Canadian Environmental Assessment Agency
Research and Development Monograph Series

A decision support tool to aid in evaluating significance of adverse effects on birds for environmental assessment

By David Kirk

2001

Government of Canada Gouvernement du Canada

Canada

A decision support tool to aid in evaluating significance of adverse effects on birds for environmental assessment

by David Kirk

2001

This report was prepared with the support of the Research and Development Program at the Canadian Environmental Assessment Agency. The views, conclusions and recommendations expressed herein are those of the authors and do not represent the views of the Canadian Environmental Assessment Agency or the Government of Canada.

Table of Contents

En105-63/2001E
0-662-86255-4

List of Acronyms

AA	Average Abundance
ABI	Association for Biodiversity Information
AI	Area Importance
BBS	Breeding Bird Survey
BCP	Bird Conservation Plan
BCR	Bird Conservation Region
BD	Breeding Distribution
CBO	Colorado Bird Observatory
CDC	Conservation Data Centre
CEAA	Canadian Environmental Assessment Agency
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CVWMA	Creston Valley Wildlife Management Area
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DST	Decision Support Tool
EA	Environmental Assessment
EP	Enbridge Pipeline
ESA	Ecologically Sensitive Area
ESEIA	Environmental and Socio-Economic Impact Assessment
GIS	Geographic Information System
GSWSP	General Status of Wild Species Project
IBA	Important Bird Area
MBS	Migratory Bird Sanctuary
NABCI	North American Bird Conservation Initiative
NAWMP	North American Waterfowl Management Plan
ND	Non-breeding Distribution
NEB	National Energy Board
NP	National Park
NWA	National Wildlife Area
PIF	Partners in Flight
PT	Population Trend
RENEW	Recovery of Nationally Endangered Wildlife
RMBO	Rocky Mountain Bird Observatory
RP	Responsibility by Population
RR	Responsibility by Range
SCP	Southern Crossing Pipeline
TB	Threats on Breeding Grounds
TN	Threats on Non-breeding Grounds
VEC	Valued Ecosystem Component
WOW	Wings Over Water

1.0 Introduction

Evaluating the significance of potential environmental impacts that may be incurred during development is a key step in environmental assessment (EA) and, to the greatest extent possible, must be based on objective scientific information. Various indicators of significance have been identified by the Canadian Environmental Assessment Agency (CEAA); these include statistical significance, ecological significance, social importance, and health and safety considerations (CEAA 1999, FEARO 1999a,b). Significance in EA is assessed on the basis of the extent, duration, likelihood, and magnitude of effects, as well as the potential for recovery of the environmental component.

Often threshold levels of effects are used, and these are based on environmental standards, guidelines, and objectives. When such thresholds have not been identified, as is often the case, professional judgment plays a role in decision-making and may be based on extensive local knowledge. Answers to many of the questions posed during an evaluation of significance are based on professional value judgments. For example, unless there are other follow-up EA examples from other parts of the region, it is often difficult to assess how long it will take for a site to recover from a development action; thus, value judgments must be made.

In 1984, Beanlands and Duinker developed an ecological framework for EA, using the concept of valued ecosystem components (VECs). Different VECs may be selected for different EAs and help focus the analysis on key issues that are relevant from an ecological, scientific and social perspective. Birds are usually important VECs to consider. This is because they are ubiquitous, occurring in almost every habitat, and because the federal government has a mandatory responsibility to protect migratory birds through the *Migratory Birds Convention Act* (1917) and maintain avian biodiversity, through the Biodiversity Convention, birds are typically considered VECs in most EAs (see Milko 1998 a,b).

In evaluating the significance of effects on VEC species such as birds, ideally we need to know the following:

- What proportion of the population will be affected by the development, in terms of altered survivorship or reproductive rates (<1%, 1–10%, or >10%)? How much habitat for individual species will be affected by the development?
- How much of the population or habitat could recover, with and without mitigation?
- How long would it take for this recovery to occur (<1 year, <1 generation, 1–10 years or 1 generation, >10 years or >1 generation)?

Clearly, the answer to the last question will vary according to species; those with a high reproductive rate and capacity for increase (relatively "r-selected") will recover within a much shorter time period than long-lived species that have low reproductive rates (relatively "K-selected").

Most of the above questions simply cannot be answered in routine EAs. Unless developments affect a protected or otherwise ecologically important area for which there has been a wildlife inventory or the proponent specifically conducts avian surveys, it is unlikely that abundance data will be available for many bird species. This is especially the case for species that are widespread but occur at low density, such as landbirds. Even if abundance data are available (e.g., for colonially nesting waterbirds, for which total counts can be made), the regional or national population may be unknown. This is important in order to assess the proportion and component of the population (e.g., breeders, non-breeders or juveniles) that may be affected by the development, either through increased mortality or decreased reproductive success. In reality, even simple species lists are often lacking for many EAs, and an appraisal is made by assessing habitat to identify candidate bird species at a site. This makes it difficult to provide a context for evaluating the significance of environmental impacts on migratory birds.

In most EAs the main focus is on species at risk (e.g., those listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or those on provincial red or blue lists) or species with special nesting requirements (e.g., diurnal raptors or owls sensitive to disturbance and which are subject to specific legislation dealing with buffer zones around nests).

A different approach that may be adopted is to try and identify a priori candidate bird species that are a priority for conservation action and could occur in an area; if these species are present at a development site, then limited resources can be directed towards ascertaining the importance of the site, the significance of development, and the potential for mitigation of effects on these priority species. It is emphasized that these may be "common" or rare species, thus the focus is expanded from 'species at risk' to a wider pool of species.

This project deals with determining ecological significance — that is, the importance of development project-induced changes from an ecological perspective. Its goal is to develop an objective, standardized, nationally consistent, biologically based system to assess the significance nationally of potentially adverse effects on migratory birds using birds. It builds on earlier work investigating the potential for assessing significance of impacts on birds in EA using various information sources (Kirk 2000). Specifically, the objectives are to:

- develop an electronic decision support tool (DST) that will aid in determining significance in EAs using birds;
- establish general principles for selecting appropriate prioritization systems for the evolution of the DST; and
- test the DST model using two Canadian examples.

The DST is intended to assist in the process of determining significance, not to replace any existing structure or process. It is designed only to aid in evaluating the significance of adverse effects on birds and does not provide a measure of significance for other components of EA. It is important to clarify that the DST will help in identifying when

further investigations may be required and will not provide all of the answers for EA for birds. In particular, quantitative information on priority species abundance is needed to fully evaluate significance.

While the DST is intended for use principally by EA practitioners, it may also prove useful to avian scientists and consultants providing expert advice for EAs, since its aim is to facilitate the use of the best available scientific information. Note that much of the information compiled in the DST is not currently available elsewhere in this form. Many people are unfamiliar with the priority-setting schemes available or specifically with the approach taken by the North American Bird Conservation Initiative (NABCI) and its latest developments. This provides an opportunity to develop a standardized national approach that will improve the scientific credibility of EA across the country. However, because of the large scale of bird conservation regions (BCRs), local knowledge and site specifics are still critical components of EAs. At the final phase of the DST, it is likely to be necessary to contact local Canadian Wildlife Service (CWS) or other avian experts.

2.0 Background

2.1 Why are birds important?

In most ecosystems, birds play a critical role in food webs as tertiary predators, consumers of invertebrates, seed dispersers, and pollinators. This ecosystem role extends to an economic one. In forests, birds can reduce the frequency of insect outbreaks and thus indirectly increase tree growth (Marquis and Whelan 1994); in farmland, their predation on invertebrate pests has been shown to have a significant economic benefit (Kirk et al. 1996). As well, birds have been used as indicators of environmental change (Furness and Greenwood 1993) — for example, for monitoring contaminant levels in the Great Lakes (Hebert et al. 1999), lake acidification (Blancher et al. 1992), pesticides in the environment (Ratcliffe 1967), and, more recently, climate change (Brown et al. 1999, Both and Visser 2001).

Partly because birds comprise the majority of vertebrate fauna in most terrestrial habitats and they are highly visible, probably more is known about them than about any other taxa, humans excepted. The latter is also due to the fact that birds are highly valued by people, and many organizations and individuals spend large amounts of time and money on their conservation. In the past, birds were valued largely for consumptive purposes and feathers for the millinery trade, and legislation introduced to protect birds was in direct response to declining populations (e.g., the *Migratory Birds Convention Act* 1917). An important step in North American bird conservation is the shift of focus from birds of utilitarian value to all bird species, including non-game species such as migratory songbirds. Another reason that so much is known about birds is that they are easily identified and surveyed, relative to other taxa; counting birds at a single point in a forest or grassland allows the collation of data on a whole suite of species (Hutto 1998). Hence, their populations have been monitored over long periods of time in many countries.

2.2 Bird conservation initiatives

Long-term monitoring (e.g., over 30 years in the case of the North American Breeding Bird Survey [BBS]; Dunn et al. 2000) can indicate the status of species populations — that is, whether they are increasing or decreasing. In the late 1980s, analyses of BBS data suggested that many species of migratory songbirds in North America were declining (Robbins et al. 1989). Similarly, recent concern has been expressed about declining farmland birds in Europe and North America (Fuller et al. 1995; Kirk et al. 2000). Many shorebirds were almost hunted to extinction in the late 19th century (e.g., Eskimo Curlew) (scientific names of bird species occurring in Canada that are listed in DST are provided in Appendix 3); it was concern about these and other species which led to the implementation of the *Migratory Birds Convention Act* (1917).

In direct response to concerns over the conservation of bird populations in North America, four major initiatives have been developed:

- the North American Waterfowl Management Plan (NAWMP);
- Partners in Flight (PIF), a tri-national umbrella organization with the goal to conserve non-game birds and their habitats throughout North America;
- Shorebird Conservation Plans (developed independently in the United States and Canada); and
- Seabird and Colonial Waterbird Conservation Plans (again developed independently in the United States and Canada).

While these initiatives differ in many respects, they share a common objective of prioritizing goals for conservation of avifauna.

In November 1998, NABCI, a multinational umbrella organization, was established to provide a strategy for the conservation of birds and their habitats throughout North America and to coordinate the efforts of other conservation initiatives. The NABCI vision is a regionally based, biologically driven, and landscape-oriented process for bird conservation. A strong focus is coordinating conservation strategies that will maintain or enhance populations of species to desired levels (targets) and to reverse population declines. Thus, NABCI is proactive, in that it aims to prevent species from becoming threatened or endangered, with the concomitant curtailing of expensive recovery programs.

3.0 Methods

3.1 Integrating comments on draft DST

In 2000, a report was produced for CWS of Environment Canada to investigate the possibility of using avian priority-setting systems and other initiatives to evaluate significance in EA (Kirk 2000). This report reviewed the different types of prioritization systems that were available, determined which ones were most applicable to EA, and also examined other sources of information, such as protected areas databases and waterfowl management plans. In addition, this report outlined, in preliminary form, a series of steps that may be taken during EA using these different data sources.

This first-level analysis concluded that such information may be useful in determining significance. It was recommended that the best prioritization system on which to focus was the NABCI-PIF one, because this provided a more objective evaluation of species' status rather than other schemes, which tend to focus on rarity. However, prioritization under NABCI-PIF is constantly changing (and has changed dramatically since Kirk 2000). Thus, it is difficult to communicate specific information because it is so variable; a regularly updated web site was considered most appropriate to provide the platform for a DST. This led to the development of the current DST.

Comments were solicited on this report from CWS EA regional coordinators and CWS avian scientists. This report reviewed different sources of information on birds, including NABCI priority-setting initiatives, and provided a preliminary decision tree. Development of the DST presented here involved the preparation of a modified draft decision tree (substantially updated and developed from the draft decision tree in Kirk 2000). This was then distributed to CWS avian scientists and CWS EA regional coordinators, and comments were solicited. The comments received were then collated in a summary report to CEAA.

3.2 Selection of DST software — technical considerations

The following features were identified as top priorities for candidate software:

- It could be easily modified and updated (especially considering the state of flux of the avian priority-setting process).
- It had the capacity to incorporate algorithms to manipulate and transform data.
- It could be interactive and allow a user to submit entries (select from lists of bird species).
- It could provide a printed report.

It was suggested that software such as Adobe Acrobat was suitable for development of the tool because it could provide the horizontal forms needed to provide the backbone of the DST. However, Adobe Acrobat is inflexible with regards to modification and cannot provide an interactive capacity to the extent required. Therefore, web-based applications were investigated.

As a result of extensive consultation with experts, it was decided to use a web-based application. "ColdFusion" was by far the best option for implementation of the tool. ColdFusion has the advantage that it is extremely flexible and user-friendly, is well supported by government, and has been on the market for many years. It is also well established, unlike some newer software, such as ASP.

Delivery of the DST is in a series of "horizontal" forms. Thus, on any given page, a user is faced with only 2–3 questions, rather than a long and daunting single-page survey. How these questions are answered determines the next set of questions that are presented. The system allows a user to create an account, generate a record by filling out the forms, and then have an administrator review the record. The user can later edit his or her submission.

3.3 Access to DST

A critical consideration early in this project was how users would access the DST for appraisal purposes. A stand-alone web site (e.g., Wet Kit) was not feasible within the time frame or budget of this project, since it would necessitate purchase of a server and software. Also, a stand-alone site could not be implemented in a phased approach, whereas a site that is part of an existing government web site could be. This was an extremely important consideration.

It is hoped that the DST can be incorporated into an existing federal government web site, following a trial period of one year during which it will be tested and reviewed. In the interim, the DST would need to be accessible to a restricted audience (EA practitioners) on a secure site; this site was set up according to government standards and EC format. In its initial first phase, the DST is available in English only; French translation was not possible within the time frame and budget of the current project.

3.4 Data compilation and management

Extensive data compilation was necessary for the DST database. Maps were downloaded from web sites and saved in a standard software (.jpg or .bmp files). In addition, an electronic database of protected areas was referenced on the Natural Resources Canada web site.

The main database (NABCI-PIF priority lists for all BCRs in Canada) was obtained from the Rocky Mountain Bird Observatory (RMBO, previously Colorado Bird Observatory, CBO), which hosts this information (see DST for web site links — http://www.suburbiasystems.ca/birdea/index.cfm). This database was modified to include only those fields relevant to Canadian avifauna (at that time, seven main criteria). For example, the United States has an avian "watch list," which is not applicable to Canada, so this field was dropped. It was critical to obtain permission to use this database, since RMBO wishes to hold responsibility for the original data (M. Carter, pers. comm.).

It is planned by PIF-Canada to update the lists produced by RMBO for Canadian BCRs. The reason for this is multifold. First, the RMBO lists are recognized as being preliminary, and many species are missing, particularly for Canadian BCRs. Second, the mechanism by which species reach the priority pool is different in the two countries. For example, species that are on provincial red lists or blue lists will reach Tier IV (federally listed species or species of local management concern) for the Canadian component of BCRs, whereas such species will not be included for the United States. When the BCR database has been completely updated by regional PIF-Canada coordinators, the DST could reference the web site. However, for use in the DST, the data would then need to be manipulated using an algorithm.

It was suggested that databases and other material be incorporated directly into the DST, because of the excessive time needed to link to web sites. This may be appropriate for some of the material (e.g., a map of the BCRs); however, using electronic copies of maps within the DST raises the question of who will update the maps. Linkages to web sites have the advantage that the very latest information is available, or at least e-mail addresses of personnel to contact are available. This is critical in relation to the bird priority-setting database (list of species in each BCR with the scores for each of the seven criteria and the priority pool they are assigned). Although in the interim it is planned to incorporate the RMBO priority-setting database directly into the DST, this has still to be updated and must be negotiated further with RMBO. As mentioned above, how Canadian concerns will be incorporated into this database is not yet known.

As a component of Step 2 (see Section 5.1) in the DST, birds had to be categorized by habitat type. This is because for many EAs no bird species list will be available. Therefore, a candidate bird species list needs to be constructed for the site. While an exhaustive list is available for all BCRs in which developments potentially occur, this needs to be pared down to the species that could occur in the habitats affected by the project development (i.e. ground truthing needs to be carried out).

To categorize bird species by habitat, it was decided that an existing system should be adopted. Many types of habitat classification systems exist, from the extremely complex Nature Conservancy (TNC) system to the simple system used for the Breeding Bird Survey database and CANBIRD (an EC web site). Ideally, the habitat classification adopted would have been a standardized scheme used and recognized by PIF-US and PIF-Canada. However, although the PIF web site provides bird conservation plans (BCPs) for different physiographic regions, these categorize only a few priority species by habitat. Despite extensive consultation with PIF-US and PIF-Canada regional coordinators, no standardized PIF scheme was found to exist. This is something that may be developed in the future as BCPs are developed.

Having a standardized habitat scheme at a national scale may not be appropriate, because habitat categories are also likely to vary by BCR; for example, a particular type of wetland in BCR 11 may be categorized quite differently from a wetland in BCR 9. Other habitat classification schemes investigated included the habitats in the CANBIRD database (Environment Canada web site), which are also used for the BBS. These were considered too coarse a scale for the purposes of the DST (wetland, grassland, shrub, coniferous, deciduous, urban), and many habitats were missing (e.g., coastal, tundra). By contrast, The Nature Conservancy habitat classification was too complex. The classification used by the US Geological Survey Geographical Approach to Planning for Biodiversity (http://www.gap.uidaho.edu/) was chosen. This provided a simple but sufficiently detailed classification to categorize all bird species in Canada by habitat. The habitats were Unvegetated, Developed, Agricultural, Open Water, Wetland, Non-forested, Deciduous/Hardwood Forest, Deciduous/Conifer Forest, and Conifer Forest.

Most databases were prepared and edited in Microsoft Excel; they were then imported into Microsoft Access.

4.0 Identifying the Best Available Biological Information

4.1 Sources of avian scientific knowledge

North American Bird Conservation Initiative (NABCI)

NABCI has several different components and includes NAWMP, PIF, Shorebird Conservation Plans, and Seabird and Colonial Waterbird Conservation Plans, as well as the Important Bird Area (IBA) program (Commission for Environmental Cooperation 1999):

- The *North American Waterfowl Management Plan* (NAWMP) was initiated in 1986 in direct response to declining populations of hunted waterfowl species, which comprise about 7% of North America's avifauna. Its principal goal is to enhance the capacity of landscapes to support waterfowl (NAWMP 1998). Through its regional Joint Ventures, NAWMP has set management goals and population targets for waterfowl species; these can be used as benchmarks to assess significance of impacts in EA.
- *Partners In Flight* (PIF) was launched in 1990 in response to declining populations of Neotropical migrants (species that breed in the Nearctic and spend the non-breeding season in the Neotropics of Mexico, Central America, and South America). It is a trinational effort (between United States, Canada, and Mexico) and is composed of partnerships among federal, state, and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. PIF is now subdivided into PIF-US and PIF-Canada and has expanded its responsibility to include all landbirds; in the near future, PIF may expand again to incorporate other bird species groups. PIF has recently completed avian priority-setting for all landbirds and other species for all BCRs in the United States and Canada (see BCR map in DST at http://www.suburbiasystems.ca/birdea/step2.cfm). These lists are currently being modified based on local knowledge; two such lists have been finalized, one for BCR 9 (Great Basin) and the other for BCR 11 (Prairie Potholes), and the remainder are under way. The lists of priority species are the core database to be used in the DST.
- Two shorebird conservation plans exist: the US *Shorebird Conservation Plan* and the *Canadian Shorebird Conservation Plan* (Hyslop et al. 1999). These plans are broadly similar and are expected to become more closely aligned in the near future. Priority-setting has been carried out for all shorebirds; the system used differed from that used for landbirds for the reasons mentioned above. The aim is to collaborate with PIF to produce one priority-setting system (Kennedy 2000). Priority lists of shorebirds provide the core database for the DST.
- *Wings Over Water* is a strategic plan to prioritize conservation priorities for seabirds and colonial waterbirds (Donaldson et al. 2000). The counterpart plan in the United States is the *North American Colonial Waterbird Conservation Plan*; as is the case for shorebirds, the goal is to synchronize efforts between Canada and the United States. Again, priority lists of seabirds and colonial waterbirds provide the core database for the DST.

- *Important Bird Areas* is an international program to identify areas for bird conservation and was developed by BirdLife International; it is spearheaded (in Canada) by Bird Studies Canada (BSC) and the Canadian Nature Federation (CNF):

The reason that different initiatives have been set up for different species groups is a result of tradition; their life history strategies, conservation issues, and importance to humans are very different. NAWMP was developed in response to perceived and actual declines in waterfowl populations, partly as a result of wetland habitat loss and possibly over-hunting. Direct management action for waterfowl can be undertaken by management and creation of wetlands across North America, to increase the capacity of landscapes to support waterfowl populations for hunting purposes. Shorebirds are widely distributed at low density on their breeding grounds (often in remote arctic tundra, where almost their entire populations may be centred), but on migration and on the wintering grounds they concentrate in huge numbers at a few stopover sites. By contrast, most seabird species breed in colonies (e.g., huge aggregations of Thick-billed Murres on cliffs in the Canadian Arctic), but in the non-breeding season can be widely dispersed at sea.

Not only do these groups vary in their dispersion patterns, but other life history characteristics differ widely; many seabirds, for example, have delayed maturity (meaning they must be at least several years old before they can breed), have a low reproductive rate, and may recover slowly from population perturbations. By contrast, landbirds are generally widely dispersed on the breeding areas, concentrate at stopover sites on migration, and are similarly widely dispersed in the non-breeding season (although many species forage in flocks in the Neotropics). However, many landbirds, such as those that spend the boreal winter in the tropics, face many threats, including habitat fragmentation and loss of breeding and non-breeding areas, direct mortality on migration, and destruction of stopover sites.

Other sources of information on migratory birds

As well as initiatives that fall under NABCI, other types of information are also available to the EA practitioner. These include provincial bird lists and local checklists compiled by local birders. Note that these are incorporated in the DST in a hierarchical screening process to check that all available sources of information have been scrutinized. Other information, such as the BBS population trends, is already incorporated into the scoring system. Species Recovery Plans are also relevant and available from Recovery of Nationally Endangered Wildlife (RENEW), as well as other Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists (http://www.cosewic.gc.ca/) and provincial "species at risk" lists (the Association for Biodiversity Information ABI-Canada has a web site with links to Canadian Conservation Data Centres — http://www.abi-canada.ca/english/map.htm); one extremely relevant information source that collates much of this information is CANBIRD, and a web site link is provided for this database (http://www.cws-scf.ec.gc.ca/canbird/pif/ p_title.htm). A protected areas database is now available at the Geogratis web site. As well, a large amount of information is available on the location of protected areas, such as Migratory Bird Sanctuaries (MBSs), National Wildlife Areas (NWAs), Ramsar sites, Important Waterfowl Habitat Areas, and Ecologically

Sensitive Areas (ESAs). A web-based source of information for southern Ontario that uses GIS to allow matching of lists of priority bird species with specific development sites is at http://www.bsc-eoc.org (Couturier 2000).

4.2 Selecting appropriate biological information for EA

One of the keys for conducting a scientifically defensible EA is knowing which types of information are appropriate and which are not. In this DST, emphasis is placed on prioritization systems that consider many aspects of species ecology, not just rarity. In some respects, priority-setting under NABCI-PIF is no different from other types of conservation priority-setting. What sets NABCI's goals apart is that instead of focusing on endangered or threatened species, its aim is to conserve biodiversity (keeping common species common) by maintenance of bird species populations and their habitats. Within NABCI, there is also an emphasis on habitat-centred rather than species-centred conservation (see Section 4.3), in that there has been a shift from single species to guilds of species (those sharing similar habitat, for instance). In this sense, the Multi-Initiative Species Assessment protocol is proactive, in that it seeks to prevent species from becoming so uncommon that special attention is warranted, such as listing (federally or provincially) under endangered species acts. Recovery plans and other conservation efforts for endangered species are extremely costly, and a fundamental goal of NABCI is to avoid such last-ditch conservation attempts.

Modern conservation is beginning to focus on a unified approach — for ecosystems, landscapes, and habitats that conserve suites of species, rather than single-species conservation; in fact, the entire NABCI-PIF conservation planning process has such a goal as its basis. By implication, most other prioritization schemes have focused, and continue to focus, on rarity, whether or not this is implicit. For example, the priority-setting scheme deployed by the General Status of Wild Species Project (GSWSP) does not provide a special category for species that are still widespread and abundant (and for which Canada may have high responsibility by range or population) but are showing long-term population declines. Numerous species that are in this special concern group are listed as "secure" by the GSWSP (e.g., Long-tailed Duck, Common Eider, Connecticut Warbler, Rusty Blackbird). Yet species that are on the periphery of their range but are extremely common in the United States are given high ranks. From an EA perspective, focusing solely on single species and rarity is inappropriate.

In the same way that single species-centred conservation is artificial, in that it does not evaluate all species and their habitats, so the differentiation of bird species into different groups (waterfowl, colonial waterbirds, shorebirds, and landbirds) is an artifact of history (traditionally these species are dealt with separately because of different life history strategies, economic importance, and conservation concerns). Thus, recent priority-setting has been developed independently for these different species groups. In some respects this is necessary, because of their different life history strategies, as mentioned above. However, it is a current stated goal of PIF to develop a unified approach so that all bird groups are incorporated into the same standardized system. This is a sensitive area of development, and in order to harmonize priority-setting it is important that

PIF landbird committees are cognizant of the views and concerns of other bird species committees (those for waterfowl, shorebirds, and colonial waterbirds), otherwise groups may feel alienated.

4.3 Habitat versus species approach

A multifaceted combined habitat and species-centred approach is in keeping with the goals of modern conservation biology. One strong feature of the DST is that it combines both of these aspects. Both are needed to develop sound conservation strategies. Habitat concerns enter the DST from the perspective of protected or other ecologically important areas (not just whether developments are actually in protected areas, but whether developments will have repercussions on protected or other ecologically important areas). Second, habitat is a component, in that ultimately target areas will be set for different habitats within BCRs (e.g., maintain 10–20 large forest patches within the regional study area) under the BCPs being developed. Such a concept will require the incorporation of cumulative effects — probably using GIS. Third, habitat is incorporated into the hierarchical screening process (BCR — habitat — provincial/local checklist) in instances where no bird species list is available at a development site.

4.4 The changing state of avian biological information and its availability

Critical components of the DST were identified as the following:

- The tool must be easily updated because of the state of flux in avian priority-setting.
- The web site hyperlinks that are used must relay the best and most up-to-date information.
- The tool must be simple to use and comprehensible to non-experts.
- Web site hyperlinks must be minimized to the greatest extent possible to reduce user time.
- The tool cannot replace local knowledge or expertise.

Avian priority-setting under NABCI-PIF is still in a state of flux and has changed considerably since Kirk (2000). Concern has therefore been expressed that future changes to databases used in the DST would not be communicated to EA practitioners or other end-users who might remain unaware of critical developments. The most up-to-date and complete information currently available for all BCRs in Canada is housed at the RMBO. Note that a relatively recent development is that the data currently displayed on the RMBO web site have now been adapted to BCRs as well as physiographic regions.

The reason that the lists generated by PIF-US/NABCI-PIF and housed at RMBO require updates is that while they contain lists of species in all bird groups (waterfowl, shorebirds, seabirds, colonial waterbirds, landbirds) for all BCRs, many species omissions and errors exist, and the priority lists of species generated may differ from those potentially generated in Canada. This was demonstrated by verifying a list produced specifically for BCR 9 in British Columbia with the RMBO list (see Appendix 1). A unified approach (combining

the priority-setting systems for seabirds and colonial waterbirds, shorebirds, and landbirds) is close to completion following several meetings of NABCI-PIF (in Patuxent in January 2001, in Mexico in February 2001).

The RMBO lists use BBS data extensively. However, the BBS has limited coverage in Canada and certainly does not provide adequate data for the three uniquely Canadian BCRs. The RMBO lists also do not reflect all of the Canadian concerns (e.g., stewardship responsibility score RR); they are therefore currently being updated by Canadian PIF regional coordinators.

It is intended that these lists be updated based on local knowledge in Canada and input by PIF-Canada regional coordinators. An extremely important point is that the database at RMBO is based on the entire BCRs (transboundary ones included), but thus far the Canadian vetted priority lists are relevant only to the Canadian component of the BCRs. This partly accounts for why so many differences were found between the RMBO list for BCR 9 and the one compiled by PIF-Canada (see Appendix 1). A second point is that the PIF-Canada vetted lists are currently focused only on landbirds (with some shorebirds of conservation concern, e.g., Long-billed Curlew in BCR 9), while the RMBO BCR lists include all species groups. This has a number of implications; cross-validation may be required between these two lists in the interim while the BCR lists are being vetted and revised by PIF-Canada. Note that for EA purposes, a list of all priority bird species, not just one for landbirds, is necessary and this is where initiatives for other bird species groups such as WOW, and the CSCP come into play.

How alterations to priority lists are to be incorporated into the RMBO database is yet to be decided, since changes made to BCR lists by Canadian PIF coordinators will have to be endorsed by RMBO and NABCI. This is important for all BCRs and especially important for the three BCRs unique to Canada, for which RMBO lists are extremely preliminary and essentially a first cut. Priority-setting databases will eventually be available as a hyperlink to the RMBO web site from a NABCI web site, but whether a hyperlink will be incorporated into the DST is yet to be decided.

While the lists from RMBO have some problems with respect to the criteria used (see below), they are the best available current information, given that the updating process by PIF-Canada may take months (perhaps years) to complete (this is being coordinated by CWS, Ontario Region). Lists will require continual updating even after they are completed when new monitoring information on populations becomes available. Although this state of flux in the information database creates some challenges in the short-term, EA practitioners can use the DST as a prototype in the interim. It is emphasized that the DST presented here is a prototype, and changes to databases will be relatively simple to implement. Note that the current database on the RMBO web site has now been updated and contains separate tiers for the wintering season. This was not used as the database for the current DST because it was not available at the time of DST development.

The lists from RMBO — the ones used in the interim DST — may be close to the final lists that will be made available and may only require fine tuning. It is important to note here that even though criteria for priority-setting have changed, sometimes dramatically, the species that are listed as of high conservation concern are usually the same or similar (E. Dunn, pers. comm.). This suggests that the process is quite robust and that results will be similar, regardless of changes in methodology.

5.0 Organizing Biological Information Into Steps for EA

5.1 An overview of the NABCI-PIF priority-setting approach

Because limited financial and human resources are available for conservation, it is important that priorities are established (Dunn et al. 1999). With this goal in mind, various scoring systems have been devised that prioritize species using objective criteria. Initially, such scoring systems focused on rare or endangered species (e.g., Master 1991; World Conservation Union 1996); however, new schemes are putting a great deal more emphasis on biodiversity considerations — in other words, maintaining populations of all species in an area or region. Such a prioritization effort for birds was begun under the auspices of PIF for the southeastern United States (Carter and Barker 1993; Hunter et al. 1993) and was later expanded to cover all of North America north of Mexico (Carter et al. 2000).

The goal of this prioritization was to be able to implement a standardized system applicable to any geographic region at any time of year. Put simply, each species is assigned a score from 1 (low priority) to 5 (high priority) for seven parameters that describe their vulnerability. These parameters include Breeding Distribution (BD), Non-breeding Distribution (ND), Average Abundance (AA), Threats to Breeding (TB), Threats to Non-breeding (TN), Population Trend (PT), and Area Importance (AI). The first three parameters are "global"; that is, a single value is given for a species over its entire range. The second three parameters may be global but are also assigned at the local level. The last parameter is always assigned locally for a specific area.

In addition, two other parameters can be used: Responsibility by Population (RP; formerly called percent population) and Responsibility by Range (RR; formerly called jurisdictional responsibility). However, there is still disagreement over the use of these criteria; only RR was included in the database, and this was available only for landbirds (E. Dunn, pers. comm.).

The descriptions of the criteria given below are derived from an unpublished document by Kennedy (2000):

- **Breeding Distribution (BD)** — This is the area of a species' breeding range (km^2 or km of coastline), which is assessed using bird distribution information from the *Field Guide to the Birds of North America* (National Geographic Society 1987) and *A Guide to the Birds of Mexico and Northern* Central *America* (Howell and Webb 1995). It assesses the vulnerability of species to stochastic events.
- **Non-breeding Distribution (ND)** — This is the area of non-breeding range (km^2 or km of coastline), and it includes distribution during migration. The score is based on the smallest area occupied (i.e., highest point of vulnerability) so that concentrations of birds are included, especially for shorebirds. Thus, a migratory shorebird species that staged in high numbers would score highly for ND.

- **Average Abundance (AA)** — This is the relative abundance (landscape scale) of a species throughout its range as an indication of vulnerability. For landbirds, AA is the number of birds per BBS route, averaged across all routes on which the species occurred during the 1990s. Instead of AA, colonial waterbird and shorebird plans use total global population (a problem with this approach is that breeding distribution and abundance are not independent).
- **Threats to Breeding (TB)** — This evaluates past, current, and future conditions that affect the ability of a breeding area to support healthy populations of a bird species.
- **Threats to non-breeding (TN)** — This is the same as threats on a breeding area, but applies to the non-breeding distribution area.
- **Population Trend (PT)** — The BBS is the standard data source, but other data sets should be used when they better represent some species groups and/or geographic areas. The longest time series of data is given precedence. Categories are as follows: 50% decline or increase over 30 years; 15% decline or increase over 30 years; stable trends score lower (2) than uncertain trends (3).
- **Area importance (AI)** — This is determined from the area of highest relative abundance from BBS and is assigned scores based on percentile categories (e.g., 50% of maximum relative abundance = 5, 25–49% = 4, etc.). It is an area-independent criterion that estimates how important the BCR is within the overall range of the species. However, for many species, the BBS provides a poor measure of abundance.
- **Responsibility by population (RP)** — This identifies regionally characteristic species for which an area has particular responsibility regardless of scores on other criteria; these are species with a high percentage of their total population in the region. The threshold is determined by the size of the planning unit; a small BCR has a low threshold, a large BCR a high one. RP is the proportion of population / proportion of area, where proportion of population = (BBS density in BCR x BCR area) / (BBS density across range x total range size) and proportion of area = (area of BCR/total size of North America south of the open boreal forest). Where BBS data are not available, a surrogate based on range can be used: (area of range in BCR / total range size) / (area of BCR / total size of North America south of tree line).
- **Responsibility by Range (RR)** — These are regionally characteristic species for which the region has stewardship responsibility regardless of scores on other criteria; these are species with a relatively high percentage of their total population in the region. As in RP, the threshold is set by the size of the planning unit (a small BCR has a low threshold, a large BCR has a high one). It is determined from the proportion of a species' North American range within a BCR. RR = (area of range within BCR / area of total range) / (area of BCR / average size of range for all North American landbirds). Average range size is approximately 6.5 million square kilometres for breeding season scores and 4.25 million square kilometres for wintering season scores.

From the first seven criteria, decision rules can be applied to place species in different categories (called tiers) and thus prioritize them for conservation action. Species are currently ranked using a tier system, but this is subject to change. A critical point is that the tiers within the NABCI-PIF priority-setting system **do not rank species in order of priority**. That is, Tier I species are not more important than those in Tier IV. Thus, within the priority-setting procedure, the take-home point is that an entire pool of priority species for conservation action is created; all of these are important to consider in EA, and, depending on the species and threats involved, different mitigative action can be taken. Note that species enter the priority pool for a broad range of reasons, and not just depending on whether they are species at risk.

Descriptions of the tiers are as follows:

- **Tier I:** all species with composite scores for the seven criteria of (22 that occur in the area in manageable numbers (i.e., AI (2). Species must have multiple concern issues and be of conservation concern across its range.
- **Tier II:** species with moderate composite scores (19–21) *and* AI = 2 *and* occurs in one of three special categories.
    - **Tier IIA:** species for which area is important relative to other parts of range and for which population trend is either negative or unknown.
    - **Tier IIB:** species for which area has a significant responsibility, even if current trends or threats are only moderate.
    - **Tier IIC:** species for which apparent threats are significant. These are species that may not yet show a negative population trend, but the future status of which is in doubt.
- **Tier III:**
    - **Tier IIIA:** species for which area has a high responsibility even if total score is low. Maintaining habitat and monitoring are necessary for these species.
    - **Tier IIIB:** species on US national Watch List, but score low within the area in question (may not apply in Canada).
- **Tier IV:**
    - **Tier IVA:** AI of 1 is sufficient, in that federally listed birds receive conservation attention wherever they occur.
    - **Tier IVB:** extremely flexible — species of local management concern (for numerous reasons) can be entered into the species pool.

Note that species do not enter the priority pool by simply summing the scores for the criteria but by using a series of decision rules. While a previous version of priority setting did use summed scores, even then thresholds (cutoff points) were devised that ensured that a species, for example, scoring 3 for all seven criteria could not reach Tier I (3x7=21, cutoff is 22). Therefore a species had to have moderate concern in all factors with an elevated concern for at least one factor; a species would be considered more at risk in this situation than if only one factor was scored highly.

Moreover it should be noted that these scores do not necessarily imply that conservation action can or must be taken. For example, a moderate score for a species may highlight the need for adequate monitoring so that we can determine if and when it is time to take action. A species that scores high on one criteria may in fact be included among a suite of high-scoring species that share similar habitat and will benefit from conservation action taken to mediate the threat to that habitat. Hence it is important to remember that these scores are only the first step in identifying species that may require conservation; determining the course of action will be determined during preparation of the conservation plan for the BCR.

Priority-setting was initially defined by PIF for "physiographic areas" that are a modification of the physiographic strata used in the BBS (Robbins et al. 1986). However, the current conservation planning unit for priority-setting is the BCR. In total, there are 37 BCRs in North America; 12 of these are in Canada. Two BCRs occur only in Alaska, three are shared between Canada and Alaska (3, 4, and 5), three BCRs are unique to Canada (BCRs 6, 7, and 8), and the remaining six BCRs are shared between Canada and the lower 48 contiguous United States (9, 10, 11, 12, 13, and 14; see BCR map in DST at http://www.suburbiasystems.ca/birdea/step2.cfm). It is intended that BCPs be developed for each BCR by regional coordinators of PIF. Ultimately, these will set desired targets for habitat and species populations; while several BCPs have been completed in the United States, as yet no BCPs have been completed for Canada.

Priority-setting for birds under NABCI-PIF is extremely useful for EA because instead of assessing the significance of developments using mainly listed species (e.g., those listed by COSEWIC as endangered or of special concern, or species red- or blue-listed by the provinces or territories), it attempts to broaden the range of priority species to include species for which Canada has high responsibility or widespread and abundant species that are showing long-term population declines. Many of the bird species that are listed by COSEWIC are at the periphery of their ranges in Canada, but have broad ranges elsewhere (e.g., Prothonotary Warbler). Conservation efforts directed toward such species are important over the long-term since species' ranges are not static; however they may have little short-term effect on overall populations. Conservation action at the periphery of the ranges of these species may prevent species range retraction, and is important for conserving biodiversity.

Evaluating significance based on rarity ignores the fact that a large proportion of the world population may occur in Canada (e.g., Common Loon, Buff-breasted Sandpiper, Connecticut Warbler), and therefore Canada has high responsibility (by range or total population) for these species. While some of the species are still common and widespread, they are vulnerable to threats in much of their range (e.g., Common Loon to lake acidification and other changes in water quality, as well as contaminants such as mercury, ingestion of lead sinkers and jigs, habitat removal and disturbance by cottage development and personal watercraft). It is important to ensure that population declines do not occur in such species as a result of nibbling loss (the cumulative impact of small effects over a wider area).

Note that factors such as harvesting, recreation, aesthetics, and cultural factors need to also be factored into an EA. These considerations are incorporated into the priority-setting process used in the DST; species of local management interest including species listed provincially, for socio-economic reasons, because they are harvested, for cultural or religious reasons, because they are eco-tourism attractions, because they are over-abundant or because of depredation or because they are representative of important habitat will enter Tier IV of the NABCI priority-setting system.

5.2 The Steps of the DST

The steps of the DST were based on the above and are as follows:

Step 1: Impacts on conservation areas

The first step is to identify:

- whether the development is to be carried out in an existing protected or ecologically important area (these include Biosphere Reserves, Conservation Authority Areas, Ecological Areas [such as estuaries, wetlands, old-growth forests, native grassland], Ecologically Sensitive Areas [ESAs], Important Waterfowl Habitat Areas [Eastern Habitat Joint Venture], Forest Educational Reserves, Heritage Areas, Important Bird Areas [IBAs], MBSs, National Parks [NPs], National Capital Commission Areas, NWAs, Provincial Parks, Ramsar Sites (some of these sites may have dual designations), Western Hemisphere Shorebird Reserve Network (WHSRN) Sites, Wilderness Areas, Wildlife Management Areas, Wildlife Protection Areas, Other Miscellaneous Conservation Areas
- whether any protected or ecologically important area could be affected by the development;
- whether the development is to occur in an area that meets all criteria but has not yet been designated; and
- whether the development is close to a protected or ecologically important area (i.e., within a buffer zone of restricted land use options) and if it could have any adverse effects.

Table 1 lists some of the different types of protected or special habitat areas in Canada. It is important to note that under certain circumstances, 1) strictly controlled developments may occur within protected areas; and 2) areas of impact may extend well beyond the boundaries of the specific development site and affect adjacent conservation areas.

Table 1: Types of avian conservation areas in Canada

Designation	Number	Criteria
Biosphere Reserves	10	Terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use.
Biodiversity hotspots		?
Ecologically Sensitive Areas (ESAs)		Various (by jurisdiction)
Important Bird Areas (IBAs)	150	Threatened species (1% of population); restricted-range species; biome-restricted species — contains 1% or more of biogeographical population; congregations of waterfowl, 20 000, 15 000, or 10 000; of shorebirds, 10 000, 5000, or 2500; of landbirds (non-raptor), 500 000
Important Waterfowl Habitat Areas	17 (in Canada)	Areas designated under management plans from each province/territory — criteria used differed by province/territory
Migratory Bird Sanctuaries (MBSs)	99	Must contain nationally significant habitat; regularly supporting at least 1% of any bird species or subspecies population
National Wildlife Areas (NWAs)	49	Must contain nationally significant habitat; regularly supporting at least 1% of any bird species or subspecies population
National Parks (NPs)	39	Various; few set up specifically for birds
Other (estuaries, wetlands, native prairie, etc.)		?
Provincial Parks	?	Six types including Nature Reserves, wilderness
Ramsar sites	36	Specific criteria for birds: >20 000 waterbirds occur at site
Western Hemisphere Shorebird Network Sites	5 (54 proposed)	Hemispheric: >500 000 shorebirds annually (30% of flyway); international: 100 000 shorebirds annually (15% of flyway0; regional: >20 000 shorebirds annually (5% of flyaway); endangered sites — critical to survival of endangered species.

Whether a development is proposed in, or close to, a conservation area, may be very important in evaluating the significance of projects for birds. Development projects that threaten strictly protected areas may have to be abandoned or relocated; other conservation areas encompass the philosophy of multiple use (e.g., Biosphere reserves) and thus mitigation may reduce effects on avian biodiversity. Note that the World Conservation Union (IUCN) provides categories for the degree of protection afforded in different conservation areas and this is relevant to EA:

- **I** Strict nature reserve/wilderness area: Protected area managed mainly for science or wilderness protection
- **II** National park: Protected area managed mainly for ecosystem protection and recreation
- **III** Natural monument: Protected area managed mainly for conservation of ecosystem type
- **IV** Habitat/species management area: Protected area managed mainly for conservation through management intervention
- **V** Protected landscape/seascape: Protected area managed mainly for landscape/seascape conservation and recreation
- **VI** Managed resource protection area: Protected area managed for the sustainable use of natural ecosystems

Steps 2 to 4 below involve a hierarchical screening of bird species lists: First, examine the complete list of species that occur in the BCR (Step 2), then select habitats within the BCR (Step 3); these lists are then matched to produce an "expected" species list (Step 4). Then screen the BCR list with the provincial list and local checklists to make sure no species are missing (Step 5). From this cross-validation process, a final list of priority species is produced (Step 6).

Step 2: Bird conservation region

There are 12 BCRs in Canada; note that only 10 are included on the web site because these were all that was available at the time. Although bird lists are now available for BCR 7 and 8 on the RMBO web site these are extremely preliminary and incomplete.

In this step, the practitioner examines the BCR map included in the DST to check in which BCR the development occurs. A development could potentially span the boundaries of two BCRs, in which case priority lists from both BCRs would need to be examined.

Step 3: Habitat

In many cases, a bird species list may not be available for a specific development site. In addition, as the test cases in the appendices show, often these lists are only partially complete, and priority species may be missing. That is, site lists are not exhaustive and cannot be relied upon to identify all priority species. Therefore, a need exists to identify the type of habitat within the BCR affected by the development. Some developments may affect many different habitats (for Test Case #1 in Appendix 1, for example, the pipeline

transected many different habitat types, and therefore all habitats would be checked in the DST). Note that most developments, except perhaps very small ones in homogeneous habitat types, will occur in several different types of habitat. It is also important to point out that many "generalist" bird species occur in many different habitats, while habitat specialists will occur in only one or a few habitats.

Step 4: Expected species list

The expected species list for the development site is derived by matching the BCR and habitat bird lists. In the test case examples (Appendices 1 and 2), all candidate priority species were identified. The list of species from the specific development site can be identified separately to assess how complete or incomplete it is.

Step 5: Local species list

Even when a site species list is available, priority lists should be screened using provincial and local checklists. These can be obtained from regional CWS staff or regional biologists with the conservation data centres (Natural Heritage Information and Conservation Data Centres; http://www.abi-canada.ca/english/map.htm).

Step 6: Priority species matching

Once a definitive bird species list is obtained for the site and narrowed down to a list of priority species, it is important to determine why species have reached the priority pool. This is very important in assessing possibilities for mitigation in the EA. For example, if a species scored highly for its narrow non-breeding distribution and no other criteria, and it spent the non-breeding season outside Canada, conservation action taken on the breeding areas in Canada may have little effect. However, if a species scored highly for its narrow breeding distribution (in the extreme circumstances of occurring only in one habitat within the particular BCR where the development was to take place), then mitigation during the EA would be critical for this species.

Step 7: Local data collection

Having identified the priority pool of species and why these species were considered important for conservation action, it would be necessary for the proponent to conduct specific surveys to assess the distribution and status of the priority species. Depending on the species, it may be necessary to carry out surveys at different times of year to encompass breeding, migration, and wintering periods. Once the temporal pattern of distribution and abundance of the priority species is known, the next step is to assess the importance of the site for these species at multiple scales (local, regional, national, and international populations). In addition, it is at this stage that cumulative effects need to be examined by incorporating impacts of other developments at the different scales. Ideally, this would be done using a Geographic Information System (GIS).

Step 8: Existing conservation

This step is an assessment of existing conservation for the priority species. Are there any protected or designated areas nearby that afford protection for the species? Could the individuals that are displaced by the development project go to these areas, or would they die or suffer reduced reproduction? This is determined by the area of a particular habitat in a region; ultimately, these types of assessment would best be made using a GIS.

Step 9: Mitigation

One of the most important steps in EA is whether mitigation can eliminate or reduce impacts of development. For example, in the first test case (Appendix 1), extensive mitigation took place to avoid wetlands important for waterbirds, by rerouting the pipeline so that it was outside the wetland area. In addition, rehabilitation of habitat took place after the pipeline was installed to restore vegetation to as natural a state as possible. In Test Case #2 (Appendix 2), it was stipulated in the Environmental and Socio-Economic Impact Assessment (ESEIA) document that activities relating to pipeline construction take place outside the breeding season of sensitive species. Moreover, nest sites of sensitive species or species at risk were given a buffer zone to minimize disturbance.

Step 10: Completion of DST, evaluation of significance, decision

The final step provides a printout of the DST steps, a list of priority bird species, and the reasons for these species being priority for conservation action. Having identified the priority species, the proponent would then need to conduct surveys to ascertain how much preferred habitat, and how many individuals occur at the site in question. What proportion of the local, regional or national habitat/species' populations does this represent?

"Decision" implies deciding how important the site is for the priority species identified, whether the effects of the development on these species can be mitigated, and whether the development should proceed as planned.

Step 11: Local follow-up

After a development has taken place, it is important that follow-up surveys are conducted to assess whether the goals identified during mitigation were reached. This is also a chance to learn from other EAs with similar impacts, habitats, or species complements.

5.3 Selection of test cases

Of the 12 BCRs in Canada, updated priority species lists have thus far been prepared only for two: BCR 9 (Great Plains) in British Columbia (K. de Groot, PIF-Canada regional coordinator, pers. comm.) and BCR 11 (Prairie Potholes) in Manitoba, Saskatchewan, and Alberta (T. Wellicome, PIF-Canada regional coordinator, pers. comm.). Because updated lists are available for BCRs 9 and 11 that have been scrutinized by Canadian avian experts, it was decided that it was most appropriate to locate test cases in these two BCRs. However, because of time constraints and other factors, the Canadian

vetted lists for BCRs 9 and 11 are not included as part of the main database. For example, the list for BCR 9 contained only landbirds (and one shorebird) and was based on an older priority-setting scenario (K. de Groot, pers. comm.).

First, contact was made directly with CWS EA-coordinators for them to nominate candidate development projects. As a result of these discussions, two sites were chosen: the Southern Crossing Pipeline (SCP) in BC, and the Enbridge Pipeline (EP) in Alberta. While both developments are somewhat similar (linear pipeline developments), the habitats through which pipelines are being built are very different. Both projects occur in two of the highest areas for avian conservation concern in Canada.

The test cases are presented in Appendix 1 (SCP) and Appendix 2 (EP).

6.0 Conclusions and Recommendations

6.1 Can the DST be used to assist in determining significance of adverse effects on birds for EA?

The DST brings the latest internationally accepted scientific information directly to the EA practitioner. Conversely, the tool can also identify what is needed from avian scientists from an EA perspective. Thus, while the DST can provide access to internationally accepted science for the EA practitioner and arrange it in a series of steps, local bird experts may still be required to evaluate significance.

It should be re-emphasized that the DST expands the list of candidate species for analysis of significance by considering species identified as of conservation concern for reasons other than rarity (for example jurisdictional responsibility), thus giving a broader, biodiversity perspective to EA. Furthermore, the DST is a more than a species-centred approach to avian conservation because it incorporates a habitat component (through protected areas, and the habitat classification of bird species).

It is important to recognize that obtaining lists of priority species for a site are only a first phase; in itself, this does not assess significance. Hence, the tool itself does not automatically assign a 'number' for significance but instead provides direction for future analyses. Having identified a list of priority species, it would then be a requirement of the proponent to conduct surveys to assess: 1) the abundance of each priority species at a site, and the relative importance of the site at different scales (global, national, regional, local); 2) how much of the population of each species will be affected by the development; 3) whether mitigation can reduce impacts; and, finally, 4) what level of impact is acceptable (i.e. how many priority bird species may die, be displaced to other habitats/areas or incur reduced reproductive capacity).

Of direct application to evaluating significance and the level of acceptable impact is the future development by NABCI-PIF of targets (specified limits) for both habitat area and species populations. This will be invaluable for determining significance since it will allow habitat and population effects to be placed in context at different scales. By assessing cumulative effects at multiple scales, it will be possible to evaluate the proportion of target habitat and population that could potentially be affected by development.

While an attempt was made to use an existing habitat classification and to keep classification fairly simple, one recommendation may be to fine tune the habitat types included. NABCI may develop an avian habitat classification system for the BCRs and it would be best to adopt this when it is completed rather than develop a new system.

In relation to scale effects, it is important to note that the DST was designed for the BCR scale which may be appropriate at the national level. However, a finer scale may useful and the DST could be adapted to include other ecological scales (e.g., ecoregion) in the future. This would involve classifying all species at the finer scale adopted and is outside the scope of the first phase of the DST.

At this point the database applies only to priority lists of species during the breeding season. Eventually it will be extended to the migration and wintering periods. This is a very important aspect since species priority lists may change seasonally. For example, currently this DST cannot be used to aid in evaluating significance of adverse effects of developments proposed for migration corridors (e.g., Redhill in Ontario). Note that the RMBO database has recently been updated to include wintering scores. Because the RMBO species database is likely to change in the very near future (following revisions by Canadian NABCI-PIF representatives), it was not considered time-efficient to incorporate the new database in this first phase of the DST.

6.2 Can the prototype serve as a decision-making tool?

Currently, the DST tool does not have the capacity to function reliably with the current databases from RMBO, once the lists are improved and updated it does have the potential to work well. While the lists are being refined, the tool can be tested for 1-2 years; this testing will also provide the opportunity to examine different types of projects.

The DST prototype developed here can aid in decision-making. However, the DST will not be able to determine ecological significance without further investigation of: 1) how important an area is for a species in terms of the proportion of the population that uses the site; 2) the proportion of its range that the site will affect; or 3) how habitat loss during a particular project will affect species populations cumulatively (in addition to other projects) in the area or region.

Many of the steps taken to organize the information will not change in the future. For example, even though the RMBO BCR database will change (and thus, the lists of priority species generated), a habitat classification is still needed for priority species (to narrow down the list of species for an entire BCR to the habitat affected by development and for situations when no bird species list is available from a development site).

6.3 Challenges and principles for making information available to EA practitioners

Bridging the gap between avian science and policy or management is not an easy task (Hejl and Granillo 1998). In the case of the DST presented here, it is especially difficult for two related reasons:

- While the concept of avian priority-setting and the criteria used may seem simple to avian scientists involved in it directly, to the non-bird specialist it may be difficult to understand.
- Priority-setting for birds under NABCI-PIF is still in progress, and lists have not been vetted by Canadian PIF representatives for all BCRs in Canada. This makes it difficult even for avian scientists familiar with the approach to keep abreast of all changes, unless they are involved directly in committee meetings or have access to minutes/unpublished reports from meetings. While it is critical that the DST be simple to use and easily comprehensible, it is important to point out that avian priority-setting is a very complex and evolving field.

6.4 How can we ensure that future EAs use best available science?

The approach of this DST using avian priority-setting is something new to EA in Canada, and it is important that EA practitioners benefit from this information immediately in the absence of anything better. However, the DST is not yet functional, but has the potential to be so in the near future.

Even the implementation of the idea of priority-setting for assessing significance is an important step forward and a move towards thinking about communities and ecosystems in EA rather than a focus on indicators or listed species. This raises two important general principles: 1) the importance of using the best available information for EA and ensuring that EA practitioners know what this information is and where to find it; and, related to this, 2) the importance of ensuring that any DST be sufficiently flexible to allow regular updates. For example, it may be best to set a time interval for incorporations of revised databases and other updates (e.g., 3-4 months). Scientific and other data are subject to constant change, and so there will always be a need to ensure the incorporation of the latest and best available information. For example, bird trend information from the BBS or other monitoring programs (one of the seven criteria used for priority-setting under NABCI-PIF) is constantly changing, as new data are collected each year. In the final analysis, this reinforces the need for a DST to be managed actively and on a regular basis to ensure that it remains relevant and to ensure that all hyperlinks are maintained and up to date. With information management becoming increasingly more challenging, an effective system needs to be based on, and linked to, the latest available information as it evolves. Therefore, probably the most effective means to ensure that EAs use the best available scientific information is to provide a web access with links to regularly updated sites.

7.0 Acknowledgments

I would like to thank CEAA and the Environmental Assessment Branch of Environment Canada for funding this project. Susan Mojgani and Paula Caldwell were instrumental in orchestrating this research. Many people helped with the background information presented and in the modification of the DST presented here. In particular, I would like to thank Louise Kingsley for help, guidance, and direction at all stages of the work, as well as detailed comments on earlier drafts. For extremely helpful and insightful comments, I thank Erica Dunn, Judith Kennedy, Paul Gregoire, Krista de Groot, Louise Kingsley, Craig Machtans, Kurt Mazur, Susan Mojgani, Andrew Robinson, and Troy Wellicome. Extensive consultation on the software for the DST was provided by Robert Beric, Sean Burns, Scott FitzGerald, Guy Follen, James Ojaste, and Chak Wong: thanks to them all for their input. Management of species lists and habitat classifications were carried out by Josée Nesdoly, to whom I am extremely grateful. The DST was produced by Sean Burns and Nina Beck; both worked diligently and were extremely helpful in producing the most cost-effective tool. I thank Marla Sheffer for help with editing and finally the two anonymous reviewers for perceptive comments on an earlier draft.

8.0 References

BC gas 2000. Southern Crossing Pipeline Project: Wildlife habitat mitigation and compensation program report — Phase II construction (MELP Region 8).

Blancher, P.J., McNichol, D.K., Ross, R.K., Wedeles, C.H.R., and Morrison, P. 1992. Towards a model of acidification effects on waterfowl in eastern Canada. Environmental Pollution 78: 57–63.

Both, C., and Visser, M. E. 2001. Adjustment to climate change is constrained by arrival date in a long-distance migrant bird. Nature 411: 296-298.

Brown, J. L., Li, S. H., and Bhagabati, N. 1999. Long-term trend toward earlier breeding in an American bird: a response to global warming? Proceedings of the National Academy of Sciences USA 96:5565-5569.

Butler, R.W., Stushnoff, B.G., and McMackin, E. 1986. The birds of the Creston Valley Wildlife Management Area, 1969–1991. Technical Report Series No. 161. Canadian Wildlife Service, Pacific and Yukon Region, British Columbia.

Campbell, R. W., Dawe, N. K., McTaggart-Cowan, I., Cooper, J.M., Kaiser, G. W., and McNall, C. E. 1990. The birds of British Columbia. Volume 2, Nonpasserines. British Columbia Museum and Canadian Wildlife Service of Environment Canada.

Canadian Environmental Assessment Agency (CEAA) 1999. Cumulative Effects Assessment Practitioner's Guide. Canadian Environmental Assessment Agency, Hull, Québec.Carter, M.F., and Barker, K. 1993. An interactive database for setting conservation priorities for western Neotropical migrants. Proceedings of the Status and Management of Neotropical Migratory Birds, Estes Park, Colorado. Rocky Mountain Range and Experiment Station, Ft. Collins, CO. Gen. Tech. Rep. RM-229.

Carter, M.F., Hunter, M.C., Pashley, D.N., and Rosenberg, K.V. 2000. Setting conservation priorities for landbirds in the United States: The Partners in Flight approach. Auk 117:541-548.

Commission for Environmental Cooperation (CEC). 1999. North American Important Bird Areas: A directory of 150 key conservation sites. Communications and Public Outreach Department, CEC Secretariat, Montréal, Canada.

Couturier, A. 1999. Conservation priorities for the birds of southern Ontario. Bird Studies Canada. Internal Report, Port Rowan.

Donaldson, G., Elliott, R., and Milko, R. 2000. Wings Over Water: Canada's conservation plan for seabirds, colonial waterbirds and related species. Draft March 29, 2000.

Dunn, E.H., Hussell, D.J.T., and Welsh, D.A. 1999. Priority-setting tool applied to Canada's landbirds based on concern and responsibility for species. Conservation Biology 13: 1404–1415.

Dunn, E., Downes, C. M., and Collins, B. T. 2000. The Canadian Breeding Bird Survey, 1967-1998. Canadian Wildlife Service Progress Note No. 216. Canadian Wildlife Service Headquarters, Environment Canada, Hull, Québec

FEARO. 1999a. The responsible authority's guide. Canadian Environmental Assessment Act Procedural Manual. Federal Environmental Assessment Review Office. http://www.ceaa.gc.ca/act/act_e.htm

FEARO. 1999b. Reference guide: Determining whether a project is likely to cause significant adverse environmental effects. Canadian Environmental Assessment Act Procedural Manual. Federal Environmental Assessment Review Office. http://www.ceaa.gc.ca/act/act_e.htm

Fuller, R., Gregory, R.D., Gibbons, D.W., Marchant, J.H., Wilson, J.D., Baillie, S.R., and Carter, N. 1995. Population declines and range contraction among lowland farmland birds in Britain. Conservation Biology 9:1425–1441.

Furness R.W., and Greenwood, J.J.D. (Editors). 1993. Birds as monitors of environmental change. Chapman and Hall, New York.

Hejl, S.J., and Granillo, K.M. 1998. What managers really need from avian researchers. Pages 431–437 in J. M. Marzluff and R. Sallabanks. Avian conservation: Research and management. Island Press, Washington, D.C.

Hebert, C.E., Norstrom, R.J., and Weseloh, D.V.C. 1999. A quarter century of environmental surveillance: The Canadian Wildlife Service's Great Lakes Herring Gull Monitoring Program. Environmental Reviews 7: 147–166.

Howell, S.N.G., and Webb, S. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press, Oxford. 851 pp.

Hunter, W.C., Carter, M.F., Pashley, D.N., and Barker, K. 1993. The Partners in Flight prioritization scheme. Pages 109–119 in D.M. Finch and P.W. Stangel (eds.), Status and management of Neotropical migratory birds. USDA Forest Service, Fort Collins, Colorado.Hutto, R.L. 1998. Using landbirds as an indicator species group. Pages 75–92 in J.M. Marzluff and R. Sallabanks. Avian Conservation: Research and management. Island Press, Washington, D.C.

Hyslop, C., Donaldson, G., Morrison, G., and Davidson, I. 1999. Canadian shorebird conservation plan (CSCP). Internal Report Draft November 1999, Environment Canada.

Kennedy, J. 2000. Priority setting for North American birds: A unified approach under NABCI. Draft document from PIF-Canada, PIF-US meeting July 2000.

Kirk, D. A. 2000. Developing criteria to assist in determining the significance of adverse environmental effects on migratory birds. Internal report to Environment Canada headquarters, Hull, Québec.

Kirk, D.A., Evenden, M.D., and Mineau, P. 1996. Past and current attempts to evaluate the role of birds as predators of insect pests in temperate agriculture. Current Ornithology 13:175–269.

Kirk, D. A., Boutin, C. and Freemark, K. E. 2000. A multivariate analysis of bird species composition and abundance between crop types and seasons in southern Ontario, Canada. EcoScience in press.

Marquis, R.J., and Whelan, C.J. 1994. Insectivorous birds increase growth of white oak through consumption of leaf-chewing insects. Ecology 75: 2007–2014.

Master, L. 1991. Assessing threats and setting priorities for conservation. Conservation Biology 5: 559–563.

Milko, R. 1998a. Environmental assessment guideline for forest habitat of migratory birds. Environment Canada Publications Office.

Milko, R. 1998b. Migratory birds environmental assessment guideline. Environment Canada Publications Office.

Mosquin, T., Whitney, P.G., and McAlister, D.E. 1995. Canada's biodiversity: the variety of life, its status, economic benefits, conservation costs and unmet needs. Canadian Museum of Nature, Ottawa.

National Geographic Society. 1987. Field guide to the birds of North America. 2nd Edition. National Geographic Society, Washington, D. C.

North American Waterfowl Management Plan (NAWMP). 1998. Expanding the vision: 1998 update.

Ratcliffe, D. 1967. The Peregrine Falcon. T. and A. D. Poyser, Calton.

Robbins, C.S., Bystrak, D.A., and Geissler, P.H. 1986. The Breeding Bird Survey: its first fifteen years, 1965–1979. USDI, Fish and Wildlife Service resource publication 157. Washington, D.C.

Robbins, C.S., Dawson, D.K., and Dowell, B.A. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic states. Wildlife Monographs 103: 1–34.

Tera Environmental Consultants (Alta.) Ltd. 2000. Environmental and socio-economic impact assessment for the proposed Enbridge Pipelines Inc. Terrace Phase II Expansion Program. Unpublished report prepared for Enbridge Pipelines Inc., Edmonton, Alberta.

Wilson, S. F. 1992. Creston Valley Wildlife Management Area: Habitat management and wildlife responses, 1968-1991. Technical Report Series No. 162. Canadian Wildlife Service, Pacific and Yukon Region, British Columbia.Wilson, S.F., and Stushnoff, B.G. 1992. Wildlife surveys conducted on the Creston Valley Wildlife Management Atea, 1969–1991. Technical Report Series No. 161. Canadian Wildlife Service.

World Conservation Union. 1996. 1996 IUCN red list of threatened animals. Gland, Switzerland.

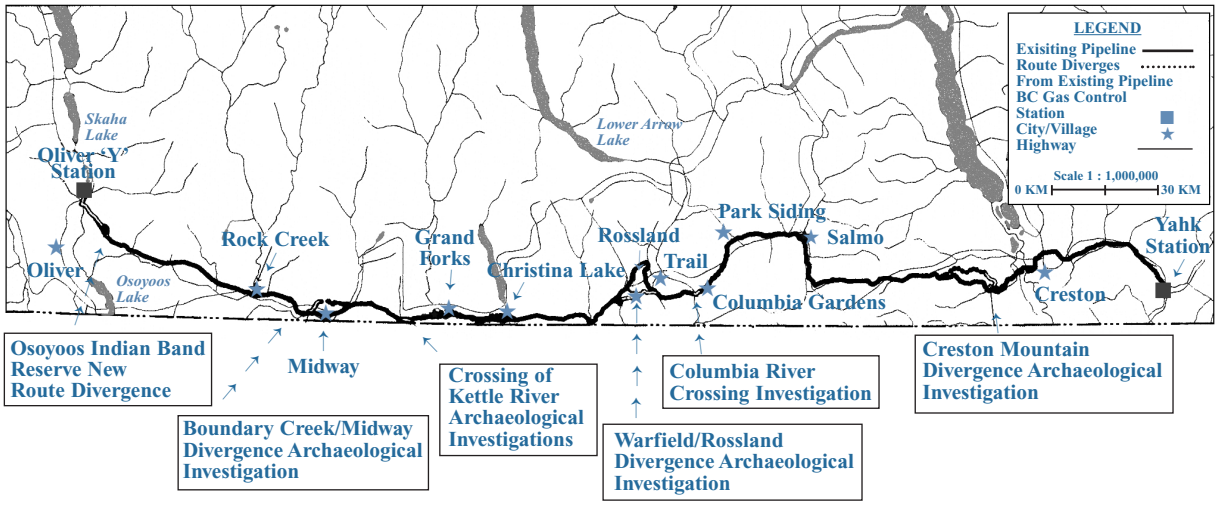
Appendix 1: Test Case #1 — Southern Crossing Pipeline (SCP)

Background

The Southern Crossing Pipeline (SCP) is a 312-km, 24-inch-diameter natural gas pipeline (BC Gas Utility Ltd.) that extends from Yahk in the east to Oliver in the west of British Columbia (Fig. 1.1). The pipeline connects the BC Gas System to the Alberta Natural Gas Transmission System. Additional developments include the installation of two compressor units at the existing BC Gas Kitchener Compressor Station and small modifications to the BC Gas Oliver Y Control Station.

Fig. 1.1: Map of SCP study area

"Location of Supplemental Studies Discussed in this Report"



The EA for the pipeline was a harmonized provincial/federal review, with the provincial review taking precedence; the Responsible Authority under the *Canadian Environmental Assessment Act* was the Department of Fisheries and Oceans (DFO). The Application for a Project Approval Certificate was submitted on 9 January 1998; a decision was issued on 3 April 1998, and the review was suspended on 5 June 1998 by the Minister of Environment, Land and Parks. The EA was approved, and most of the pipeline is already completed. The main conclusions with respect to migratory birds mainly concerned two wetland areas, as well as some interior forested areas and shrub-steppe habitat.

The SCP transects the Southern Interior and Southern Interior Mountain ecoprovinces in BC, which contain many important habitats for birds, such as antelope-brush and sagebrush grasslands of the southern Okanagan valley, one of three biodiversity hotspots in Canada (Mosquin et al. 1995). As well, the pipeline transects several wetlands (including one protected area) and old-growth Douglas-fir forests.

Specifically, the pipeline transects eight distinct wildlife habitat types: 1) low-elevation and midslope forest (62% of total area), including interior cedar-hemlock, montane spruce, and Douglas-fir forests; 2) riparian (6%), including deciduous shrub and tree-dominated riparian areas, coniferous riparian areas, and developed riparian areas; 3) wetlands (3%), including two important wetland areas; 4) subalpine (8% of length) west of Creston; 5) grasslands (7%); 6) ponderosa pine/bunchgrass parkland (0.7% of length); 7) shrub-steppe (1.8% of length); and 8) valley bottom disturbed corridor (BC Gas 2000).

In the southern Okanagan, 45 species of vertebrates are red- or blue-listed, meaning that they are considered of high concern by the BC government. Despite the importance of the habitats transected by the pipeline and the number of listed species, relatively few concerns were raised. Three main concerns pertaining to migratory bird populations were expressed by CWS: 1) the pipeline should avoid parts of two important waterfowl areas — the Creston Valley Wildlife Management Area (CVWMA) and the Salmo wetlands and ended close to Vaseux Lake, a NWA; 2) that clearing and construction take place (especially during the breeding season) in very sensitive habitats, such as South Okanagan shrub-steppe and ponderosa pine/bunchgrass parkland (with its associated numerous red- and blue-listed species); and 3) that clearing and construction be timed outside the breeding season to minimize interference on nesting birds.

Critical questions in relation to the pipeline development related to how effectively natural vegetation can be re-established following disturbance and the extent of invasion by noxious weeds (A. Robinson, pers. comm.). Depending on adjacent vegetation, it was also possible that the linear corridor right-of-way created would affect breeding success of some forest-dependent songbirds, perhaps through allowing movement of avian nest predators or avian brood parasites. However, note that 86% of the pipeline was constructed on, or adjacent to, an existing right-of-way (BC gas, abandoned CPR railway, or electrical transmission line).

Methods

The EA document for the BC SCP was obtained from the CWS EA regional coordinator (A. Robinson), together with a "partial" bird species list; the latter was derived from local naturalists groups, local checklists, and on-site surveys contracted out to consultants. The partial list included 153 species: 117 landbird, 20 waterfowl, 11 shorebird, and 5 colonial waterbird species.

The first step was to determine whether any protected areas or biodiversity hotspots were to be affected by the development. The bird species list derived from the SCP site was then matched with two types of BCR priority lists — one obtained from RMBO and the Canadian list produced by PIF-Canada. Although it was thought that the Canadian list should be given priority, since it was developed with local expertise and refers to the Canadian portion of BCR 9 alone, there were several problems with this list. First, it contained only landbirds (and one shorebird), so cross-validation was also done using the RMBO database. Second, the PIF-Canada list was produced using the criteria derived from the Oak Hammock Marsh PIF-Canada/PIF-US meeting, which have now been updated. Thus, although a detailed comparison between the PIF-Canada

and the RMBO lists is provided here, in the DST itself, only the RMBO database is used. Note that because the RMBO lists are more "up to date" does not mean that they are better than the PIF-Canada list; in fact they are probably not. 'Up to date' here may mean that different scoring systems have been used or slightly different criteria — not necessarily more up-to-date data. This indicates that whatever changes are made to the RMBO lists or PIF-Canada lists, scores should be reviewed to see if the species that are generated make biological sense. The solution to this problem is not clear but may be dealt with by the new PIF-Canada coordinator with responsibility for priority-setting in the different BCRs (P. Blancher, Ontario Region, CWS).

Results

Step 1: Impacts on protected areas

In the original proposal, two wetlands were to be crossed by pipeline — the CVWMA and the Salmo wetlands. The pipeline also ended at Oliver, near Vaseux lake which is a NWA (there was concern that the pipeline may have some indirect effect on this area). The CVWMA was established in 1968 under provincial legislation and was designated as a Ramsar site in 1994. Under the Creston Valley Wildlife Act, approximately 7000 ha of Kootenay River floodplain south of Kootenay Lake was protected for "wildlife conservation, management and development...in particular, as a waterfowl management area" (Wilson 1992; Wilson and Stushnoff 1992).

The CVWMA supports the second largest colony of Western Grebe (red list), the second largest colony of Great Blue Heron (blue list) west of the Coast Range, the largest colony of breeding Black Terns in BC, and the highest densities of Osprey nests anywhere in Canada. The Creston Valley is the only known nesting location of Forster's Tern (red list) in BC (Butler et al. 1986). Significant wetland areas in the Salmo Valley were also considered at risk; this valley supports nesting colonies of Great Blue Heron. At the west end of the pipeline near Oliver is another wetland, Vaseux Lake; this region supports a wide variety of migratory passerine and waterfowl species. Numerous other water body crossings occur along the route of the pipeline.

Other types of important habitats included a CWS Area of Interest for Migratory Birds in open, mature, and old-growth ponderosa pine. The latter provides habitat for the White-headed Woodpecker (red list, COSEWIC threatened status). Several proposed divergences of the pipeline to accommodate environmental or anthropogenic concerns included 1) east and west of the village of Midway and 2) Salmo divergence. For the former divergence CWS recommended that the CDC of the BC Ministry of Environment, Land and Parks should be contacted. It was considered possible that Lewis's Woodpecker (COSEWIC Special Concern) could occur in the area of Midway East Divergence; the Midway West Divergence included a 2.2 km stretch of riparian habitat along the Kettle River.

Step 2: Bird conservation region

The SCP project occurs in BCR 9 — the Great Basin.

Step 3: Habitat

The habitats transected by the pipeline included all of the categories available in the DST, so all would be selected in this step.

Step 4: Expected species list

This step matches all of the species in BCR 9 with the habitats selected. Because all habitats were selected, 262 species were listed.

Step 5: Local species list

Next, the site list was screened with provincial and local species lists to check that no species had been missed that could potentially occur at the site. The following species were not on the site list but were present on the Okanagan species list: Mute Swan, Gray Partridge, Spruce Grouse, White-tailed Ptarmigan, Glaucous-winged Gull, Boreal Owl, Boreal Chickadee, Veery, American Pipit, Clay-colored Sparrow, and Rusty Blackbird.

As well, according to Campbell et al. (1990), Ferruginous Hawk (Tier IIC) also occurs in the area (listed in PIF-Canada BCR 9 list, but not on site list or Okanagan list). Spotted Owl (Tier IV) probably does not occur in the area affected. Sage Grouse (Tier I) was listed in the PIF-Canada BCR 9 list, but not on any other lists (the species is extirpated according to Campbell et al. 1990 and the BC CDC).

The following priority species were listed in the PIF-Canada BCR 9 file and the Okanagan list but were not on the partial site list: Black Swift, Blue Grouse, Dusky Flycatcher, Gray Flycatcher, Lazuli Bunting, Sandhill Crane (Tier I); Lark Sparrow, Veery (Tier IIA); Rock Wren (Tier IIB); Common Poorwill (Tier IIC); and Barn Owl, Burrowing Owl, Peregrine Falcon, Short-eared Owl, Swainson's Hawk, and Yellow-breasted Chat (Tier IV) (see Table 1.4).

The above results indicated that many species that were of concern were not included on the partial site list from the SCP project; thus, site lists alone are not reliable in identifying priority species.

Step 6: Priority species matching

Recall that the chief goal of this step is to identify the reasons why species reach the priority pool.

Altogether, 33 of the species in the site list fell into Tiers I–IV; 52 species were identified in the PIF-Canada list and 68 species in the RMBO list and were therefore of high priority for conservation action. Some of the differences between PIF-Canada and the RMBO list were due to the inclusion of colonial waterbirds, waterfowl, and shorebirds in the database. In Tier I, these included Snowy Plover, Willet, and Wilson's Phalarope; in Tier IIA, American Avocet, California Gull, Cinnamon Teal, Killdeer, Northern Pintail, and Ruddy Duck; in Tier IIB, Forster's Tern; in Tier IIC, Black Tern; and in Tier IIIA, Black-necked Stilt, Caspian Tern, and Gadwall. Several species on the RMBO priority list for

BCR 9 do not occur in Canada. Also, many species in the PIF-Canada were entered in Tier IV because they are of provincial concern in BC but are not considered of special concern in the US portion of BCR 9.

The reasons why species reached the priority pool are listed in Tables 1.1–1.3. For example, for the site list, 20 species reached the high-priority pool because of area importance (AI), 15 because of declining populations (PT), 14 because of threats to breeding (TB), one because of average abundance (AA), two because of breeding distribution (BD), and four because of their narrow non-breeding distributional range (ND). Six species were red-listed and nine blue-listed by the BC government (Table 1.1).

Thus, pipeline construction must avoid ponderosa pine breeding habitat for species such as Flammulated Owl and White-headed Woodpecker, shrub-steppe/sagebrush for Sage Thrasher, and wetlands for Western Grebe, American Bittern, and Great Blue Heron.

Table 1.1: Reasons why 33 priority species in site list reach priority pool: number of species in each category

Tier1 (no. of species)	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
I (12)	2	4	1	5		6	9	9	2	3
IIA (6)						5	4			
IIC (4)				4			3	1	2	
IV (11)				5		4	4	5	2	6

[1] Note that 'Tier' for this table and all other following tables is derived from the first seven criteria and does not include RR

Table 1.2: Reasons why 52 priority species from PIF-Canada list reach priority pool: number of species in each category

Tier (no. of species)	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
I (19)	5	8	2	5		9	13	12	4	5
IIA (8)							7	5	1	1
IIB (1)				1					1	
IIC (6)				1	6	2	5	3	3	3
IV (18)			2	11	6	5	6	9	8	7

Table 1.3: Reasons why 68 priority species from RMBO list reach priority pool: number of species in each category

Tier (no. of species)	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
I (31)	24	29	26	5	31	24	25	14	5	3
IIA (13)	2	4	10	8	5	13	13			
IIB (6)	5	6	4	3	1	1	6	2	1	2
IIC (11)	1	2	10	11	9	7	6	3	2	
IIIA (7)			3	3	1	2	7			

Table 1.4: Species listed by PIF Canada by tier and reasons that they enter priority pool of species (species in site list are in bold font; species in both PIF-Canada and RMBO lists in grey shade)

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
Black Swift	I		x	x				x	x		
Blue Grouse	I						x		x		
Calliope Hummingbird	I	x						x	x		
Dusky Flycatcher	I	x					x				
Flammulated Owl	I		x		x				x		x
Gray Flycatcher	I	x	x					x			x
Hammond's Flycatcher	I		x				x		x		
Lazuli Bunting	I		x					x			
Lewis' Woodpecker	I			x			x	x	x		x
Northern Rough-winged Swallow	I						x	x			
Pacific-slope Flycatcher	I	x	x				x		x		
Prairie Falcon	I						x	x		x	
Red-naped Sapsucker	I				x		x	x			
Rufous Hummingbird	I			x					x	x	
Sage Grouse	I							x	x	x	
Sage Thrasher	I				x			x	x	x	
Sandhill Crane	I						x	x			x
White-headed Woodpecker	I	x	x		x				x	x	
Williamson's Sapsucker	I				x			x	x		x
American Kestrel	IIA						x	x			
Cassin's Finch	IIA							x			
Chipping Sparrow	IIA						x	x			
Golden-crowned Kinglet	IIA						x				
Lark Sparrow	IIA						x	x	x	x	
Mountain Chickadee	IIA						x	x			
Olive-sided Flycatcher	IIA						x				
Veery	IIA						x				
Rock Wren	IIB			x					x		
Cassin's Vireo	IIC				x			x			
Common Poorwill	IIC				x	x		x	x		
Ferruginous Hawk	IIC			x	x	x		x	x	x	
Vaux' s Swift	IIC				x			x			
Western Grebe	IIC				x					x	
Western Screech Owl	IIC				x			x	x	x	
American Bittern	IV				x						x
Barn Owl	IV										x

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
Bobolink	**IV**				**x**			**x**		**x**	
Brewer's Sparrow	**IV**				**x**			**x**	**x**	**x**	
Burrowing Owl	IV				x	x			x	x	
Canyon Wren	**IV**								**x**		**x**
Grasshopper Sparrow	**IV**				**x**				**x**	**x**	
Great Blue Heron	**IV**						**x**				**x**
Long-billed Curlew	**IV**										**x**
Peregrine Falcon	IV				x	x			x	x	
Sharp-tailed Grouse	**IV**				**x**		**x**				
Short-eared Owl	IV			x	x	x		x			x
Spotted Owl	IV			x	x	x	x		x	x	
Swainson's Hawk	IV				x	x			x	x	
Western Meadowlark	**IV**						**x**	**x**	**x**		
White-throated Swift	**IV**							**x**	**x**		**x**
Yellow Warbler	**IV**						**x**	**x**			
Yellow-breasted Chat	IV				x	x				x	

Abbreviations:

AA – Average abundance
BD – Breeding distribution
ND – Non-breeding distribution
TN – Threats on non-breeding area
TB – Threats on breeding area
AI – Area importance
PT – Population trend
RR – Responsibility by range within BCR
Blue – Blue list
Red – Red list

Table 1.5: Species listed by RMBO by tier and reasons that they enter priority pool of species (species in site list are in bold font; species in both PIF-Canada and RMBO lists in grey shade)

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
American White Pelican	I	x	x		x	x	x	x			
Black Swift	I	x	x	x	x	x	x	x	x		
Black-chinned Hummingbird	I	x	x	x	x		x		x		
Black-chinned Sparrow	I	x	x	x	x	x	x	x			
Blue Grouse	I	x	x	x	x	x	x		x		
Brewer's Sparrow	I	x	x		x		x	x	x	x	
Calliope Hummingbird	**I**	**x**	**x**	**x**	**x**			**x**	**x**		

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
Cassin's Vireo	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**			
Dusky Flycatcher	I	x	x	x	x		x	x			
Ferruginous Hawk	I		x	x	x	x	x	x	x	x	
Flammulated Owl	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**		**x**
Greater Sage-Grouse	I	x	x	x	x	x	x	x	x		
Hammond's Flycatcher	**I**	**x**	**x**	**x**	**x**			**x**	**x**		
Hermit Warbler	I	x	x		x	x	x				
Lewis' Woodpecker	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**		**x**
MacGillivray's Warbler	I	x	x	x	x		x	x			
Mountain Quail	I	x	x	x	x	x	x				
Prairie Falcon	**I**			**x**	**x**	**x**	**x**	**x**		**x**	
Red-breasted Sapsucker	I	x	x	x	x	x	x	x	x		
Redhead	I			x	x	x	x	x			
Sage Sparrow	I	x	x		x	x		x			
Sandhill Crane	I		x	x	x	x	x	x			
Snowy Plover	I		x	x	x	x	x	x			
Spotted Owl	I	x	x	x	x	x	x	x	x	x	
Tricolored Blackbird	I	x	x		x	x	x				
White-headed Woodpecker	**I**	**x**	**x**	**x**	**x**	**x**	**x**		**x**	**x**	
Willet	I	x	x	x	x	x		x			
Williamson's Sapsucker	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**		**x**
Willow Flycatcher	I		x	x	x		x	x			
Wilson's Phalarope	I		x	x	x	x		x			
Yellow Rail	I	x	x	x	x	x	x	x			
American Avocet	IIA		x			x	x	x			
California Gull	IIA	x	x				x	x			
Cinnamon Teal	IIA			x	x	x	x	x			
Chukar	IIA			x			x	x			
Evening Grosbeak	IIA			x	x		x	x			
Golden Eagle	IIA			x	x		x	x			
Killdeer	IIA			x		x	x	x			
Northern Pintail	**IIA**			**x**	**x**		**x**	**x**			
Northern Rough-winged Swallow	**IIA**		**x**	**x**			**x**	**x**			
Olive-sided Flycatcher	**IIA**			**x**	**x**	**x**	**x**	**x**			
Pinyon Jay	IIA	x	x		x		x	x			
Purple Finch	IIA			x	x		x	x			
Ruddy Duck	IIA			x	x	x	x	x			
California Quail	IIB	x	x		x			x	x		
Forster's Tern	IIB	x	x	x	x		x	x			

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Red	Blue
Gray Flycatcher	IIB	x	x	x				x			x
Lazuli Bunting	IIB		x	x				x			
Long-billed Curlew	**IIB**	**x**	**x**	**x**	**x**	**x**		**x**			**x**
Sage Thrasher	**IIB**	**x**	**x**					**x**	**x**	**x**	
Black Tern	IIC			x	x	x	x				
Black-backed Woodpecker	IIC			x	x	x	x				
Black-throated Sparrow	IIC	x	x		x			x			
Grasshopper Sparrow	**IIC**			**x**	**x**	**x**	**x**		**x**	**x**	
Loggerhead Shrike	IIC			x	x	x	x				
Marsh Wren	IIC			x	x	x		x			
Northern Harrier	IIC			x	x	x		x			
Peregrine Falcon	**IIC**			**x**	**x**	**x**	**x**		**x**	**x**	
Short-eared Owl	**IIC**			**x**	**x**	**x**	**x**	**x**			
Swainson's Hawk	**IIC**		**x**	**x**	**x**	**x**		**x**	**x**		
Yellow-billed Cuckoo	IIC			x	x		x	x			
Black-necked Stilt	IIIA				x			x			
Brewer's Blackbird	IIIA						x	x			
Caspian Tern	IIIA			x	x			x			
Eared Grebe	IIIA							x			
Gadwall	IIIA			x	x		x	x			
Rock Wren	IIIA			x				x			
White-faced Ibis	IIIA					x		x			

Step 7: Local data collection

Surveys need to be implemented for the priority species mentioned above to evaluate the importance of the area for these species. For some species (e.g., Great Blue Heron), this may require nest surveys to update information (in Butler et al. 1986) or special surveys for species such as Flammulated Owls or White-headed Woodpecker.

Which priority list should be used? The most conservative approach is to include species in both the PIF-Canada and RMBO lists for the time being (and exclude species that do not occur in the Canadian portion of a BCR). These two lists will ultimately be harmonized. Note that some survey data are already available from CVWMA and the Salmo wetlands and could be used to provide estimates of abundance for some priority species.

Step 8: Existing conservation

Existing protected areas do provide habitat for some priority species (e.g., wetlands such as CVWMA for Western Grebe, Great Blue Heron). There is a need to assess whether the pipeline development is detrimental to these species (in the area of wetland affected) and whether sufficient wetland area remains intact to support local populations.

Step 9: Mitigation

Rerouting of the pipeline so that effects on the CVWNA and Salmo wetlands were minimized would be the main mitigation for habitat/protected areas in the DST; however, there appears to have been little consideration given to shrub-steppe and ponderosa pine/bunchgrass habitat. With regards to priority species, lack of information on abundance makes it difficult to assess significance and therefore to suggest mitigative steps. However, in the absence of this information, the planned construction of the pipeline outside the breeding season of the priority species identified would also be recommended.

In the EA, it was suggested that concerns raised by CWS would be met if construction took place outside the breeding season (1 April to 1 August) and that if the timing window needed to be altered, then a qualified wildlife biologist should comment on the precise dates during which construction would cause least disturbance.

A second important concern was to avoid important wetland areas (CVWMA and Salmo wetlands); extensive consultation took place between the proponent and the "Management Authority" to reroute the pipeline outside the CVWMA. No protection covenants exist with regard to the Salmo wetlands; however, an alignment divergence did take place in this area to lessen impacts on fewer fish streams, wildlife habitat, community watershed, etc. (A. Robinson. pers. comm.). A third concern was to avoid other ecologically sensitive areas such as the South Okanagan shrub-steppe and the ponderosa pine/bunchgrass parkland, which support red- and blue-listed species; these include species such as Sage Thrasher in the former habitat and White-headed Woodpecker and Flammulated Owl in the latter. Finally, a mitigative measure designed to create habitat (wildlife trees) by topping large trees (e.g., black cottonwood) was not recommended because large living trees also provide wildlife habitat.

Step 10: Completion of DST, evaluation of significance, decision

The DST identified a large number of priority species, only some of which were identified of concern in the EA review process (these were mostly listed species such as Sage Thrasher, White-headed Woodpecker, Lewis' Woodpecker). The PIF-Canada list identified 52 priority species, many of which were not mentioned in the EA report.

The greatest concern expressed by CWS was over the wetlands (involving some rerouting of the pipeline) and minimizing disturbance to breeding migratory birds. However, while the latter concern is valid, it is somewhat cosmetic if no attempt is made to quantify habitat loss at different scales (e.g., loss of wildlife trees for cavity nesters or possible population-level effects within the study area and beyond). This points to a need to quantify abundance of priority species. Moreover, while the effect of loss of shrub-steppe or ponderosa pine habitat may seem small, no apparent attempt was made to evaluate the cumulative effects of loss or fragmentation of these habitats by impacts of several development projects.

Step 11: Local follow-up

This step would be an evaluation of the mitigative steps taken, for example, to avoid impacts on wetland areas (how successful was restoration of aquatic vegetation; did this have any impact on wetland bird species?).

Differences in tiers between RMBO and PIF-Canada lists

Nine species that reached a tier in the RMBO list were not assessed for the PIF-Canada priority list (this is because the PIF-Canada list only included landbirds). Some of these species occurred in the CVWMA and were priority species (e.g., Black Tern, Forster's Tern).

Four species in the RMBO list reached Tier I (Black-chinned Hummingbird, Brewer's Sparrow, Cassin's Vireo, and MacGillvray's Warbler) but did not do so in the PIF-Canada list. By contrast, five species reached Tier I in the PIF-Canada list but did not do so in the RMBO list (Northern Rough-winged Swallow, Pacific Slope Flycatcher, Red-naped Sapsucker, Rufous Hummingbird, and Sage Thrasher). Further comparisons can be made by examining Table 1.6.

Table 1.6: Differences in tiers between RMBO list and PIF-Canada lists

Species	RMBO Tier	PIF-Canada Tier
American Bittern	None	IV
American Kestrel	None	IIA
Black Tern	IIC	Not assessed
Black-chinned Hummingbird	I	None
Bobolink	None	IV
Brewer's Blackbird	IIIA	None
Brewer's Sparrow	I	IV
California Gull	IIA	Not assessed
Canyon Wren	None	IV
Cassin's Finch	None	IIA
Cassin's Vireo	I	IIC
Chipping Sparrow	None	IIA
Cinnamon Teal	IIA	Not assessed
Forster's Tern	IIB	Not assessed
Gadwall	IIIA	Not assessed
Golden Eagle	IIA	None
Golden-crowned Kinglet	None	IIA
Grasshopper Sparrow	IIC	IV
Great Blue Heron	None	IV
Killdeer	IIA	Not assessed
Long-billed Curlew	IIB	IV
MacGillivray's Warbler	I	None
Species	RMBO Tier	PIF-Canada Tier

Species	RMBO Tier	PIF-Canada Tier
Marsh Wren	IIC	None
Mountain Chickadee	None	IIA
Northern Harrier	IIC	None
Northern Pintail	IIA	Not assessed
Northern Rough-winged Swallow	IIA	I
Pacific-slope Flycatcher	None	I
Red-naped Sapsucker	None	I
Redhead	I	Not assessed
Ruddy Duck	IIA	Not assessed
Rufous Hummingbird	None	I
Sage Thrasher	IIB	I
Sharp-tailed Grouse	None	IV
Vaux's Swift	None	IIC
Western Grebe	None	IIC
Western Meadowlark	None	IV
Western Screech-Owl	None	IIC
White-throated Swift	None	IV
Yellow Warbler	None	IV

It is important that the differences between the RMBO lists and the PIF-Canada lists be reconciled, or that separate lists are available for the Canadian portion and US portion of BCRs, as well as an overall list for transboundary BCRs.

Appendix 2: Test Case #2 — Enbridge Pipeline (EP)

Background

The Enbridge Pipeline (Enbridge Pipelines Inc., hereafter EP) involves the construction of 123 km of new 914-mm (36-inch) pipeline over three separate construction segments located between Enbridge's Hardisty, Alberta, terminal and its Kerrobert, Saskatchewan, terminal. The construction phase of the project is scheduled to begin in the summer or autumn of 2001 or in the winter of 2001/2002 (Tera Environmental Consultants [Alta.] Ltd. 2000, hereafter TERA 2000). The EA was a federal review, with the National Energy Board (NEB) leading.

Fig. 2.1: Location of proposed Enbridge Pipeline

The EP project passes through the Prairie Pothole BCR (11) region and transects the parkland subregion. Most land that will be transected by the pipeline is agricultural (65%); 12% is "bush or bush/pasture," 9% is native prairie, 7% improved pasture, 6% hay land, and <1% miscellaneous (TERA 2000).

Segments of the pipeline pass through 'critical wildlife areas'; three locations were identified that harboured species for which development was restricted. To minimize effects of the pipeline (disturbance of native prairie, alteration of wildlife habitat, and disturbance to wildlife), a route was selected that paralleled the existing EP corridor. TERA (2000) recommended that "rare and endangered wildlife" be surveyed before construction and, if necessary, prior to the spring cleanup.

The ESEIA for the proposed EP pipeline Terrace II expansion program concluded that effects of the project were not significant given the "appropriate mitigation, environmental orientation, some additional studies, and environmental inspection" (TERA 2000). Alternatives to the pipeline were considered but were not 'operationally, economically, or environmentally favourable'. The pipeline route was selected to 1) avoid as much as possible native vegetation and use cleared land or that used for industry; 2) choose grass areas over bush or woodland; 3) avoid specially designated areas; and 4) avoid known locations providing habitat for wildlife species of concern.

When this project was begun, it was believed that no bird species list was available, thus necessitating inclusion of a step in the DST to include situations where no bird surveys have taken place. This is a typical situation in EAs; often EA practitioners base their assessment of candidate bird species on the type of habitat at the site. Following on from this is that using a candidate list of all potential species that occur in the entire BCR within which the development project is located (in this case BCR 11) is too broad and will include many species that do not occur at the development site. BCRs can contain many different habitats, and more specific habitat information is required to narrow the list of bird species present to that likely to be present at the site. Thus, a need was identified to provide habitat descriptors for priority bird species. This need also exposed a larger issue — that of how to extrapolate from the large scale (the BCR) to the local scale (the development site). To incorporate this concept, new components were added to Step 3 (screening using local checklists and habitat categories).

In fact, a species list was available from the Enbridge site; detailed wildlife surveys were conducted from 1 May to 6 June 1999 by environmental consultants (Tera 2000). Early surveys (1–9 May) were to locate Sharp-tailed Grouse leks and raptor nests, as well as reptiles; later surveys (31 May – 6 June) were to identify breeding sites for species of special conservation concern. Eleven species of special conservation concern (with development restrictions) were identified: Eared Grebe, Great Blue Heron, Cooper's Hawk, Ferruginous Hawk, Peregrine Falcon, Sharp-tailed Grouse, Long-billed Curlew, Franklin's Gull, Burrowing Owl, Loggerhead Shrike, and Sprague's Pipit. Other species of concern (without development restrictions) included Great Crested Flycatcher and Baird's Sparrow.

Most of the mitigation recommended related to timing restrictions imposed by CWS (avoiding construction during the breeding period of species such as Burrowing Owl and an Eared Grebe colony) and either avoiding the destruction of specific nest sites (e.g., a clump of willow containing a Loggerhead Shrike nest) or translocating the nesting vegetation.

The ESEIA focused on species listed by COSEWIC or those listed by provincial conservation data centres; thus this assessment was limited and did not evaluate the range of species highlighted in the DST. Although other species were also surveyed, no estimates of abundance of any of the avian species surveyed were presented, so it is impossible to evaluate the relative importance of the area affected by the pipeline. While 17 wetlands are located within 100 m of the proposed pipeline, there is no indication of how important the wetlands are to waterfowl and other wetland birds; at least three cattail (Typha spp.) marshes will be transected by the pipeline, and this could potentially affect several wetland bird species. The pipeline will also cross several migratory bird habitat subregions but whether any impacts will occur at the site level is uncertain.

Methods

Lists were obtained from RMBO and the PIF-Canada regional coordinator for the prairies (T. Wellicome, pers. comm.). The Canadian vetting of the RMBO lists for BCR 11 was still in progress when this document was prepared. Three lists were available: a complete list of all 366 species (including accidentals) from BCR 11 (PIF-Canada), the RMBO list of 187 species, 54 of which are priority species (40 of these were priority according to PIF-Canada), and the Enbridge site list of 124 species, 35 of which were priority for conservation action. In addition to the 187 species in the RMBO list were 59 species that breed or winter marginally in BCR 11; these were not considered further. Note that unlike the BCR 9 PIF-Canada list, the PIF-Canada list for BCR 11 was for the entire BCR (i.e. the USA and Canada) and not the Canadian portion alone.

The decision rules used by PIF-Canada to screen the RMBO list were those documented by Kennedy (2000). Note that this document is now outdated, but it is all that was available at the time.

Results

Step 1: Impacts on protected areas

Seventeen wetlands were identified within 100 m of the proposed pipeline route. The pipeline will also traverse five significant migratory bird habitat subregions:

- Battle River Upland (national significance for breeding ducks and regional significance for staging ducks [Bellshill Lake] and geese);
- Ribstone Plain (national significance for staging shorebirds [Sounding Lake]; regional significance for breeding Whooping Crane and staging shorebirds and local significance for staging geese [Sounding Lake, Shorncliffe Lake] and breeding ducks);
- Provost Upland (national significance for staging geese; regional significance for breeding and staging ducks, staging geese, and shorebirds [Gillespie Lake area]; and local significance for staging ducks and geese and breeding Ferruginous Hawk;
- Trampling Lake Plain (regional significance for staging ducks, geese, and shorebirds, local significance for moulting and staging ducks, staging geese, breeding Piping Plover and Ferruginous Hawk); and

- Sibbald Plain (national significance for staging ducks and geese, provincial significance for staging ducks and local significance for moulting ducks, staging geese, breeding Piping Plover, Ferruginous Hawk, and Burrowing Owl).

TERA (2000) noted that although the pipeline transects these subregions, this does not mean that these levels of significance apply at the site level.

Step 2: Bird conservation region

The proposed EP project is located in BCR 11 (the Prairie Potholes).

Step 3: Habitat

Initially, the priority species list was generated for the aspen parkland sub-region (by cross-validating the BCR list with one obtained from the Saskatchewan CDC for parkland), since this was considered the main vegetation type to be affected by the pipeline. However, later most habitat categories were included except deciduous/conifer and conifer forest (in the analyses presented here).

Step 4: Expected species list

BCR and habitat data were cross-matched to produce a list of priority species.

Step 5: Local species list

Complete species lists for BCR 11 were obtained from the regional coordinator for PIF-Canada. The complete list contained 366 species; this included many accidentals and was not used to generate the priority pool of species. However, it was assumed that this list contained all species and thus it was not necessary to reconcile this list with provincial or local species lists.

Step 6: Priority species matching

Of the 54 priority species in the RMBO database, 50 were reached the priority pool because of threats to breeding habitat, 15 for breeding distribution and eight for range responsibility (Table 2.1). By comparison the number of species reaching the priority pool 31 because of threats to breeding habitat, eight for responsibility by range and six for breeding distribution (Table 2.2).

The criteria by which species reached the priority pool are shown in Table 2.1 and 2.2. Note that nine of the 11 species surveyed during the EA reached the priority pool and were species for which mitigation might potentially be effective (e.g., those with threats to breeding areas or those with a narrow breeding distribution).

Table 2.1: Reasons why species reach priority pool: number of species in each category (based on all 54 priority species in BCR 11 in RMBO database)

Tier (no. of species)	BD	ND	AA	TB	TN	PT	AI	RR	Blue
I (25)	13	18	23	25	24	20	22	6	2
IIA (4)			4	3	2	4	4		
IIB (9)	1	4	5	9	8		9		
IIC (7)	1	4	3	7	7	6	2	2	
IIIA (9)			7	6			9		

Table 2.2: Reasons why species reach priority pool: number of species in each category (based on 26 priority species on Enbridge site list)

Tier (no. of species)	BD	ND	AA	TB	TN	PT	AI	RR	Blue
I (12)	5	10	12	12	11	9	12	6	
IIA (3)			3	2	2	3	3		
IIB (7)	1	4	4	7	6		7		
IIC (4)		1	3	4	4	6	1	2	
IIIA (9)			7	6			9		

Table 2.3: List of species by tier and reasons that they enter priority pool of species. Species in bold were listed for the EP site; species in grey occurred in RMBO list but not PIF-Canada list; and last three species with ? for criteria scores were in PIF-Canada priority list but not RMBO list.

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Blue
American Bittern	I			x	x	x	x	x	x	
Baird's Sparrow	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	
Black-billed Cuckoo*	I			x	x	x	x	x	x	
Chestnut-collared Longspur	I	x	x		x	x		x	x	
Ferruginous Hawk		**I**		**x**	**x**	**x**	**x**		**x**	**x**
Grasshopper Sparrow	I			x	x	x	x	x	x	
Greater Prairie-Chicken*	I	x	x	x	x	x	x			
Henslow's Sparrow*	I	x	x	x	x	x	x	x		
Le Conte's Sparrow	**I**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	
Long-billed Curlew	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**ND**	
Marbled Godwit	**I**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	**ND**
McCown's Longspur	I	x	x		x	x	x	x	x	
Nelson's Sharp-tailed Sparrow	I	x	x	x	x	x		x	x	
Northern Harrier	**I**			**x**	**x**	**x**	**x**	**x**		
Piping Plover	I	x	x	x	x	x	x		ND	
Red-headed Woodpecker	I			x	x	x	x	x		

Species	Tier	BD	ND	AA	TB	TN	PT	AI	RR	Blue
Sharp-tailed Grouse	**I**			**x**	**x**		**x**	**x**	**x**	
Short-eared Owl	I			x	x	x	x	x		x
Sprague's Pipit	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	
Swainson's Hawk	**I**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	
Trumpeter Swan*	I	x	x	x	x	x	x		ND	x
Upland Sandpiper	**I**		**x**	**x**	**x**	**x**		**x**	**ND**	
Willet	**I**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**ND**	
Wilson's Phalarope	**I**		**x**	**x**	**x**	**x**		**x**	**ND**	
Yellow Rail	I	x	x	x	x	x	x	x	x	
Canvasback	**IIA**			**x**	**x**	**x**	**x**	**x**	**ND**	
Killdeer	**IIA**			**x**		**x**	**x**	**x**	**ND**	
Northern Pintail	**IIA**			**x**	**x**		**x**	**x**	**ND**	
Virginia Rail	IIA			x	x		x	x		
Black Tern	**IIB**			**x**	**x**	**x**		**x**	**ND**	
Bobolink	IIB				x	x		x	x	
Clay-colored Sparrow	**IIB**		**x**		**x**	**x**		**x**		
Franklin's Gull	**IIB**	**x**	**x**		**x**			**x**	**ND**	
Marsh Wren	**IIB**			**x**	**x**	**x**		**x**		
Redhead	**IIB**			**x**	**x**	**x**		**x**	**ND**	
Ruddy Duck	**IIB**			**x**	**x**	**x**		**x**	**ND**	
Sedge Wren	**IIB**	**x**	**x**	**x**	**x**	**x**		**x**		
Yellow-headed Blackbird	**IB**		**x**		**x**	**x**		**x**		
American Avocet	**IIC**		**x**		**x**	**x**	**x**	**x**	**ND**	
Burrowing Owl	**IIC**			**x**	**x**	**x**	**x**		**x**	
Dickcissel*	IIC		x		x	x				
Lark Bunting	IIC	x	x		x	x	x		x	
Loggerhead Shrike	**IIC**			**x**	**x**	**x**	**x**		**x**	
Peregrine Falcon	**IIC**			**x**	**x**	**x**	**x**			
American Coot	**IIIA**			**x**				**x**		
Blue-winged Teal	**IIIA**			**x**	**x**			**x**	**ND**	
Eared Grebe	**IIIA**				**x**			**x**		
Gadwall	**IIIA**			**x**	**x**			**x**	**ND**	
Gray Partridge	**IIIA**			**x**				**x**		
Mallard	**IIIA**			**x**	**x**			**x**	**ND**	
Northern Shoveler	**IIIA**			**x**	**x**			**x**	**ND**	
Pied-billed Grebe	**IIIA**			**x**	**x**			**x**		
Vesper Sparrow	**IIIA**							**x**		
Greater-Sage Grouse	?	?	?	?	?	?	?	?		
Sage Thrasher	?	?	?	?	?	?	?	?		
Mountain Plover	?	?	?	?	?	?	?	?		

* Peripheral species in Canada; not listed by COSEWIC.

Step 7: Local data collection

Little information was presented in the ESEIA report for the priority species listed above, except for the 11 species of concern (for example, one Loggerhead Shrike nest was located, one potential pair of Burrowing Owls, a potential Eared Grebe colony). The DST indicated that abundance data needs to be gathered for many other species (see Table 2.1-2.3).

Step 8: Existing conservation

Do existing protected or ecologically important areas conserve the above species? This is hard to assess without wildlife inventory information from such areas in the vicinity of the pipeline.

Step 9: Mitigation

The main mitigation suggested in the EA was for pipeline construction to occur outside the breeding season (for wetlands the CWS timing constraint of 15 April - 15 July, for individual species . However, there appeared to be no recommendations to re-route the pipeline away from wetlands (e.g., the wetland with the Eared Grebe colony). On the other hand, since the surrounding land is in agriculture, mechanical operations already occur and may have an impact on nesting waterbirds; the question then is what is the added effect of the pipeline construction?

Step 10: Completion of DST, evaluation of significance, decision

It was suggested by TERA (2000) that most of the potential impacts of the pipeline would be 'short- to medium-term in duration and of low magnitude'. Although most of the area affected by the pipeline is in agricultural land, no assessment was made of loss of woodland or native prairie. It is important to identify the cumulative loss of the latter two habitats as well as the effects of the pipeline on wetlands within the region.

The DST suggests that data should be presented on many more species than the 11 species in the EA. Results were not reported in the EA for many species that reached the priority pool and occurred on the site list. They included seven species in Tier I, Le Conte's Sparrow, Marbled Godwit, Northern Harrier, Swainson's Hawk, Upland Sandpiper, Willet and Wilson's Phalarope; three in Tier IIA, Canvasback, Killdeer, Northern Pintail; seven in Tier IIB, Clay-colored Sparrow, Marsh Wren, Redhead, Ruddy Duck, Sedge Wren, Yellow-headed Blackbird and American Avocet; and eight in Tier IIIA, American Coot, Blue-winged Teal, Gadwall, Gray Partridge, Mallard, Northern Shoveler, Pied-billed Grebe and Vesper Sparrow (Table 2.3). Before making a decision an evaluation of the abundance of these species is required. This could affect mitigative measures.

Step 11: Local follow-up

This step would involve a thorough evaluation of the abundance of the priority species in the vicinity of the pipeline and the importance of these populations at different scales.

Differences in tiers between RMBO and PIF-Canada lists

Note that seven species in Tier IIB and nine species in Tier IIIA in the RMBO list were not evaluated by PIF-Canada because criteria scores for RP or RR were not available (these species are highlighted in light grey shade).

Three species were missing from the RMBO list that were included in the priority list by PIF-Canada: Greater Sage-Grouse, Sage Thrasher, and Mountain Plover.

Also, several species are peripheral in Canada and are not listed by COSEWIC; these include Black-billed Cuckoo, Dickcissel Greater Prairie-Chicken (extirpated), Henslow's Sparrow, and Trumpeter Swan (these are shown with an asterisk in Table 2.3). These species should be excluded from the priority species in the Canadian portion of BCR 11.

Appendix 3: List of bird species in Web site database and in background document and their scientific names

Species	Scientific name
Red-throated Loon	*Gavia stellata*
Common Loon	*Gavia immer*
Yellow-billed Loon	*Gavia adamsii*
Pacific Loon	*Gavia pacifica*
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Clark's Grebe	*Aechmophorus clarkii*
Short-tailed Albatross	*Phoebastria albatrus*
Black-footed Albatross	*Phoebastria nigripes*
Laysan Albatross	*Phoebastria immutabilis*
Yellow-nosed Albatross	*Thalassarche chlororhynchos*
Northern Fulmar	*Fulmarus glacialis*
Black-capped Petrel	*Pterodroma hasitata*
Fea's Petrel	*Pterodroma feae*
Mottled Petrel	*Pterodroma inexpectata*
Murphy's Petrel	*Pterodroma ultima*
Cory's Shearwater	*Calonectris diomedea*
Pink-footed Shearwater	*Puffinus creatopus*
Flesh-footed Shearwater	*Puffinus carneipes*
Greater Shearwater	*Puffinus gravis*
Buller's Shearwater	*Puffinus bulleri*
Sooty Shearwater	*Puffinus griseus*
Short-tailed Shearwater	*Puffinus tenuirostris*
Manx Shearwater	*Puffinus puffinus*
Black-vented Shearwater	*Puffinus opisthomelas*
Audubon's Shearwater	*Puffinus lherminieri*
Wilson's Storm-Petrel	*Oceanites oceanicus*
Fork-tailed Storm-Petrel	*Oceanodroma furcata*
Leach's Storm-Petrel	*Oceanodroma leucorhoa (leucorhoa)*
Band-rumped Storm-petrel	*Oceanodroma castro*
Northern Gannet	*Morus bassanus*
American White Pelican	*Pelecanus erythrorhynchos*
Brown Pelican	*Pelecanus occidentalis*
Great Cormorant	*Phalacrocorax carbo*

Species	Scientific name
Double-crested Cormorant	*Phalacrocorax auritus*
Neotropic Cormorant	*Phalacrocorax brasilianus*
Brandt's Cormorant	*Phalacrocorax penicillatus*
Pelagic Cormorant	*Phalacrocorax pelagicus*
Red-faced Cormorant	*Phalacrocorax urile*
Anhinga	*Anhinga anhinga*
Magnificent Frigatebird	*Fregata magnificens*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba (egretta)*
Little Egret	*Egretta garzetta*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Cattle Egret	*Bubulcus ibis*
Green Heron	*Butorides virescens*
Black-crowned Night-heron	*Nycticorax nycticorax (hoactli)*
Yellow-crowned Night-heron	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
White-faced Ibis	*Plegadis chihi*
Wood Stork	*Mycteria americana*
Greater Flamingo	*Phoenicopterus ruber*
Fulvous Whistling Duck	*Dendrocygna bicolor*
Black-bellied Whistling Duck	*Dendrocygna autumnalis*
Tundra Swan	*Cygnus columbianus (columbianus)*
Trumpeter Swan	*Cygnus buccinator*
Mute Swan	*Cygnus olor*
Bean Goose	*Anser fabalis*
Pink-footed Goose	*Anser brachyrhynchus*
Greater White-fronted Goose	*Anser albifrons*
Snow Goose	*Chen caerulescens*
Ross's Goose	*Chen rossii*
Emperor Goose	*Chen canagica*
Brant	*Branta bernicla*
Barnacle Goose	*Branta leucopsis*
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
American Green-winged Teal	*Anas crecca (carolinensis)*

Species	Scientific name
Eurasian Green-winged Teal	*Anas crecca crecca*
Baikal Teal	*Anas formosa*
Falcated Duck	*Anas falcata*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Garganey	*Anas querquedula*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
Common Pochard	*Aythya ferina*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Tufted Duck	*Aythya fuligula*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Common Eider	*Somateria mollissima*
King Eider	*Somateria spectabilis*
Spectacled Eider	*Somateria fischeri*
Steller's Eider	*Polysticta stelleri*
Labrador Duck	*Camptorhynchus labradorius*
Harlequin Duck	*Histrionicus histrionicus*
Oldsquaw (Long-tailed Duck)	*Clangula hyemalis*
Black Scoter	*Melanitta nigra (americana)*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca (deglandi)*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Smew	*Mergellus albellus*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser (americanus)*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Black Vulture	*Coragyps atratus*
Turkey Vulture	*Cathartes aura*

Species	Scientific name
Osprey	*Pandion haliaetus (carolinensis)*
Swallow-tailed Kite	*Elanoides forficatus*
White-tailed Kite	*Elanus leucurus*
Mississippi Kite	*Ictinia mississippiensis*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus (hudsonius)*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus (sanctijohannis)*
Golden Eagle	*Aquila chrysaetos (canadensis)*
Crested Caracara	*Caracara plancus*
Eurasian Kestrel	*Falco tinnunculus*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Gyrfalcon	*Falco rusticolus*
Prairie Falcon	*Falco mexicanus*
Gray Partridge	*Perdix perdix*
Chukar	*Alectoris chukar*
Ring-necked Pheasant	*Phasianus colchicus*
Spruce Grouse	*Falcipennis canadensis*
Blue Grouse	*Dendragapus obscurus*
Willow Ptarmigan	*Lagopus lagopus*
Rock Ptarmigan	*Lagopus mutus*
White-tailed Ptarmigan	*Lagopus leucurus*
Ruffed Grouse	*Bonasa umbellus*
Sage Grouse	*Centrocercus urophasianus*
Great Prairie Chicken	*Tympanuchus cupido*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Wild Turkey	*Meleagris gallopavo*
Northern Bobwhite	*Colinus virginianus*
California Quail	*Callipepla californica*
Mountain Quail	*Oreortyx pictus*
Yellow Rail	*Coturnicops noveboracensis*

Species	Scientific name
Black Rail	*Laterallus jamaicensis*
Corn Crake	*Crex crex*
Clapper Rail	*Rallus longirostris*
King Rail	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Purple Gallinule	*Porphyrula martinica*
Common Moorhen	*Gallinula chloropus (cachinnans)*
Eurasian Coot	*Fulica atra*
American Coot	*Fulica americana*
Sandhill Crane	*Grus canadensis*
Common Crane	*Grus grus*
Whooping Crane	*Grus americana*
Northern Lapwing	*Vanellus vanellus*
Black-bellied Plover	*Pluvialis squatarola*
Eurasian Golden-Plover	*Pluvialis apricaria*
American Golden-Plover	*Pluvialis dominica*
Pacific Golden-Plover	*Pluvialis fulva*
Mongolian Plover	*Charadrius mongolus*
Snowy Plover	*Charadrius alexandrinus (nivosus)*
Wilson's Plover	*Charadrius wilsonia*
Common Ringed Plover	*Charadrius hiaticula*
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover	*Charadrius melodus*
Killdeer	*Charadrius vociferus*
Mountain Plover	*Charadrius montanus*
American Oystercatcher	*Haematopus palliatus*
Black Oystercatcher	*Haematopus bachmani*
European Oystercatcher	*Haematopus ostralegus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Common Greenshank	*Tringa nebularia*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Redshank	*Tringa erythropus*
Wood Sandpiper	*Tringa glareola*
Solitary Sandpiper	*Tringa solitaria*
Common Redshank	*Tringa totanus*
Willet	*Catoptrophorus semipalmatus*
Wandering Tattler	*Heteroscelus incanus*

Species	Scientific name
Spotted Sandpiper	*Actitis macularia*
Terek Sandpiper	*Xenus cinereus*
Upland Sandpiper	*Bartramia longicauda*
Eskimo Curlew	*Numenius borealis*
American Whimbrel	*Numenius phaeopus (hudsonicus)*
Eurasian Whimbrel	*Numenius phaeopus [phaeopus group]*
Bristle-thighed Curlew	*Numenius tahitiensis*
Slender-billed Curlew	*Numenius tenuirostris*
Far Eastern Curlew	*Numenius madagascariensis*
Eurasian Curlew	*Numenius arquata*
Long-billed Curlew	*Numenius americanus*
Black-tailed Godwit	*Limosa limosa*
Hudsonian Godwit	*Limosa haemastica*
Bar-tailed Godwit	*Limosa lapponica*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*Arenaria melanocephala*
Surfbird	*Aphriza virgata*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Red-necked Stint	*Calidris ruficollis*
Little Stint	*Calidris minuta*
Temminck's Stint	*Calidris temminckii*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Sharp-tailed Sandpiper	*Calidris acuminata*
Purple Sandpiper	*Calidris maritima*
Rock Sandpiper	*Calidris ptilocnemis (tschuktschorum)*
Dunlin	*Calidris alpina*
Curlew Sandpiper	*Calidris ferruginea*
Stilt Sandpiper	*Calidris himantopus*
Spoonbill Sandpiper	*Eurynorhynchus pygmeus*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Ruff	*Philomachus pugnax*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*

Species	Scientific name
Jack Snipe	*Lymnocryptes minimus*
Common Snipe	*Gallinago gallinago (delicata)*
Eurasian Woodcock	*Scolopax rusticola*
American Woodcock	*Scolopax minor*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicaria*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Great Skua	*Catharacta skua*
South Polar Skua	*Catharacta maccormicki*
Laughing Gull	*Larus atricilla*
Franklin's Gull	*Larus pipixcan*
Little Gull	*Larus minutus*
Black-headed Gull	*Larus ridibundus*
Bonaparte's Gull	*Larus philadelphia*
Heermann's Gull	*Larus heermanni*
Mew Gull	*Larus canus (brachyrhynchus)*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Herring Gull	*Larus argentatus (smithsonianus)*
Thayer's Gull	*Larus thayeri*
Iceland Gull	*Larus glaucoides (kumlieni)*
Lesser Black-backed Gull	*Larus fuscus*
Slaty-backed Gull	*Larus schistisagus*
Western Gull	*Larus occidentalis*
Glaucous-winged Gull	*Larus glaucescens*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Black-tailed Gull	*Larus crassirostris*
Yellow-legged Gull	*Larus cachinnans*
Black-legged Kittiwake	*Rissa tridactyla*
Red-legged Kittiwake	*Rissa brevirostris*
Ross's Gull	*Rhodostethia rosea*
Sabine's Gull	*Xema sabini*
Ivory Gull	*Pagophila eburnea*
Gull-billed tern	*Sterna nilotica*
Caspian Tern	*Sterna caspia*
Royal Tern	*Sterna maxima*

Species	Scientific name
Elegant Tern	*Sterna elegans*
Sandwich Tern	*Sterna sandvicensis*
Roseate Tern	*Sterna dougallii*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Forster's Tern	*Sterna forsteri*
Least Tern	*Sterna antillarum*
Aleutian Tern	*Sterna aleutica*
Bridled Tern	*Sterna anaethetus*
Sooty Tern	*Sterna fuscata*
White-winged Tern	*Chlidonias leucopterus*
Black Tern	*Chlidonias niger (surinamensis)*
Black Skimmer	*Rynchops niger*
Dovekie	*Alle alle*
Common Murre	*Uria aalge*
Thick-billed Murre	*Uria lomvia*
Razorbill	*Alca torda*
Great Auk	*Pinguinus impennis*
Black Guillemot	*Cepphus grylle*
Pigeon Guillemot	*Cepphus columba*
Marbled Murrelet	*Brachyramphus marmoratus*
Kittlitz's Murrelet	*Brachyramphus brevirostris*
Long-billed Murrelet	*Brachyramphus perdix*
Xantus's Murrelet	*Synthliboramphus hypoleucus*
Ancient Murrelet	*Synthliboramphus antiquus*
Cassin's Auklet	*Ptychoramphus aleuticus*
Parakeet Auklet	*Aethia psittacula*
Crested Auklet	*Aethia cristatella*
Rhinoceros Auklet	*Cerorhinca monocerata*
Tufted Puffin	*Fratercula cirrhata*
Atlantic Puffin	*Fratercula arctica*
Horned Puffin	*Fratercula corniculata*
Rock Dove	*Columba livia*
Band-tailed Pigeon	*Columba fasciata*
Eurasian Collared Dove	*Streptopelia decaocto*
White-winged Dove	*Zenaida asiatica*
Mourning Dove	*Zenaida macroura*
Passenger Pigeon	*Ectopistes migratorius*
Inca Dove	*Columbina inca*
Common Ground Dove	*Columbina passerina*

Species	Scientific name
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Yellow-billed Cuckoo	*Coccyzus americanus*
Groove-billed Ani	*Crotophaga sulcirostris*
Barn Owl	*Tyto alba (pratincola)*
Flammulated Owl	*Otus flammeolus*
Eastern Screech Owl	*Otus asio*
Western Screech Owl	*Otus kennicottii*
Great Horned Owl	*Bubo virginianus*
Snowy Owl	*Nyctea scandiaca*
Northern Hawk Owl	*Surnia ulula*
Northern Pygmy Owl	*Glaucidium gnoma*
Burrowing Owl	*Athene cunicularia (hypugaea)*
Northern Spotted Owl	*Strix occidentalis (caurina)*
Barred Owl	*Strix varia*
Great Gray Owl	*Strix nebulosa*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
Boreal Owl	*Aegolius funereus (richardsoni)*
Northern Saw-whet Owl	*Aegolius acadicus*
Lesser Nighthawk	*Chordeiles acutipennis*
Common Nighthawk	*Chordeiles minor*
Common Poorwill	*Phalaenoptilus nuttallii*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Black Swift	*Cypseloides niger*
Chimney Swift	*Chaetura pelagica*
Vaux's Swift	*Chaetura vauxi*
White-throated Swift	*Aeronautes saxatalis*
Green Violet-Ear	*Colibri thalassinus*
Broad-billed Hummingbird	*Cynanthus latirostris*
Ruby-throated Hummingbird	*Archilochus colubris*
Black-chinned Hummingbird	*Archilochus alexandri*
Anna's Hummingbird	*Calypte anna*
Costa's Hummingbird	*Calypte costae*
Calliope Hummingbird	*Stellula calliope*
Rufous Hummingbird	*Selasphorus rufus*
Belted Kingfisher	*Ceryle alcyon*
Lewis' Woodpecker	*Melanerpes lewis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-bellied Woodpecker	*Melanerpes carolinus*

Species	Scientific name
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Williamson's Sapsucker	*Sphyrapicus thyroideus*
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
White-headed Woodpecker	*Picoides albolarvatus*
Three-toed Woodpecker	*Picoides tridactylus*
Black-backed Woodpecker	*Picoides arcticus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Eastern Wood-Pewee	*Contopus virens*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Gray Flycatcher	*Empidonax wrightii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Cordilleran Flycatcher	*Empidonax occidentalis*
Black Phoebe	*Sayornis nigricans*
Eastern Phoebe	*Sayornis phoebe*
Say's Phoebe	*Sayornis saya*
Vermilion Flycatcher	*Pyrocephalus rubinus*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Great Crested Flycatcher	*Myiarchus crinitus*
Great Kiskadee	*Pitangus sulphuratus*
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*
Variegated Flycatcher	*Empidonomus varius*
Tropical Kingbird	*Tyrannus melancholicus*
Cassin's Kingbird	*Tyrannus vociferans*
Thick-billed Kingbird	*Tyrannus crassirostris*
Western Kingbird	*Tyrannus verticalis*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Kingbird	*Tyrannus dominicensis*
Scissor-tailed Flycatcher	*Tyrannus forficatus*

Species	Scientific name
Fork-tailed Flycatcher	*Tyrannus savana*
Sky Lark (Eurasian Skylark)	*Alauda arvensis*
Horned Lark	*Eremophila alpestris*
Purple Martin	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Cave Swallow	*Petrochelidon fulva*
Barn Swallow	*Hirundo rustica (erythrogaster)*
Gray Jay	*Perisoreus canadensis*
Steller's Jay	*Cyanocitta stelleri*
Blue Jay	*Cyanocitta cristata*
Western Scrub-Jay	*Aphelocoma californica*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie	*Pica pica (hudsonia)*
American Crow	*Corvus brachyrhynchos*
Northwestern Crow	*Corvus caurinus*
Fish Crow	*Corvus ossifragus*
Common Raven	*Corvus corax*
Eurasian Jackdaw	*Corvus monedula*
Black-capped Chickadee	*Poecile atricapillus*
Carolina Chickadee	*Poecile carolinensis*
Mountain Chickadee	*Poecile gambeli*
Gray-headed Chickadee	*Poecile cinctus*
Boreal Chickadee	*Poecile hudsonicus*
Chestnut-backed Chickadee	*Poecile rufescens*
Bridled Titmouse	*Baeolophus wollweberi*
Tufted Titmouse	*Baeolophus bicolor*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Pygmy Nuthatch	*Sitta pygmaea*
Brown Creeper	*Certhia americana*
Cactus Wren	*Campylorhynchus brunneicapillus*
Rock Wren	*Salpinctes obsoletus*
Canyon Wren	*Catherpes mexicanus*
Carolina Wren	*Thryothorus ludovicianus*

Species	Scientific name
Bewick's Wren	*Thryomanes bewickii calophonus*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Sedge Wren	*Cistothorus platensis (stellaris)*
Marsh Wren	*Cistothorus palustris*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Siberian Rubythroat	*Luscinia calliope*
Bluethroat	*Luscinia svecica*
Northern Wheatear	*Oenanthe oenanthe*
Eastern Bluebird	*Sialia sialis*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Veery	*Catharus fuscescens*
Gray-cheeked Thrush	*Catharus minimus*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Bicknell's Thrush	*Catharus bicknelli*
Wood Thrush	*Hylocichla mustelina*
Eurasian Blackbird	*Turdus merula*
Eye-browed Thrush	*Turdus obscurus*
Fieldfare	*Turdus pilaris*
Redwing	*Turdus iliacus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Stonechat	*Saxicola torquata*
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*
Sage Thrasher	*Oreoscoptes montanus*
Brown Thrasher	*Toxostoma rufum*
Bendire's Thrasher	*Toxostoma bendirei*
Yellow Wagtail	*Motacilla flava*
White Wagtail	*Motacilla alba*
Black-backed Wagtail	*Motacilla lugens*
Red-throated Pipit	*Anthus cervinus*
American Pipit	*Anthus rubescens*
Sprague's Pipit	*Anthus spragueii*

Species	Scientific name
Bohemian Waxwing	*Bombycilla garrulus (pallidiceps)*
Cedar Waxwing	*Bombycilla cedrorum*
Phainopepla	*Phainopepla nitens*
Northern Shrike	*Lanius excubitor*
Loggerhead Shrike	*Lanius ludovicianus*
European Starling	*Sturnus vulgaris*
Crested Myna	*Acridotheres cristatellus*
White-eyed Vireo	*Vireo griseus*
Bell's Vireo	*Vireo bellii*
Black-capped Vireo	*Vireo atricapillus*
Blue-headed Vireo	*Vireo solitarius*
Yellow-throated Vireo	*Vireo flavifrons*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Philadelphia Vireo	*Vireo philadelphicus*
Red-eyed Vireo	*Vireo olivaceus*
Plumbeous Vireo	*Vireo plumbeus*
Cassin's Vireo	*Vireo cassinii*
Blue-winged Warbler	*Vermivora pinus*
Golden-winged Warbler	*Vermivora chrysoptera*
Tennessee Warbler	*Vermivora peregrina*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Virginia's Warbler	*Vermivora virginiae*
Northern Parula	*Parula americana*
Yellow Warbler	*Dendroica petechia*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Magnolia Warbler	*Dendroica magnolia*
Cape May Warbler	*Dendroica tigrina*
Black-throated Blue Warbler	*Dendroica caerulescens*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Hermit Warbler	*Dendroica occidentalis*
Black-throated Green Warbler	*Dendroica virens*
Blackburnian Warbler	*Dendroica fusca*
Yellow-throated Warbler	*Dendroica dominica*
Pine Warbler	*Dendroica pinus*
Kirtland's Warbler	*Dendroica kirtlandii*
Prairie Warbler	*Dendroica discolor*

Species	Scientific name
Palm Warbler	*Dendroica palmarum*
Bay-breasted Warbler	*Dendroica castanea*
Blackpoll Warbler	*Dendroica striata*
Cerulean Warbler	*Dendroica cerulea*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Prothonotary Warbler	*Protonotaria citrea*
Worm-eating Warbler	*Helmitheros vermivorus*
Swainson's Warbler	*Limnothlypis swainsonii*
Ovenbird	*Seiurus aurocapillus*
Northern Waterthrush	*Seiurus noveboracensis*
Louisiana Waterthrush	*Seiurus motacilla*
Kentucky Warbler	*Oporornis formosus*
Connecticut Warbler	*Oporornis agilis*
Mourning Warbler	*Oporornis philadelphia*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Hooded Warbler	*Wilsonia citrina*
Wilson's Warbler	*Wilsonia pusilla*
Canada Warbler	*Wilsonia canadensis*
Painted Redstart	*Myioborus pictus*
Yellow-breasted Chat	*Icteria virens*
Summer Tanager	*Piranga rubra*
Scarlet Tanager	*Piranga olivacea*
Western Tanager	*Piranga ludoviciana*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Lazuli Bunting	*Passerina amoena*
Indigo Bunting	*Passerina cyanea*
Varied Bunting	*Passerina versicolor*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Green-tailed Towhee	*Pipilo chlorurus*
Eastern Towhee	*Pipilo erythrophthalmus*
Spotted Towhee	*Pipilo maculatus*
Bachman's Sparrow	*Aimophila aestivalis*
Cassin's Sparrow	*Aimophila cassinii*
American Tree Sparrow	*Spizella arborea*

Species	Scientific name
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow	*Spizella breweri*
Field Sparrow	*Spizella pusilla*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow	*Amphispiza belli*
Lark Bunting	*Calamospiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Baird's Sparrow	*Ammodramus bairdii*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Seaside Sparrow	*Ammodramus maritimus*
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
White-crowned Sparrow	*Zonotrichia leucophrys*
Harris's Sparrow	*Zonotrichia querula*
Dark-eyed Junco	*Junco hyemalis*
McCown's Longspur	*Calcarius mccownii*
Lapland Longspur	*Calcarius lapponicus*
Smith's Longspur	*Calcarius pictus*
Chestnut-collared Longspur	*Calcarius ornatus*
Rustic Bunting	*Emberiza rustica*
Snow Bunting	*Plectrophenax nivalis*
McKay's Bunting	*Plectrophenax hyperboreus*
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird	*Agelaius phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Rusty Blackbird	*Euphagus carolinus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Great-tailed Grackle	*Quiscalus mexicanus*

Species	Scientific name
Common Grackle	*Quiscalus quiscula*
Shiny Cowbird	*Molothrus bonariensis*
Brown-headed Cowbird	*Molothrus ater*
Orchard Oriole	*Icterus spurius*
Hooded Oriole	*Icterus cucullatus*
Baltimore Oriole	*Icterus galbula*
Scott's Oriole	*Icterus parisorum*
Bullock's Oriole	*Icterus bullockii*
Common Chaffinch	*Fringilla coelebs*
Brambling	*Fringilla montifringilla*
Black Rosy-finch	*Leucosticte atrata*
Gray-crowned Rosy Finch	*Leucosticte tephrocotis*
Pine Grosbeak	*Pinicola enucleator*
Purple Finch	*Carpodacus purpureus*
Cassin's Finch	*Carpodacus cassinii*
House Finch	*Carpodacus mexicanus (frontalis)*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera (leucoptera)*
Common Redpoll	*Carduelis flammea*
Hoary Redpoll	*Carduelis hornemanni*
Pine Siskin	*Carduelis pinus*
Lesser Goldfinch	*Carduelis psaltria*
American Goldfinch	*Carduelis tristis*
European Goldfinch	*Carduelis carduelis*
Evening Grosbeak	*Coccothraustes vespertinus*
House Sparrow	*Passer domesticus*
Eurasian Tree Sparrow	*Passer montanus*