscape era? Biological Conservation. 83(3): 247-257.

Species at Risk Act, S.C. 2002, c.29. (http://laws.justice.gc.ca/en/s-15.3/text.html).

Staton, S.K., A. Dextrase, J.L. Metcalfe-Smith, J. Di Maio, M. Nelson, J. Parish, B. Kilgour and E. Holm. 2003. Status and trends of Ontario's Sydenham River ecosystem in relation to aquatic species at risk. Environmental Monitoring and Assessment. 88: 283-310.

Tear, T.H., J.M. Scott, P.H. Hayward and B. Giffith. 1995. Recovery plans and the Endangered Species Act: are criticisms supported by data? Conservation Biology. 9(1): 182-195.

Thaumas Environmental Consultants. 2004. Thematic mapping of Species At Risk within Large Ocean Management Areas. Unpublished report.

U.K. Biodiversity Action Plan. 2004. Action plans in the U.K. U.K. BAP website. (http://www.ukbap.org.uk/GenPageText.aspx?id=54).

U.S. Federal Caucus. 2000. Conservation of Columbia Basin fish: final basinwide Salmon recovery strategy, Vol. 1. (www.salmonrecovery.gov).

U.S. Fish and Wildlife Service. 2005. Listed FWS/Joint FWS and NMFS species and populations with recovery plans. Threatened and endangered species system. (http://ecos.fws.gov/tess_public/TESSWebpageRecovery?sort=1#E).

Wilkinson, T., T. Agardy, P. Simona, L. Rojas, D. Hyrenbach, K. Morgan, D. Fraser, L. Janishevski, H. Herrmann and H. De la Cueva. 2003. Marine species of common

conservation concern: protecting species at risk across international boundaries. In Making ecosystem based management work: proceedings of the fifth international conference on Science and Management of Protected Areas (SAMPAA V), May 11-16, 2003; Victoria, B.C. (http://www.sampaa.org/PDF/ch12/12.4.pdf).

Witherell, D., C. Pautzke and D. Fluharty. 2000. An ecosystem based approach for Alaska groundfish fisheries. ICES Journal of Marine Science. 57: 771-777.

World Wildlife Fund Canada and Conservation Law Foundation. A Planning Framework for Marine Conservation. Maintenance of the Diversity of Ecosystem Types: Benthic Classification and Usage Guidelines. In Arbour, J., Chairperson. 2004. Proceedings of a Benthic Habitat Classification Workshop Meeting of the Maritimes Regional Advisory Process: Maintenance of the Diversity of Ecosystem Types -- Benthic Classification and Usage Guidelines for the Scotia-Fundy Area of the Maritimes Region. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2004/004.

Zabel, R.W., C.J. Harvey, S.L. Katz, T.P. Good and P.S. Levin. 2003. Ecological sustainable yield. American Scientist. 91: 150-