Science, Policy and Species at Risk in Canada

A.O. Mooers¹, D.F. Doak², C.S. Findlay³, D.M. Green⁴, C. Grouios⁵, L.L. Manne⁵, A. Rashvand⁵, M.A. Rudd⁶, & J. Whitton⁷

Running Title: Science, Policy and Conservation

Keywords: Endangered species, critical habitat, deadlines, independence, listing, recovery, survival, transparency.

Article Type: Forum

Manuscript Word Count: 3084

References: 33; Figures: 3; Tables: 1

1. Biosciences Department, Simon Fraser University, Burnaby BC Canada.

2. Zoology Department, University of Wyoming, Laramie WY USA.
   <ddoak@uwyo.edu>

3. Institute of the Environment, University of Ottawa, Ottawa, ON Canada
   <findlay@uottawa.ca>

4. Redpath Museum, McGill University, Montreal PQ Canada.
   <david.m.green@mcgill.ca>

5. Zoology, University of Toronto at Scarborough, Scarborough ON Canada.
   <arashvand@richmondhill.ca>, <chris.grouios@utoronto.ca>. Current address for LLM: Biological Sciences, City University of New York, NY USA
   <Lisa.Manne@csi.cuny.edu>
6. Sir Wilfred Grenfell College, Memorial University of Newfoundland, Corner Brook NL Canada. Current address: Environment Department, University of York, Heslington, York, United Kingdom. <mr642@york.ac.uk>

7. Botany Department, University of British Columbia, Vancouver BC Canada. jwhitton@interchange.ubc.ca

* author for correspondence: <amooers@sfu.ca>, Biosciences Dept. Simon Fraser University, 8888 University Dr., Burnaby BC, V5A 1S6, Canada, tel. +1 778 782 3979; fax +1 778 782 3496, amooers@sfu.ca
Abstract

The meaningful incorporation of independent science advice into effective public policy is a hurdle for any conservation legislation. Canada's young Species at Risk Act (SARA 2002) was designed to separate the science-based determination of whether a species is at risk from the decision to award it legal protection. However, thereafter, the input of independent science into policy is not clearly identifiable. Audits of the Species at Risk Act have identified clear deficiencies in the protection and recovery of listed species; for example, of the 176 species legally protected in 2003, only one has a legal implementation plan for its recovery. We argue that clearly distinguishing science from policy at all relevant steps would increase the scientific integrity, transparency, accountability, and public acceptance of the legal listing and recovery implementation processes in SARA. This delineation would also clarify exactly what trade-offs are being made between at-risk species recovery and competing policy objectives.
Introduction

For many aspects of policy-making, especially regarding such environmental issues as endangered species conservation, the input of sound and reliable scientific knowledge is a requirement (Dybas 2006; Bean 2009). In practice, the translation of scientific information into policy is difficult (Hunt and Shackley 1999). Scientific evidence may be called mere scientific "claims" in a complex argument between world views. However, understanding and delineating the essential role of science in the policy-making realm is necessary for fostering a constructive dialogue between competing interests and agendas (Sarewitz and Pielke 2007) to form effective environmental policy (Martín-López et al. 2009).

Endangered species legislation is a major framework for the delivery of science advice into conservation policy. Much has been written of the 35-year-old US Endangered Species Act (ESA, 1973; see, e.g. Schwartz 2008) but Canada's much newer Species at Risk Act (SARA 2002) is only now undergoing its first statutory review by the Canadian federal government. This offers opportunities to draw lessons for creating or improving legal frameworks to protect biodiversity, particularly with regard to the role of independent scientific advice in the policy-making process.

Here, we review the key elements of SARA. We outline an important strength and several important shortcomings of SARA, in terms of both the statute design and its implementation, and offer suggestions as to how these shortcomings might be addressed. Our main conclusion is that the implementation of environmental legislation such as
SARA requires a very clear delineation between all natural and social scientific inputs and the political trade-offs made when deciding on what to do.

The Current Process: design and intent

Assessment of species.- The SARA process (Figure 1A, box A) begins with assessment of species by the independent Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC uses biological criteria, aboriginal and traditional knowledge and input from many stakeholders to prioritize and assess Canadian wildlife species as extirpated, endangered, threatened, of special concern or not at risk. The criteria for status assessment are patterned after the IUCN scheme (Mace et al. 2008), and delineate legally-defined “wildlife species” using the concept of a “designatable unit” (Green, 2005). These designatable units meet the same criteria of discreteness and evolutionary significance used to identify distinct population segments in the United States (Hutchings and Festa-Bianchet 2009).

COSEWIC identifies wildlife species suspected of being at risk and commissions status reports for those given highest priority. Draft reports are first reviewed by the relevant jurisdictions (i.e. federal agencies or provinces and territories), by scientists in the relevant species specialist subcommittees of COSEWIC and by aboriginal traditional knowledge holders. The subcommittee’s final draft recommendation is then discussed by all COSEWIC members before COSEWIC makes a status recommendation for the species to the federal government. The government ultimately decides whether to add that species to the SARA registry. This process thus draws on broad input and over 100
people generally comment on any one report. COSEWIC status assignments are made public on their website following wildlife species assessment meetings. Thus SARA incorporates a science-based prioritization and assessment of wildlife species independent of legal listing decisions. Note that COSEWIC considers neither the feasibility nor the cost of recovery, nor the social or political ramifications of its assessment decisions. At time of writing 598 wildlife species are on COSEWIC’s list of wildlife species at risk. While COSEWIC’s list of wildlife species at risk has grown steadily (Figure 2), the rate of growth is primarily a reflection of the rate at which COSEWIC can assess those wildlife species requiring examination.

Under SARA, COSEWIC’s recommendations impose no federal duty to list a wildlife species. The Government of Canada has three options: accept COSEWIC’s recommendation to legally list a wildlife species; decline the recommendation, in which case the responsible Minister must provide reasons; or return the issue to COSEWIC for further clarification. In making listing decisions, the federal government considers input from public consultations and internal economic assessments in addition to COSEWIC's scientific assessment (Figure 1A, box B).

After listing.- As soon as a wildlife species is listed as endangered or threatened, individuals and their dwelling places are automatically protected on Federal Land. SARA typically applies only to federally-managed lands and waters and species; the responsibility for protecting wildlife species on lands managed by provinces and
territories usually falls to the province/territory, although aquatic species and migratory birds are managed by the federal government under pre-existing statutes.

Listing also initiates a two-step recovery planning process, the first step of which is development of a Recovery Strategy (RS; Figure 1A, box C). This identifies threats to the wildlife species and its needs, as well as population and distribution objectives for recovery. Recovery strategies can be contentious because of their potential socio-economic implications. The next step is development of a Recovery Action Plan (RAP) (Figure 1A, box D). RAPs put the strategy into action by specifying concrete recovery measures and evaluating potential socio-economic impacts of these actions. Both the Recovery Strategy and the Recovery Action Plan must identify critical habitat, the habitat that is necessary for a listed species’ survival or recovery (SARA, s.2.(1)), to the extent possible. Once defined, the federal government must protect critical habitat on Federal land (which totals 4% of Canada’s 10 southern provinces as well as most of the three northern territories) and the Act is clear that the government can move to protect critical habitat outside of Federal lands if it chooses to (though notably it has never chosen to). The government must report on recovery progress for each species every five years.

There is no separate process for de-listing wildlife species under SARA; in Canada, wildlife species at risk are simply reassessed by COSEWIC at least every ten years. Such reassessments offer one window into the trajectory of Canada’s imperiled wildlife: since the inception of COSEWIC in 1977 (pre-dating SARA), wildlife species that have been assessed more than once have moved to a more imperiled status nearly twice as often as
they have moved to a less imperiled status (52:27, P < 0.01, sign-test; Table 1). Though
deteriorating status could in particular cases be due to changes in available information,
the pattern is consistent with a need for concerted action.

Critique

*Independent assessment and legal listing.*- There are limits to administrative capacity and
SARA instructs that priority for assessment should be given to those species that are
more likely to become extinct. Candidate species for assessment are themselves
prioritized by COSEWIC according to a combination of probable threat, taxonomic
distinctiveness, geographic extent and endemism, all of which require data. Furthermore,
an assessment of “data deficient” triggers neither more research under *SARA* nor
automatic reassessment. Such designations may be more common for taxa for which
there is less taxonomic expertise and this taxonomic deficit may become a more acute
problem in the future as attention turns to invertebrates.

The separation of assessment from legal listing has implications. It can provide
government with an opportunity to avoid or delay the costs and consequences of
protecting imperiled wildlife species: as of December 2007, the federal government has
chosen not to list a taxonomically and geographically non-random 23% (60/252) of
wildlife species recommended by COSEWIC since *SARA* was enacted in 2002 (Findlay
et al. 2009). However, the framework also allows a time window for stakeholders and
civil society to become more involved in the legal listing process when consultations take
place. Most importantly, the framework allows for a transparent separation of science and
Science, Policy and Conservation

policy, providing the opportunity both for accurate and science-based assessments and for an unequivocal government response. We see this as the primary strength of SARA.

Significant weaknesses in later stages of listing and recovery are described below.

Incomplete economic considerations in listing decisions.- While SARA makes no mention of economic analyses at the listing stage, it is Canadian government policy to review the economic implications of any regulatory change such as a listing (Government of Canada 2007). A key component of reviews under Canadian legislation is the Regulatory Impact Assessment Statement (RIAS). When developing a RIAS prior to a listing decision, government policy analysts are directed to work with scientists and resource managers to develop plausible scenarios for economic cost-benefit and impact analyses based on the best available information. The depth of analysis is dictated by the potential economic consequences of regulatory change. Government guidelines recognize the need to account for the economic value of public environmental goods (Government of Canada 2007). Economic impact analyses, which address short-term distributional issues regarding jobs and economic spin-offs at the regional level may also be conducted when sufficient data are available. Thus there is a framework for making evidence-based, informed economic SARA decisions, and such economic concerns have been given as an explicit reason in 50% of the cases (10 out of 20) where listing has been denied outright (Findlay et al. 2009).

In spite of the clear RIAS framework, there are several challenges to informed decision-making, all compounded by the nine-month legally mandated timeline for making a
listing decision (SARA s.27.(3); note, this timeline is often extended due to an apparent loophole in the legislation, see Mooers 2004). The initial choice of plausible scenarios to analyze is unclear. There is also substantial uncertainty about the potential impacts of listing vs. not listing under any scenario and significant technical challenges with economic cost-benefit analyses for RIASs.

For species listings with potential impacts on industry or economic interests, there has been a focus on short-term, regional economic impacts (e.g. local jobs, business spin-offs). As is typical in policy analyses focused on regional impacts, attention is deflected from long-term, national benefits to Canadian society as a whole (Vining and Boardman 2007).

This is evident in SARA listing decisions. In one egregious example, listing was denied for the porbeagle shark, Lamna nasus, in part due to the costs to a single community that derived 2% of its total landings value and two fishers who earned <25% of their gross revenue from the porbeagle shark fishery (DFO 2006): preliminary data available at the time of the non-listing decision estimated the porbeagle shark’s non-use value to Canadian society at tens of millions of dollars annually (Rudd 2009).

While we see the explicit incorporation of economic analysis as a reasonable part of the SARA process, it has often failed to live up to its potential. This is perhaps because it comes too early (Findlay et al. 2009), perhaps because of a lack of general policy analysis capacity within government (Lindquist and Devereaux 2007), or perhaps because
economic analysis is not supplied as independent science advice but is embedded in a non-scientific policy-based framework (Figure 2A, box B).

*Recovery Strategies: ineffective meshing of science and policy.*- The production of Recovery Strategies has been slow (Figure 3) and problematic. The problems may flow from having science input that is too deeply embedded in a policy framework (Figure 1A, box C). While a choice of minimal conservation goals may be a legitimate societal decision, there should be clarity as to whether the goals are arrived at based on science or socio-economic considerations.

As mandated under *SARA*, population and distribution objectives are crucial goalposts for species recovery, and must be specified in Recovery Strategies (*SARA* s.41.1.(d)). Transparent conservation decisions are dependent on clarifying the biological meaning of key terms that are not defined in the Act, such as *survival* and *recovery*. Because *critical habitat* is defined as the habitat “necessary for the survival or recovery” of a listed wildlife species (*SARA*, s.2.1), the quantity and location of critical habitat (and associated socio-economic impacts) and permitting will be sensitive to the biological interpretation of *survival* and of *recovery*. Permitting for activities that affect listed species are also based on belief that such activities will not “jeopardize the survival or recovery of the species” (*SARA* s.73.3.(c)). One standard interpretation of survival from the scientific literature based on minimum viable populations (which are widely viewed as the minimum unit for species conservation, see, e.g. Traill et al. 2007) would, following IUCN criteria, characterize *survival* as >90% chance of species persistence over at least
100 years. Not meeting the definition of the minimum viable population for survival would trigger listing of a species as at-risk in Canada, in the US, and internationally (COSEWIC 2006; Doremus 1997; Mace et al. 2008). The Federal Government of Canada has suggested policy whereby *survival* would mean maintaining the current population in the “short term” (DFO 2005). It is therefore important to ask whether a benchmark of 100 years is considered “short term” in Canadian policy: for a species already listed as at-risk of extinction, merely maintaining its current population size for some limited time (e.g. till the next COSEWIC re-assessment, in 10 or fewer years) would provide little assurance of continued survival.

*Recovery* has been defined in Canadian policy as “long-term persistence” (DFO 2005) or simply where decline is “arrested or reversed” (italics added; NRWG 2005). The definition of long-term must be clarified here. The ‘or’ in the second definition is also potentially important, as the easier goal (arresting decline) could become a policy default. Arresting decline may be enough action for the few species with large population sizes that are still widely distributed, but nonetheless considered imperiled. However, recovery as restoration, rather than merely the arrest of decline, implies higher benchmarks with respect to population size and distribution.

Critical habitat designation has been hampered for several reasons. To begin, though the law is clear that the precautionary approach must be followed (*SARA* s.38), and that critical habitat must be identified to the extent possible based on the best available information (*SARA*, s.41.(1)(c)), such habitat has been identified for just 23 of the 104
species with finalized recovery strategies (see also Figure 3), and so for only 23/447 or roughly 5% of listed species.

Recovery Strategies for two species (the Greater Sage Grouse and the Nooksack Dace) that omitted known critical habitat were successfully challenged in court in 2009 (Alberta Wilderness Association et al. vs. Minister of the Environment, 2009 FC 710; Environmental Defense Canada et al. vs. Minister of Fisheries and Oceans, 2009 FC 878). Although these precedent-setting lawsuits may lead to the official identification of some critical habitat in other Recovery Strategies, we wonder whether litigation or the fear of litigation is the most efficient approach for identifying the critical habitat needed to achieve recovery.

Currently, the government oversees the preparation of Recovery Strategies, though it usually has sought some outside scientific advice. However, the government ministries involved may have conflicting interests that could impact the final scientific content of these strategies. We suggest that the process of writing an official recovery strategy could benefit from being made more like the two-step listing process, with unbiased scientific proposals that meet clear goals being followed by clear government responses.

Recovery Action Plans: lost in the fog.– RAPs detail the specific recovery projects and activities that need to be implemented to recover species, and also analyse potential costs and benefits. They are intended to be developed and implemented by biologists, managers, economists and stakeholders, with scientific guidance from the Recovery
Science, Policy and Conservation

Strategy. Although voluntary recovery activities have been initiated for many species (Office of the Auditor General of Canada 2008), only one single wildlife species, the Banff Springs snail, *Physella johnsoni*, whose entire range is in a National Park, has a legally-accepted RAP (Figure 3). It is important to note that if critical habitat is not described in the initial Recovery Strategy, there are no legal timelines for identifying and so protecting such habitat because RAPs themselves have no legal timeline for completion. This means that much effort can be expended in a legal process of identifying, listing, and strategizing for the eventual recovery of a species with no certainty that the process will ever lead to action on the ground.

Conclusions

To ensure accountability, environmental legislation needs to clearly delineate the role independent science plays in implementation. *SARA* is one of a widening net of endangered species protection laws that have slowly spread around the world: by our count, at least 36 countries now have legislation to identify and protect species threatened with extirpation or extinction. To its credit, *SARA* was written to explicitly incorporate both scientific and economic concerns, and in a few places the law seems to limit consideration to purely scientific issues when appropriate (e.g. listing assessments, critical habitat identification, and the determination of the feasibility of recovery). In many other cases *SARA* also allows for the quantification of economic costs and benefits. This emphasis on economic analysis and planning is arguably better embodied in *SARA* than, for example, in the United States ESA (Illical and Harrison 2007). In theory, more explicit and transparent consideration of competing governmental priorities might avoid
Though the assessment process itself might be improved (see, e.g., Lukey and Crawford 2009), it does offer a clear delineation between independent science and policy. Following COSEWIC’s recommendations, however, the legal listing, recovery planning and implementation phases of SARA do not offer this delineation. These phases have been identified as problematic, such that hard choices are simply being put off to some indeterminate future (Office of the Auditor General of Canada 2008).

In particular, we suggest that both social and natural sciences must better inform independent social and economic analyses that are necessary to decide whether a wildlife species is listed. One simple improvement would be to subject the scenario choices and the resulting evaluations to independent, non-governmental, peer review (Mooers et al. 2007). Whether extra emphasis on this important stage would require longer mandated timelines in conjunction with interim legal protection is worth considering, as is how these evaluations would flow into the recovery phase. In the same vein, we recommend timely independent peer review and oversight both of Recovery Strategies and Recovery Action Plans, as is policy under, e.g. the United States ESA (Carden 2006).

In general, a structural separation of information gathering and interpretation (i.e. scientific advice) from strategic planning and action (i.e. policy and implementation) seems an excellent basis on which to proceed (Hutchings et al. 1997). This would be best
served by extracting all the science-based aspects of the conservation process – assessments of biological status, of critical habitat and threats, population and distribution objectives, and economic analysis – as discrete modules that would produce independent and transparent scientific advice to feed back into a political process (Figure 1B) with attendant hard deadlines. The need for a mandated framework for the delivery of such independent scientific advice into a subsequent political process is an important hurdle in improving SARA, and may be also be an important component for environmental legislation elsewhere.

Acknowledgements

This is publication 001 from the Canadian Institute of Ecology of Evolution (CIEE) and the Scientific Committee on Species at Risk. We thank Art Weiss and the Canadian Society for Ecology and Evolution, M. Gross and L. Rowe for support, and J. Rosenfeld and two anonymous reviewers for critical technical input and advice. AOM, DMG, SCF, LMM, and JW are each supported by NSERC Discovery Grants, and MAR by the Canada Research Chairs programme.

References


DFO (Department of Fisheries and Oceans). 2006. Potential socio-economic implications of adding porbeagle shark to the list of wildlife species at risk in the Species at Risk Act (SARA). Fisheries and Oceans Canada.


Biology 19: 1813-1820.


Tables and Figures

Table 1. Changes in risk status accorded by COSEWIC. Entries below the diagonal represent deterioration, and entries above the diagonal represent improvement in cases where COSEWIC has assessed species more than once. Numbers in brackets refer to the subset of wildlife species that have been re-assessed since legal listing under SARA. For consistency, only reassessments using COSEWIC’s IUCN-based criteria both times are used whereas emergency assessments and instances where the designatable units had changed significantly are not. Listings to more imperiled status predominate over listings to less imperiled status. Data from published COSEWIC reports <http://www.cosewic.gc.ca>

<table>
<thead>
<tr>
<th></th>
<th>to: Extirpated</th>
<th>Endangered</th>
<th>Threatened</th>
<th>Special Concern</th>
<th>Not at Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>from: Extirpated</td>
<td>27 (4)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endangered</td>
<td>2</td>
<td>98 (24)</td>
<td>5 (1)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Threatened</td>
<td>29 (7)</td>
<td>43 (15)</td>
<td>7</td>
<td>3 (1)</td>
<td></td>
</tr>
<tr>
<td>Special Concern</td>
<td>3</td>
<td>12 (2)</td>
<td>28 (10)</td>
<td>9 (1)</td>
<td></td>
</tr>
<tr>
<td>Not at Risk</td>
<td>1</td>
<td>2</td>
<td>1 (1)</td>
<td>2 (2)</td>
<td>14 (2)</td>
</tr>
</tbody>
</table>
Figure 1. Schematics of the Canadian Species at Risk Act. a. Current structure, highlighting independent science activities (in white), and activities that are a mix of policy and science (in gray).

b. Potential modification highlighting enhanced separation of science activities (in white) from government action (ochre). In this scheme, independent, peer-reviewed science offers transparent input to government decision-making.

Figure 2. Assessment of imperiled wildlife species in Canada. Numbers of species designated by COSEWIC in the “At-risk” categories of Extirpated, Endangered, Threatened, and Special Concern according to taxonomic group from 1977 to the present. Data from published COSEWIC reports <http://www.cosewic.gc.ca>

Figure 3. Listing and protection of imperiled wildlife species in Canada. For the cohort of 176 wildlife species legally listed as Threatened (black bars) or Endangered (white bars) in SARA upon its full inception June 5th 2003, the numbers of species that have accepted Recovery Strategies, that have accepted Recovery Action Plans and for which critical habitat is at least partially identified, all as of March 3, 2009. Under the law, all 176 recovery strategies were to be finalized by June 5th, 2007 at the latest. There are a further 20 Recovery Action Plans that are now overdue based on the deadlines set in their respective Recovery Strategies. All data compiled from the SARA Public Registry (http://www.sararegistry.gc.ca).
**a**

1. **Status assessment (By COSEWIC)**
   - Science-based
   - Policy and science

2. **Legal listing process**
   - Public Consultation, Social-economic analysis
   - Automatic Prohibitions, Legal Listing

3. **Recovery planning process**
   - Draft recovery strategy, Identification of critical habitat
   - Final recovery strategy

4. **Recovery implementation**
   - Recovery action plan
   - Implementation and monitoring
   - Identification of critical habitat

5. **Periodic reassessment**

**b**

1. **Status assessment (By COSEWIC)**
   - Independent science
   - Government action

2. **Legal listing process**
   - Socio-economic analysis
   - Public consultation, Legal listing

3. **Recovery planning process**
   - Draft recovery strategy
   - Identification of critical habitat
   - Final recovery strategy

4. **Recovery implementation**
   - Recovery action plan
   - Implementation and monitoring
"At-risk" wildlife species (COSEWIC assessments)

Number of species


- Plants
- Fishes
- Birds
- Mammals
- Invertebrates
- Amphibians and reptiles