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FISH AND WILDLIFE
COMPENSATION PROGRAM

COLUMBIA BASIN

SPECIES OF INTEREST ACTION PLAN

June 2012

BC hydro
FOR GENERATIONS

British Columbia
The Best Place on Earth

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Columbia Species of Interest Action Plan

1. Introduction

In 1995 the Fish & Wildlife Compensation Program (Columbia Basin) was created to coordinate efforts to compensate for fish and wildlife losses associated with BC Hydro projects in the region (Figure 1). An Administrative Agreement was signed in 1999 between the BC Ministry of Environment and BC Hydro to formalize the management of the program, which was developed to satisfy the obligations regarding fish and wildlife attached to the Arrow, Duncan, Mica, Seven Mile and Revelstoke project water licences. The program is delivered as a partnership between BC Hydro, the BC Provincial Government, Fisheries and Oceans Canada, First Nations and public stakeholders.

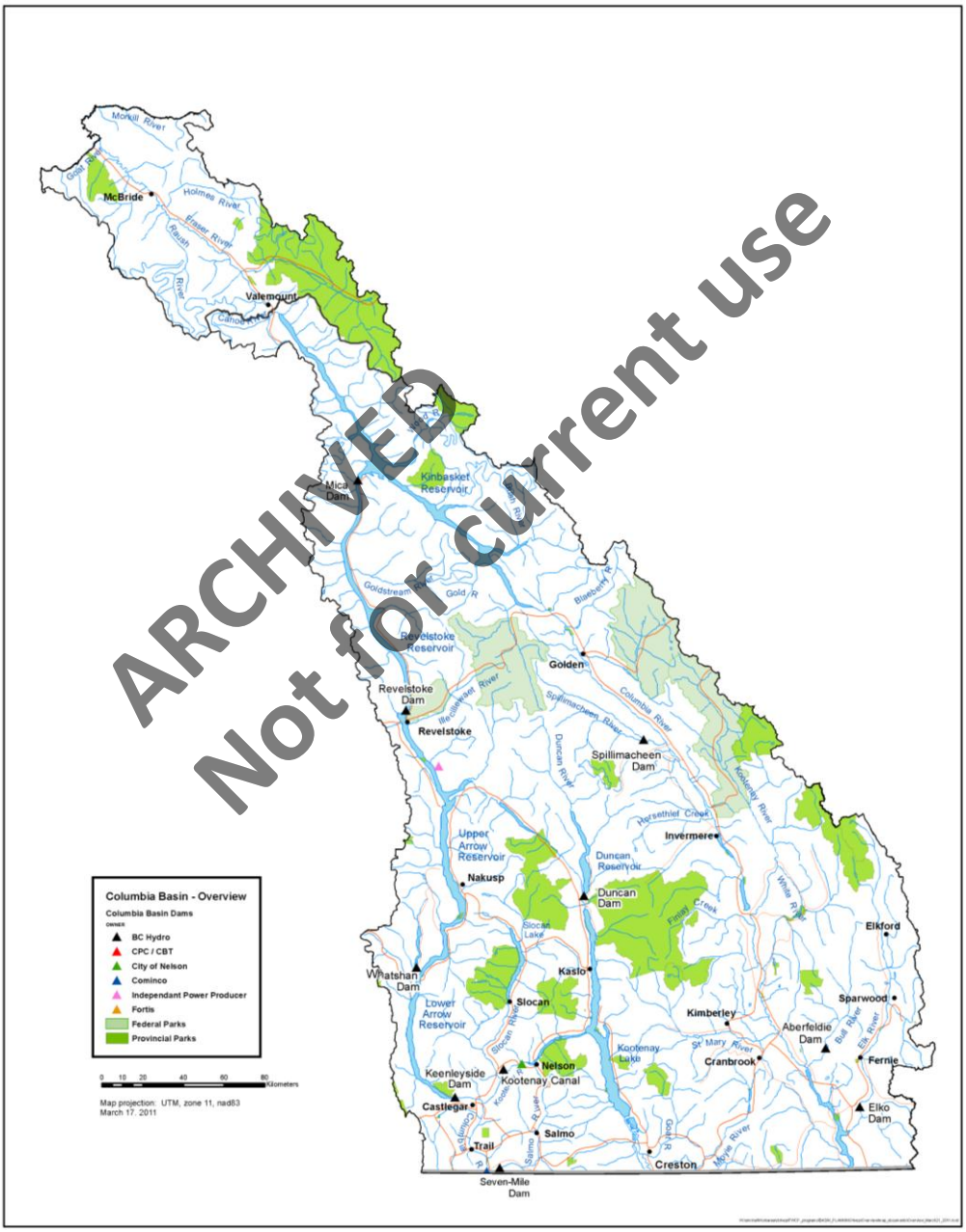

Figure 1. The Columbia basin generation system, indicating the region's major dams and reservoirs.

The FWCP developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each basin within the FWCP program area, which are in turn informing action plans that focus on specific priorities within each basin (Figure 2).

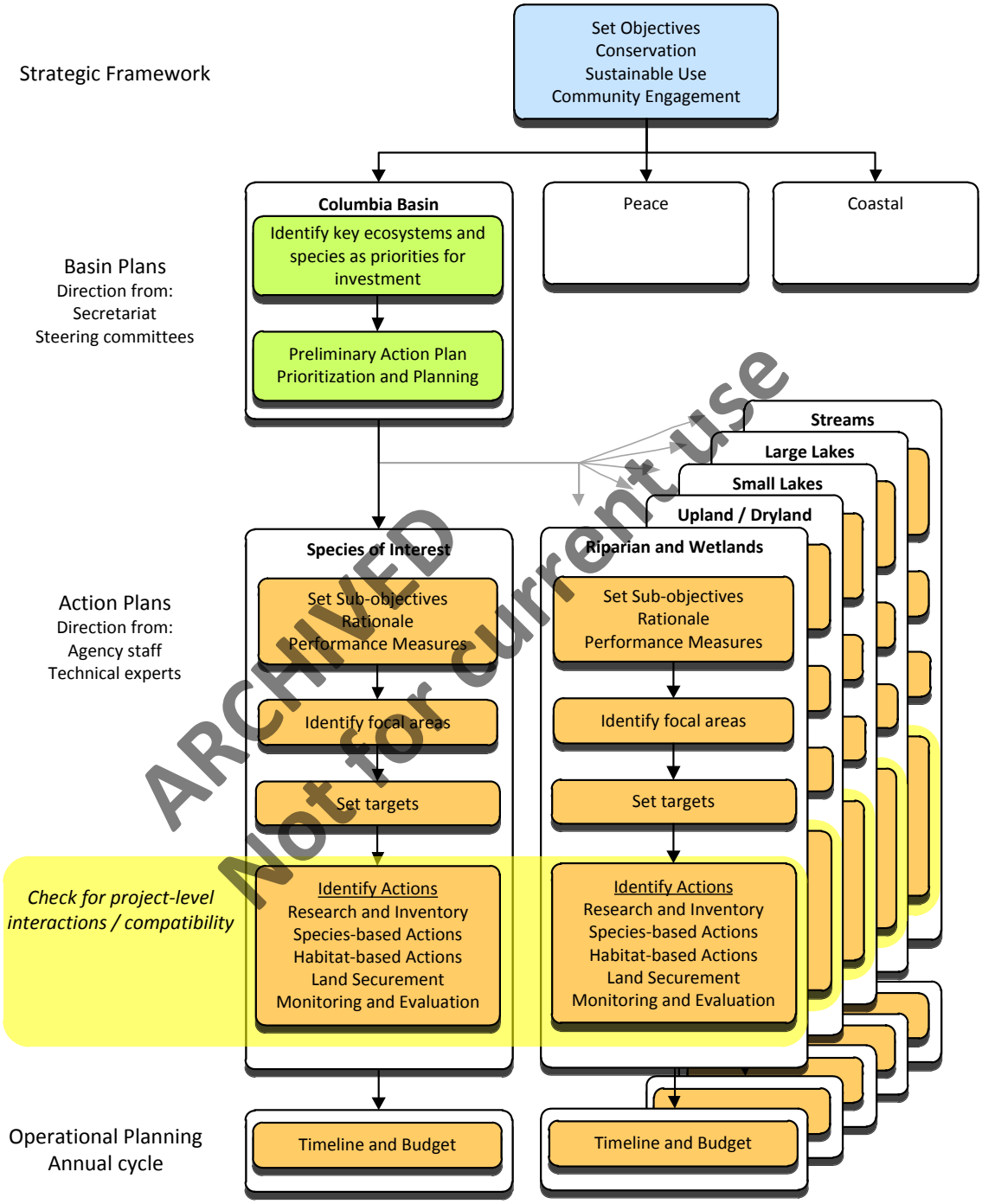

Figure 2. Relationship between the Species of Interest Action Plan and higher level planning and objectives.

This Species of Interest Action Plan sets out priorities for the Fish and Wildlife Compensation Program to guide projects within the FWCP: Columbia project area in support of fish and wildlife. Direction is provided for three categories of species: *Recovery*, *Focal* and *Inventory* (see below). The plan builds on the FWCP's strategic objectives and the FWCP Columbia Basin Plan (Fish and Wildlife Compensation Program, 2011a). Action plans have also been developed for riparian and wetlands, uplands and drylands, large lakes, small lakes, and streams;[1] some actions may be complementary across the different plans.

The actions and priorities described here have been developed with input from the BC Ministry of Environment (MOE), BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO), Fisheries and Oceans Canada (DFO), BC Hydro, First Nations and local stakeholders. It is important to understand, however, that planning priorities within action plans may not translate immediately into funded projects. Limited program funding requires that priority-setting has to also be developed across the program as a whole, not just within action plans. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

2. Overview Context

2.1. Action Plan Species Categories

There are three general categories of species of interest defined for this action plan. It is expected that species might move between categories as their conservation status changes (e.g., up-listing or down-listing by the Conservation Data Centre) and / or the information basis for planning improves.

Recovery Species — Recovery species are those of highest priority and conservation concern that have been adversely impacted by dam construction and/or operation. These species have formally been classified as either threatened or endangered by BC or Canada, and recovery plans are either in place or under development by Federal or Provincial management agencies. Actions contained within this plan are directly coordinated with recovery strategies and plans.

Focal Species — Focal species are defined by having both a high conservation concern (as defined by the BC Conservation Framework and local interest) and a strong linkage to footprint impacts. Actions proposed for species in this category should be developed in the context of the relevant ecosystem-based plans (i.e., riparian/wetlands, large lakes, etc.).

Inventory Species — These species also have both a high conservation concern and have been affected by dams, but detailed inventory and/or trend monitoring is first required to support the development of more detailed actions. Actions proposed for species in this category should aim to provide the basis for future compensation actions.

[1] All of the FWCP Columbia Plans are available at: http://www.fwcpcolumbia.ca/version2/index.php

2.2. Impacts and Threats

Aquatic and terrestrial habitats in the Columbia River system in BC have been altered significantly by the construction of dams and consequent changes to flood regimes. A comprehensive study conducted by the FWCP estimated footprint impacts of BC Hydro operations of the Columbia Basin (Utzig and Schmidt 2011, and references therein). The areal extent of impacts was estimated by photo-interpreting pre-dam imagery of impacted reaches (Ketcheson et al. 2005) and comparing them to current condition. Total aquatic and terrestrial habitat losses in the Columbia Basin resulting from BC Hydro operations are estimated to be more than 120,000 ha (Figure 3).

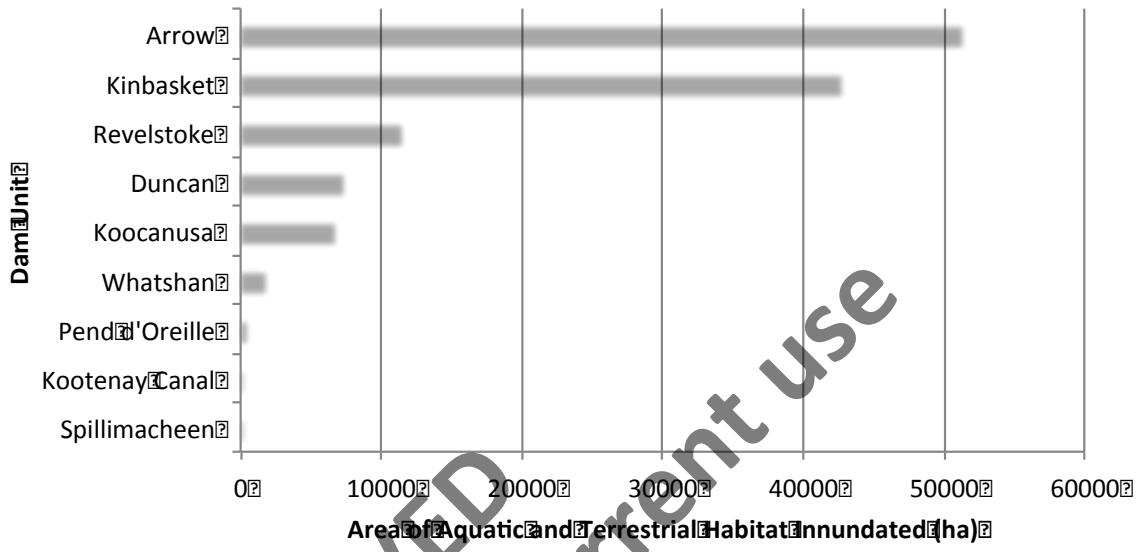

Figure 3. Aquatic and terrestrial habitat losses resulting from BC Hydro operations in the Columbia Basin, by dam unit (Utzig and Schmidt 2011).

With respect to aquatic species, dam construction and operation has generated a variety of habitat changes that have impacted species including:

- Habitat loss;
- Barriers to migration and movement;
- Entrainment;
- Changes in sediment loading;
- Nutrient regime changes; and,
- Contamination (e.g., mercury methylation).

Terrestrial species associated with highest impacts were those dependent on wetland and riparian habitats such as amphibians, waterbirds, waders, songbirds, aerial insectivorous birds and bats (Utzig and Schmidt 2011).

Lake/reservoir habitats expanded at the expense of a variety of lowland habitats, including wetlands, riparian and upland forests and streams (Utzig and Schmidt 2011). As a result, impacts on wildlife species have also been significant (Manley and Krebs 2009). Since dam construction there have been a variety of habitat stresses that have continued to erode the extent of some habitats for some species, including: conversion of wetland and riparian habitats for agriculture, forest harvesting, changes in natural disturbance regimes, and urban and extra-urban development.

2.3. Limiting Factors

Factors limiting the abundance and distribution of aquatic and terrestrial species are related to three broad categories:

Habitat Extent

The carrying capacity of habitat for any species is ultimately determined by the extent of suitable habitat. As mentioned above, inundation and other stressors have altered the extent of habitats available. Compensating for this loss requires either the creation of new habitat or treatments that increase the carrying capacity of remaining habitat.

Distribution

Connectivity among habitats is important for dispersal of fish, plants and animals and for seasonal movements of some species. Populations in suitable but isolated habitats are often at higher risk of extirpation because immigration and emigration are disrupted, making these populations more susceptible to stochastic events. Management actions that can address habitat fragmentation and barriers include re-establishing connectivity where practical, and/or transplanting individuals into unoccupied or under-occupied habitats.

Productivity

The productivity of an ecosystem is defined as its ability to grow or yield native plants and animals. Even where the extent and distribution of habitats is relatively intact, the productivity of ecosystems can be eroded by a variety of pressures such as invasive species, nutrient and sediment loading, soil erosion, changes in drainage patterns, as well as forest harvesting, livestock grazing and other extractive activities. Addressing these factors can increase the productivity of habitats in general and can provide more suitable habitat for native species.

In addition, specific habitat features can limit the distribution and abundance of species; for example, spawning beds or nest cavities. Projects designed to increase the availability of limiting habitat features can increase the productivity of habitats for specific species.

2.4. Trends and Knowledge Status

Long-term monitoring data are generally unavailable for aquatic and terrestrial species in the Columbia Basin. As a result, our knowledge of pre-dam populations is limited to anecdotal accounts or inferences made from habitat impacts. Trend information for some species (e.g., ungulate populations, recreational fish species) has become more available over the past 25 years. More recently, a focus on threatened and endangered wildlife has improved our knowledge of the distribution and abundance of these species; however, there remain significant gaps.

3. Action Plan Objectives, Measures and Targets

Clear and realistic management objectives are necessary to guide information acquisition and prioritize management actions. Priority actions and information needs will change as both improvements to the system are realized and information is gained. The current plan reflects the information available and values expressed by FWCP partners.

3.1. Objective Setting

The following definitions are used for setting objectives in this report:

Objectives:	Objectives are high-level statements of desired future conditions (outcomes), consistent with MOE's mandate and policies.
Sub-objectives:	Sub-objectives are detailed statements of desired future conditions within objectives, from which performance measures can be derived and alternative management actions evaluated. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.
Performance Measures:	Measures are specific metrics that indicate the degree to which desired future conditions have been achieved.
Targets:	Targets are the value of the performance measure that indicates the attainment of a desired condition.
Actions:	Actions are management activities, plans or policies for achieving the objectives.

Objectives are the "ends" or the outcomes we ultimately care about. Actions are the "means," or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives in relation to species of interest.

3.2. Objectives, Measures and Targets

There are two FWCP objectives for species of interest in the Columbia Basin.

Objective 1 – Maintain or improve the status of species of interest in the Columbia Basin.

Sub-objective 1: Improve the distribution and abundance of recovery and focal species.

***Rationale* —** Expanding/recovering populations and/or expanding the range species of interest that are found within the Columbia Basin is considered a high priority. Limiting factors for species of interest may be specific in nature, such as a lack of suitable nesting sites, or may be broader in scope. Consequently, action to improve the status of species may include improvements in the habitat and ecosystems they depend upon.

***Measures and Targets* —** Measures and targets will be developed when further inventory and planning is completed.

Sub-objective 2: Assess the distribution, abundance and/or trend of inventory species.

***Rationale* —** "Inventory" species are those for which the primary management action identified is inventory and monitoring (Manley and Krebs 2009; Appendix I). Addressing this need is a key step in developing detailed actions that could reduce limiting factors.

***Measures and Targets* —** Measures and targets will be developed when further inventory and planning is completed.

***Objective 2* – Maintain or improve opportunities for sustainable use.**

***Rationale* —** Many wetland and riparian species are the focus of sustainable use activities by First Nations and the public. The creation of habitat such as the CVWMA and Columbia wetlands has created direct opportunities for sustainable use. In addition, actions addressing conservation of species and ecosystems support a variety of sustainable use activities.

4. Action Plan

4.1. Overview

Management for species of interest ultimately rests with the provincial and federal environment Ministries, but FWCP contributes resources towards planning and implementation of management actions that benefit species within its program area, usually based on the outcomes of multi-agency planning processes. FWCP's mandate limits its involvement in species of interest management to activities that meet FWCP objectives.

The Action Plan has individual actions for each Recovery Species, and provides direction for proponent-led proposals aimed at improving the status of both Focal Species and Inventory Species. In general, actions are defined in support of multiple sub-objectives, which in turn support multiple objectives. Figure 4 provides an overview of the link between actions and objectives.

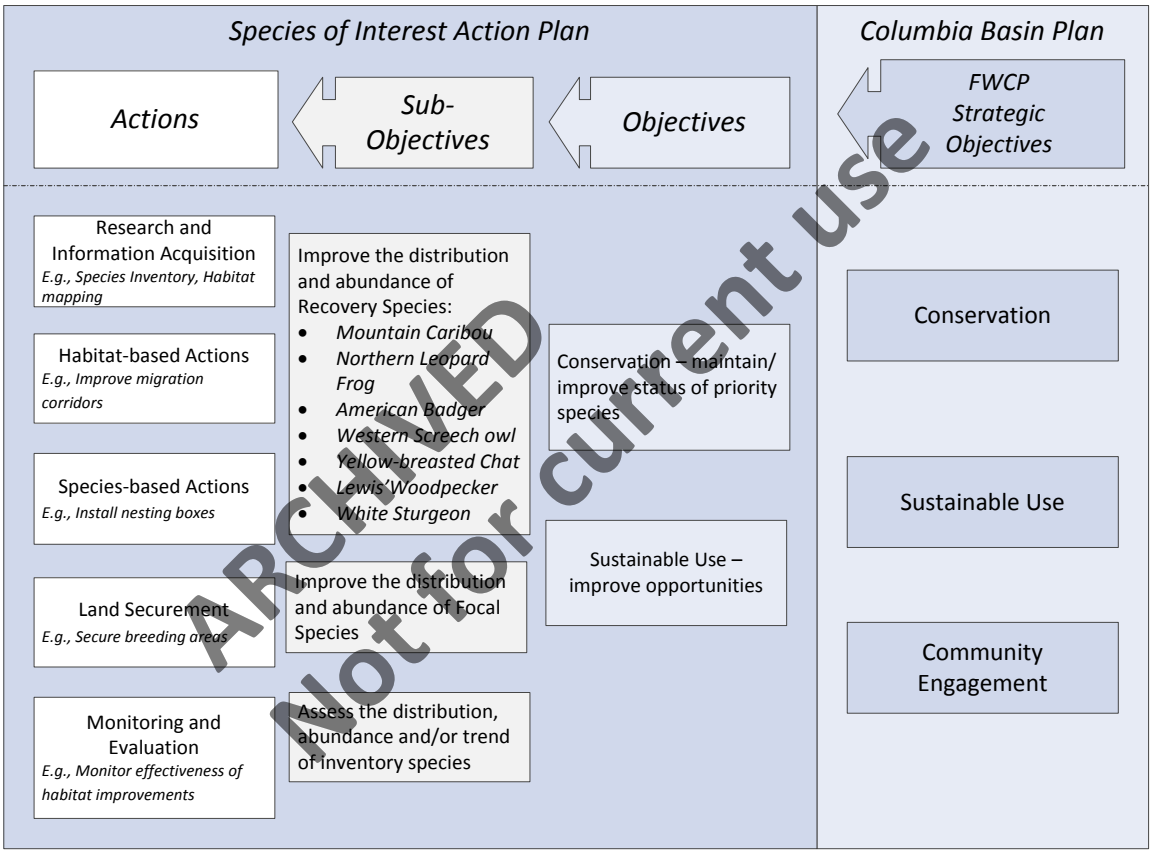

Figure 4: Relationship between actions, sub-objectives and objectives in this Species of Interest Action Plan and the FWCP strategic objectives in the Columbia Basin Plan.

Actions proposed in Section 4.2 are organized under five broad categories: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Some actions support multiple sub-objectives, which in turn support multiple objectives. Actions are assigned priorities from 1-3. Note that low priority actions were not considered.

4.2. Recovery Species

Within the context of the FWCP: Columbia Basin program there are seven species that meet the definition of *recovery species* as defined above, and that are linked to dam footprint impacts (Table 1; Manley and Krebs 2009).

Table 1. Columbia Basin species that are listed by either BC or Canada as threatened or endangered and for which recovery processes in place or in development. These species were also impacted by dam construction and/or are currently impacted by BC Hydro operations (Manley and Krebs 2009).

Species	COSEWIC	CDC	Reference
1. Mountain Caribou (*Caribou tarandus caribou*)	Threatened	Red-listed	Mountain Caribou Recovery Implementation Plan (BC Ministry of Environment 2011)
2. Northern Leopard Frog (*Rana pipiens*)	Endangered	Red-listed	Assessment and updated status report (COSEWIC 2009)
3. American Badger (*Taxidea taxus)*	Endangered	Red-listed	Recovery strategy (BC Ministry of Environment 2008)
4. Western Screech-owl (*Megascops kennicottii macfarlanei*)	Endangered	Red-listed	Assessment and updated status report (COESWIC 2002a)
5. Yellow-breasted Chat (*Icteria virens*)	Endangered	Red-listed	Species at Risk Act Management Plan (COSEWIC 2002b)
6. Lewis' Woodpecker (*Melanerpes lewis*)	Threatened	Red-listed	Assessment and status report (COSEWIC 2010)
7. White Sturgeon (*Acipenser transmontanus*) Kootenay River and Upper Columbia River populations	Endangered	Red-listed	Assessment and updated status report (COSEWIC 2003)

1. Mountain Caribou

The Columbia Basin is home to the southernmost woodland caribou herds in Canada. Although historically found through throughout the basin, during the 19th and 20th century the population was reduced significantly and now exists only in a few discrete herds, many of which are comprised of fewer than 20 animals. As part of the larger federal South Mountains Population, woodland caribou are not considered endangered, but the province has placed a very high priority on recovery of the mountain caribou ecotype of woodland caribou, which ranges in the Columbia Basin. The Province announced a recovery strategy in 2007 and has been implementing actions related to:

- additional habitat protection;
- snowmobile closures;
- a moratorium on new commercial back-country tenures and operating practices for existing tenure-holders;
- predator-prey management; and,
- augmentation of small herds by transplanting caribou from larger herds in northern BC.

Actions related to mountain caribou that align with FWCP's investment rationale are presented in Table 2. Some actions presented in the Columbia Uplands and Drylands Action Plan and, secondarily, the Riparian and Wetland Action Plan, will benefit mountain caribou.

Table 2. Actions related to mountain caribou that align with FWCP's investment rationale.

Action	Rationale	Priority
Research and information acquisition		
Contribute to monitoring survival, cause-specific mortality, and habitat selection of planned caribou augmentation	Evaluate the success of augmentation	1
Contribute to Revelstoke predator/alternate prey adaptive management pilot project	Evaluate effectiveness of adaptive management on caribou recovery	2
Survey abundance of wolves, cougars, deer, elk and moose in, and adjacent to, mountain caribou ranges	Predation is likely the major proximate factor affecting mountain caribou herds and understanding the dynamics of the predator-prey system is a priority	1
Species-based actions		
Augment very small mountain caribou herds	Several herds in the Columbia Basin have been identified as priorities for	1

Action	Rationale	Priority
with transplanted caribou	augmentation because there are few caribou remaining	
Improve recruitment via captive rearing or maternity penning where appropriate	To increase small and declining populations to recovery targets, recruitment will need to increase significantly	2
Habitat-based actions		
Identify caribou habitat restoration opportunities within the crown portion of the South Selkirk Caribou recovery zone	To accelerate the recruitment of suitable stand structure, attributes and connectivity within core caribou habitat	3
Land securement		
Contribute to land acquisition opportunities as they arise within and adjacent to caribou recovery zones	Land securement for caribou reduces future environmental risks	3
Monitoring and Evaluation		
Conduct spring inventories of mountain caribou herds	Ongoing trend information is required to understand the efficacy of management actions and to respond effectively to significant changes in abundance	1

2. Northern Leopard Frog

The northern leopard frog is one of several leopard frog species that are widely distributed throughout North America. However, many western populations have declined significantly or disappeared (Ohanjanian and Paige 2004). Historically the species occurred only in the Columbia Basin, but it's now known from only one site on the Creston Valley Wildlife Management Area (Ohanjanian 1997).

The FWCP has invested heavily in recovery actions, including population monitoring and a captive breeding and reintroduction program that operated from 2001 to 2005 (Adama and Beaucher 2006).

Actions related to northern leopard frog that align with FWCP's investment rationale are presented in Table 3. The species will also benefit from several actions identified for the Creston Valley identified in the Columbia Riparian and Wetlands Action Plan.

Table 3. Actions related to northern leopard frog that align with FWCP's investment rationale.

Action	Rationale	Priority
Research and information acquisition		
Develop strategy to deal with road mortalities	Driving on adjacent dikes might be a significant source of adult mortality	2
Species-based actions		
Implement Recovery Team's recommended reintroduction actions	The Recovery Team is currently deliberating on required reintroduction actions for recovery	1
Continue maintaining the captive assurance colony	In partnership with the Vancouver Aquarium, a captive assurance colony is maintaining genetic stock in case of a catastrophic failure of the wild population	1
Habitat-based actions		
Enhance potential habitat in adjacent ponds in the CVWMA and potentially in Bummers Flats	Frogs have established in adjacent ponds when suitable habitat has been available	1
Land securement		
Secure habitat to facilitate dispersal and access to over-wintering sites	To access over-wintering sites and to occupy new habitat, frogs need to move through unsecured habitat	1

Action	Rationale	Priority
Monitoring and Evaluation		
Continue monitoring the population in the CVWMA and Bummers Flats	Trend information is required for planning and to adequately respond to significant changes	1

3. American Badger

Badgers in North America are known only from the central and western portions of the continent, and the American badger occurs west of the Rockies from southern BC to Colorado, Utah, Nevada and California (Adams and Kinley 2004). In BC badger occur in dryland habitat of the southern and central interior, including the Columbia Valley and southern portion of the Columbia Basin.

Adams et al. (2002) estimated that there are <200 breeding adults remaining in BC. Threats to the population include (Adams and Kinley 2004):

- highway construction;
- urban development;
- agricultural development (cultivation, viniculture, orchards, range over-grazing);
- forest in-growth;
- gravel and sand pits;
- reservoir flooding; and,
- uncontrolled off-road access.

The FWCP contributed funding to a multi-agency project from 1996-2006 that addressed research needs, population augmentation and community outreach (Newhouse 2006). Management actions to address significant threats, especially road-kills, are ongoing.

Actions related to American badger that align with FWCP's investment rationale are presented in Table 4. Some actions presented in the Columbia Uplands and Drylands Action Plan will also benefit badgers.

Table 4. Actions related to American badger that align with FWCP's investment rationale.

Action	Rationale	Priority
Research and information acquisition		
Address key knowledge gaps that limit recovery implementation	Identified as a need in the recovery strategy	1

Action	Rationale	Priority
Species-based actions		
Improve the public's knowledge and awareness of badgers	Identified as a need in the recovery strategy	3
Transplant badgers into the Rocky Mountain trench	Populations were augmented with badgers from Montana, but additional work could be done	2
Habitat-based actions		
Work with MOTI to upgrade culverts to make them usable by badgers	Road mortality can be reduced if badgers can be encouraged to use culverts under roads	1
Restore dry forest and grassland to improve conditions for Columbian ground squirrels, the main prey species for badger	Increased availability of prey in areas away from roads should benefit badger.	2
Monitoring and Evaluation		
Monitor use of test drift fences in conjunction with crossing structures (e.g., culverts)	Drift fences might reduce highway mortalities but test sections needs to be monitored for use	1
Monitor road-kills	Population is small and roads are a major mortality source	1

4. White Sturgeon

White sturgeon, *Acipenser transmontanus*, is the largest, longest-lived freshwater fish species in North America (Scott and Crossman 1973). Within Canada, white sturgeon occur only in British Columbia and are divided into six populations, based on geography and genetics: the lower, mid and upper Fraser River, Nechako River, Columbia River, and Kootenay River. All populations were assessed as endangered by COSEWIC, but only the latter four are legally listed under SARA. Within the compensation area white sturgeon occur in the Kootenay and Columbia rivers. This Action Plan addresses activities directed only at these two populations (Porto 2008).

Kootenay River — The Kootenay River population of white sturgeon extends from Kootenai Falls, Montana, located 50 river-kilometres below Libby Dam, downstream through Kootenay Lake to Corra Linn Dam on the lower West Arm of Kootenay Lake, British Columbia. A natural barrier at Bonnington Falls downstream of Kootenay Lake has isolated the Kootenay River white sturgeon from other white sturgeon populations in the Columbia River basin since the end of the Pleistocene, approximately 10,000 years ago (Northcote 1973). Spawning habitat is located in the US, whereas much of the adult and juvenile rearing habitat is located in the Canadian portion of Kootenay River plus Kootenay Lake (e.g., Kootenay delta and tributary creek mouths). White sturgeon can also be found in very small numbers in Duncan Reservoir and Slocan Lake (RL&L Environmental Services Ltd. 1998a,b). Although Duncan Reservoir and Slocan Lake are within the historic range of white sturgeon, recovery of populations in these relatively small waterbodies has been deemed infeasible (National Recovery Team for White Sturgeon 2009).

Columbia River — White sturgeon historically had access from the ocean all the way to Columbia Lake in the upper Columbia and Shoshone Falls in the upper Snake River. Distribution was probably concentrated in areas of favourable habitat. Significant concentrations of white sturgeon were reported during the early 1900s in the mainstem downstream from Castlegar, the lower Kootenay River, Arrow Lakes, Big Eddy near Revelstoke, and the present site of Mica Dam (Prince 2001). At least two significant populations remain in the upper Columbia River and other remnant populations consisting of a few individuals occur, or are suspected, throughout other portions of the historic range. The largest population resides in the free-flowing transboundary reach between Hugh L. Keenleyside Dam (HLK) and Roosevelt Reservoir (FDR). A second significant subpopulation of white sturgeon currently inhabits Arrow Lakes Reservoir (ALR), upstream of HLK. The occurrence of this subpopulation may simply reflect splitting of a larger population by the construction of HLK. Abundance in this subpopulation is substantially lower than in the reach from HLK to FDR. Adult sturgeon have not been collected during investigations in Kinbasket Reservoir, Revelstoke Reservoir, or Trout Lake (RL&L Environmental Services Ltd. 1996a,b, 2000), despite repeated efforts.

Actions related to white sturgeon that align with FWCP's investment rationale are presented in Table 5. Some of these actions are being undertaken by BC Hydro through other programs but could be supported by FWCP. Sturgeon will also broadly benefit from actions identified in the Columbia Rivers and Streams Action Plan and the Large Lakes Action Plan.

Table 5. Actions related to white sturgeon that align with FWCP's investment rationale. Some of these actions are being undertaken by BC Hydro through other programs but could be supported by FWCP.

Action	Rationale	Priority
Research and information acquisition		
Identify opportunities for restoration and enhancing important white sturgeon habitats	Opportunities may exist at multiple locations. For example, channelizing and dyking of back channel habitat has reduced rearing habitat in the Creston Valley. There might be opportunities to restore habitat suitability in some areas.	3

Action	Rationale	Priority
Contribute to understanding causes of recruitment failure	There is considerable active research into the specific causes of recruitment failure and some progress is being made. Large scale restoration trials may be required to confirm impact mechanisms and to restore populations to self-supporting status. Transitioning from research trials to large-scale habitat restorations will require flexibility in both planning and funding programs. The funding of white sturgeon work from the compensation program is considered a priority given the link between recruitment failure and large dams on the Columbia and Kootenay.	1
Clarify threats to white sturgeon and their relative risks (e.g., food supply, habitat).	Addressing threats to white sturgeon requires additional information on their geographical extent, magnitude, frequency and duration of different threats.	3
Species-based actions		
Continue to contribute to hatchery program	Recovery is dependent on hatchery-reared stock	1
Habitat-based actions		
Prepare to undertake habitat-based restoration actions, if research on recruitment failure indicates that restoration can help recover a self-supporting population.	Spawning occurs within the Columbia and Kootenay rivers, but there has been insufficient recruitment to support the population. Largescale restoration of	2

Action	Rationale	Priority
	spawning and incubation habitats may allow natural recruitment. Undertaking these actions may require additional research.	
Land securement		
Protect, maintain and enhance important white sturgeon habitats	There may be opportunities to secure lands adjacent to important white sturgeon habitats	3
Monitoring and Evaluation		
Monitor population status and trends	Monitoring population abundance and distribution is important for measuring progress to recovery targets	1
Monitor hatchery releases	Opportunities to monitor wild fish are limited; however, monitoring hatchery releases to understand habitat use can provide important information for management.	2

5. Western Screech-owl

Western Screech-owls are non-migratory raptors and recovery planning is led by the Province of BC. The recovery team has completed a draft recovery plan (Western Screech Owl Recovery Team 2008) and is in the early stages of the action planning process (*O. Dyer pers. comm*.).

Population size in BC is estimated at 50- 200 individuals. The centre of the species distribution is in the southern Okanagan. Approximately 20% of the known detection sites of this species occur in the Columbia basin and these locations are confined to the southernmost portions of the East and West Kootenay (Western Screech Owl Recovery Team 2008).

This sub-species of Screech-owls occur in low elevation riparian habitat in the southern interior of BC. Riparian cottonwood habitat is consistently identified as the core-nesting habitat for this species.

FWCP has supported work on this species since 2003. Work completed to date includes inventory, radio telemetry, stewardship and Wildlife Habitat Area submissions.

Actions related to Western Screech-owl that align with FWCP's investment rationale are presented in Table 6. The source of the actions identified here is the Western Screech-owl recovery team draft action-planning table (O. Dyer, *pers. comm*.). Screech-owls will also benefit from actions presented in the Columbia Riparian and Wetlands Action Plan and, secondarily, in the Uplands and Drylands Action Plan.

Table 6. Actions related to western screech-owl that align with FWCP's investment rationale.

Action	**Rationale**	**Priority**
Research and information acquisition		
Review and update best management practices for Screech-Owls and encourage land managers to use them.	Gravel pit development and ROW management have potential to impact known territories	1
Implement a research program at a minimum of 10 occupied sites to clarify breeding and foraging habitat requirements and reproductive success using telemetry.	Detailed habitat use information is the basis for almost all other actions	1
Investigate the potential impacts associated with increased direct mortality, displacement or other responses of Screech Owls to the presence of Barred Owls.	Results to date indicate this is an important issue throughout the range- more work may be required	2
Design and implement a protocol for monitoring habitat and site occupancy trends at known sites (clarification of strategy recommendation and priority assigned by action team 2009. Orville Dyer, pers. comm.).	Following Recovery Team lead, FWCP could implement in Columbia. This would be a very useful tool. Many Columbia basin territories are inconsistently occupied	1
Develop habitat suitability models and maps.	Provincial RT initiative	3
Species-based actions		
Contribute genetic material to analysis of coastal and interior Screech-Owl populations.	Address taxonomy knowledge gaps.	3

Action	Rationale	Priority
Monitor road mortality	To quantify potential impacts	2
Contribute carcasses to assess presence of pesticide residues.	Possible agent of decline	3
Habitat-based actions		
Implement habitat restoration and enhancement activities for priority sites.	Preventing loss or damage to existing habitat is a higher priority	2
Nest box program to provide short-term supply of nest sites in known detection sites that lack Wildlife trees	Events are successful for stewardship and education	1
Land securement		
Implement private landowner contact program to develop stewardship or acquisition agreements on occupied habitat.	Develops opportunity for restoration or acquisition. Long term, education relationship building	1
Work with municipal and regional governments to incorporate habitat stewardship into planning processes such as Community Plans and bylaws.	Builds on results of telemetry and inventory	1
Work with First Nations to identify and implement opportunities for cooperative habitat conservation projects both on and off reserves.	Lower priority because few sites are on Indian Reserves	3
Develop and implement a communication plan	Identify target audiences and key messages to improve community-based conservation.	3
Monitoring and Evaluation		

Action	Rationale	Priority
Continue Monitoring known territories and detection sites, to determine long term occupancy rates	Needed to determine the success of habitat protection and stewardship efforts	1

6. Yellow-breasted Chat

The Yellow-breasted Chat is widespread throughout the United States and central Mexico, but its distribution in Canada is restricted to southern BC, Alberta, Saskatchewan, and Ontario. (Gebauer 2004). In BC, breeding Yellow-breasted Chats are found only in the extreme south Okanagan and Similkameen valley (Campbell et al. 2001) and at two sites in the Columbia Basin (Machmer and Ogle 2006). In addition, singing males are occasionally reported from Creston (Gebauer 2004). The BC population is likely 25-30 pairs (COSEWIC 2000).

Yellow-breasted Chats nest in riparian habitats and adjacent upland shrub and are highly dependent on the riparian conditions. Loss of riparian habitat is the main threat. Pesticide spraying, predation and nest parasitism by Brown-headed Cowbirds (*Molothrus ater*) may be significant problems (Gebauer 2004). In the Pend d'Oreille River area, chats breed in upland shrub habitats near Waneta Reservoir and associated transmission line rights of way.

Actions related to Yellow-breasted Chat that align with FWCP's investment rationale are presented in Table 7. As a riparian-dependent species the Chat will benefit from actions presented in the Columbia Riparian and Wetlands Action Plan and, secondarily, the Uplands and Drylands Action Plan.

Table 7. Actions related to yellow-breasted chat that align with FWCP's investment rationale.

Action	Rationale	Priority
Research and information acquisition		
Conduct demographic and threats research and monitoring for all occupied territories	Need to continue monitoring population and habitat parameters for SE BC sub-population.	1
Conduct Population viability analysis PVA for south-eastern BC sub-population	Should be done if population size warrants to assess implications of immigration	2
Evaluate habitat quality in relation to productivity	Information needed to guide habitat	2

Action	Rationale	Priority
for sub-population and determine any other factors influencing productivity	restoration and stewardship	
Conduct additional inventories to identify territories in suitable habitat in CVWMA and Waneta	Potential important nesting areas	1
Species-based actions		
Assess impacts of cowbird parasitism	Cowbirds use chat nests	3
Habitat-based actions		
Identify restore and protect suitable nesting habitat.	Needed to secure critical habitat	1
Inventory and treat invasive plants on Chat habitat. Assess sources of erosion and weed spread.	Invasive plants are an issue on or near all existing territories in SE BC	1
Complete grazing management plans for all territories potentially impacted by grazing. Install fencing as required	Cattle grazing can impact habitat quality and reproductive success. Known issue for Waneta territories	2
Land securement		
Secure and Steward occupied suitable and restorable habitat working in partnership with appropriate agencies	Some territories are on private and industrial land.	1

7. Lewis' Woodpecker

The total population of Lewis Woodpeckers in BC is estimated to be <1000 individuals (COSEWIC 2010). Approximately 25% of the population occurs in the southern portions of the Columbia basin, mostly in the East Kootenay trench. The species is associated with three habitat types in BC: riparian cottonwood forests, open ponderosa pine forests and recently burned forests (COSEWIC 2010).

Lewis' Woodpecker recovery planning is led by Environment Canada. The recovery management team is currently drafting a management plan for the species (T. Luscz, *pers. comm.*)

The species has formerly nested, or currently nests, on conservation properties managed by FWCP including the Hoodoo/Hoffert property (Cooper et al. 1998) and MOE properties in the Pend D'Oreille (Dulisse and Manley 2010). FWCP has led/participated in restoration of several crown land areas with Lewis Woodpecker focusing on wildlife tree creation with fungal inoculation (Manning 2008).

Actions related to Lewis' Woodpecker that align with FWCP's investment rationale are presented in Table 8. Actions presented in the Columbia Uplands and Drylands Action Plan and, secondarily, the Riparian and Wetlands Action Plan will also benefit Lewis' Woodpecker.

Table 8. Actions related to Lewis' Woodpecker that align with FWCP's investment rationale.

Action	Rationale	Priority
Research and information acquisition		
Develop a stewardship plan and work with existing stewardship programs and initiatives to identify priority areas	A plan is required to identify habitat to secure and set targets	1
Quantify the cumulative impact of breeding habitat loss and degradation from threats of unknown severity including pine beetle outbreaks, firewood cutting, livestock grazing, and competition with invasive species.	Rate of habitat loss is unknown	2
Test and refine existing habitat suitability model using recent inventory data.	Model requires updating and validation	2
Determine the relationships between habitat types and nest productivity.	Leads to better estimates of habitat requirements	1
Habitat-based actions		
Increase nesting opportunities for Lewis's Woodpecker using a variety of methods on a site-specific and experimental basis. Work with EK Restoration committees to incorporate targets for Lewis Woodpecker nest trees	Existing habitat can be improved through a variety of treatments; e.g., ecosystem restoration by prescribed burning combined with silvicultural techniques, fungal inoculations, and nestboxes	1

Action	Rationale	Priority
Encourage agencies and private landowners to use BMPs	Implementation will improve management	2
Work with land managers to limit further loss in the amount and quality of breeding and foraging habitat	Improve practices in road and transmission line maintenance, range use, ecosystem restoration, and pine beetle and forest management.	1
Land securement		
Secure habitat to target levels established by stewardship plan	Recovery will require additional secured habitat	1
Monitoring and Evaluation		
Develop, test and implement range-wide monitoring strategy to provide reliable population trends and estimates.	Monitoring data required to improve population size estimates	1
Develop a habitat effectiveness monitoring protocol	Determine effectiveness of management actions	2

4.3. Focal Species

Focal species are defined within the context of FWCP planning in the Columbia Basin as those species that have a high conservation concern and/or local interest and a strong linkage to footprint impacts (Table 9). These species have been identified and prioritized by FWCP staff using the Species Rating and Database Tool (Fish and Wildlife Compensation Program 2011b). Developing the focal species list involved the following steps:

1. Identifying species that have known habitat-based or species-based actions that could be implemented immediately (i.e., where the species distribution, abundance and limiting factors are sufficiently understood); and,
2. Removing species that are not of a high local or conservation concern, as defined by consultation and by MOE's Conservation Framework, and/or those that were not ranked high in the Columbia Basin dam impacts studies (e.g., Manley and Krebs 2009).

Table 9 lists the focal species cross-referenced with the priority (green) and supporting (yellow) ecosystem action plans. Habitat-based actions identified in the relevant ecosystem plans could be leveraged to benefit focal species. The reverse is also true. Species-specific actions could be crafted to benefit broader ecosystems.

As a further guide toward the identification and evaluation of proposed projects, Appendix B contains a complete list of preliminary action types that have been identified for each species under the five FWCP action categories:

Research and Information Acquisition Actions:

1) Inventory – e.g., distribution, abundance, breeding status
2) Assessments – e.g., target setting, limiting factor assessment
3) Integrated habitat planning – e.g., acquire information to inform broader planning processes

Species-based Actions:

4) Translocation and reintroduction – e.g., captive rearing and breeding
5) Alternate prey/predator management – e.g., reducing species antagonistic to recovery
6) Other – e.g., nest boxes

Habitat-based Actions:

7) Habitat creation – e.g., erect nest boxes or loafing platforms
8) Habitat restoration – e.g., prescribed burning, stream habitat complexing
9) Restore/maintain ecosystem connectivity – e.g., provide access to seasonal habitats or between populations

Land Securement Actions:

10) Habitat acquisition – purchasing land
11) Habitat stewardship – e.g., stewardship agreements with landowners

Monitoring and Evaluation Actions:

12) Trend monitoring – e.g., species or habitat status
13) Evaluation – e.g., project effectiveness

The FWCP considers projects targeting focal species and their habitats as priorities for consideration where clear habitat, land or species-based actions are available for implementation. Projects are developed and prioritized during the annual operational planning cycle.

Table 9. Focal species in the Columbia Basin. The list is based on species for which there are habitat-based or species-based actions that can be implemented immediately (i.e., where the species distribution, abundance and limiting factors are sufficiently understood), and dam impacts are known to be high. Numbers represent the ordered relationship between species and the ecosystem-based action plans.

Species	Guild	Wetlands/Riparian	Uplands/Drylands	LargeLakes	SmallLakes	Rivers/Streams
Vaux's Swift	AER	1	2		4	3
Col. Spotted Frog	AMP	1			2	3
Painted Turtle	AMP	2	3		1	
Western Toad	AMP	1	3		2	
Northern Myotis	BAT		1	3	2	4
Silver-haired Bat	BAT	2	1	4	3	
Townsends Big-eared bat	BAT	2	1		3	4
Burbot (Kootenay Lake)	BEN			1		2
Burbot (Other)	BEN			1	2	3
Grey Wolf	CAR	2	1			
Grizzly Bear	CAR	2	1	4		3
Wolverine	CAR		1			
Rainbow Trout (insectivorous-LL)	INS			1		2
Rainbow Trout (insectivorous-Fluvial)	INS					1
Rainbow Trout (insectivorous-SL)	INS				1	2
Westslope cutthroat trout	INS				2	1
Bull Trout	PIS			1	3	2
Rainbow Trout (piscivorous-LL)	PIS			1		2
Kokanee	PLK			1		2
Osprey	RAP	1		2	3	4
Bighorn Sheep	UNG		1			
Elk	UNG	2	1			
Moose	UNG	1	2			
Mule Deer	UNG	2	1			
White-tailed Deer	UNG	2	1			
American Bittern	WAD	1				
Great Blue Heron	WAD	1		4	3	2
Bobolink	WAR	1	2			
Yellow Warbler	WAR	1				
American White Pelican	WAT	2		3	1	
Common Loon	WAT			2	1	2
Harlequin Duck	WAT					1
Western Grebe	WAT	2		3	1	

4.4. Inventory Species

Inventory species are those for which inventory / data acquisition is the primary compensation action identified by FWCP staff and technical committees and in the Columbia Basin dam impacts reports (e.g., Manley and Krebs 2009). Table 10 lists the inventory species that have been identified as highly impacted by dam construction or operation. Before further actions are developed and implemented (see Appendix C), some baseline inventory work is required for these species to determine their distribution and abundance and/or trend within the Columbia Basin. Inventory species are also cross-referenced with ecosystem-based Action Plans (Table 10). Actions identified in the plans are expected to benefit these species.

The FWCP considers projects targeting Inventory species as priorities for consideration where clear outcomes leading to habitat, land or species-based actions are practically achievable. Projects are prioritized during the annual operational planning cycle.

Table 10. Inventory species identified for the Columbia Basin. Inventory species are those for which inventory/monitoring is the primary compensation action and that are highly impacted by dam construction or operation. Numbers represent the ordered relationship between species and the ecosystem-based action plans.

Species	Guild	Wetlands/Riparian	Uplands/Drylands	LargeLakes	SmallLakes	Rivers/Streams
Barn Swallow	AER	1	2			
Black Swift	AER	1				2
Northern Rough-winged Swallow	AER	1	2	4	3	
Tree Swallow	AER	1		4	2	3
Violet-green Swallow	AER	1	2		3	4
Cliff Swallow	AER	1		4	3	2
Wood Frog	AMP	1				
California Myotis	BAT	2	1			
Hoary Bat	BAT		1			
Long-eared Myotis	BAT		1	3	2	4
Long-legged Myotis	BAT		1	3	2	4
American Marten	CAR		1			
Fisher	CAR	1	2			
American Mink	CAR	1	2			
Northern River Otter	CAR	2		2	2	1
Brown Creeper	FLY		1			
Chestnut-backed Chickadee	FLY		1			
Eastern Kingbird	FLY	1	2			
Gray Catbird	FLY	1	2			
Hammond's Flycatcher	FLY		1			
Olive-sided Flycatcher	FLY	2	1			
Pacific-slope Flycatcher	FLY		1			
Red-eyed Vireo	FLY	1	2			
Veery	FLY	1	2			
Willow Flycatcher (a.k.a. Traill's Flycat	FLY	1				
American Dipper	FLY					1
Black-capped Chickadee	FLY		1			
Western Wood-pewee	FLY		1			
White-breasted Nuthatch	FLY		1			
Winter Wren	FLY	2	1			
Ruffed Grouse	GAM	2	1			
Band-tailed Pigeon	GAM		1			
Dusky Grouse	GAM		1			
Rufous Hummingbird	HUM		1			
Umatilla dace	NMI					1
Northern Pygmy-owl	OWL	2	1			
Short-eared Owl	OWL	1				
Barred Owl	OWL	2	1			
Northern Harrier	RAP	1	2			
Bald Eagle	RAP	2		1		3
Broad-winged Hawk	RAP	1	2			
Columbia sculpin	SCL				2	1
Torrent sculpin	SCL			2	3	1
Shorthead sculpin	SCL					1

Table 11. Continued

Species	Guild	Wetlands/Riparian	Uplands/Drylands	LargeLakes	SmallLakes	Rivers/Streams
Black Tern	SHO	1				
Common Tern	SHO	3		1	2	
Killdeer	SHO	2		1		
Semi-palmated Sandpiper	SHO	1		3	2	
Western Sandpiper	SHO	1		2		
Wilson's Snipe (formerly Common Snip	SHO	1				
Herring Gull	SHO	1		3	2	4
American Beaver	SMA	1			2	2
Meadow Vole	SMA	1	2			
Western Jumping Mouse	SMA		1			
Virginia Rail	WAD	1			2	
Sora	WAD	1			2	3
Black-throated Green Warbler	WAR	1				
Common Yellowthroat	WAR	1	2			
Connecticut Warbler	WAR	2	1			
Purple Finch	WAR		1			
Yellow-headed Blackbird	WAR	1				
American Redstart	WAR	1	2			
Black-headed Grosbeak	WAR	1	2			
Northern Waterthrush	WAR	1				
Barrow's Goldeneye	WAT	2		4	1	3
Pied-billed Grebe	WAT	1			2	
American Coot	WAT	1			2	
Belted Kingfisher	WAT	2				1
Blue-winged Teal	WAT	1		4	3	2
Canvasback	WAT	1		4	3	2
Cinnamon Teal	WAT	1				
Greater Scaup	WAT			1		2
Lesser Scaup	WAT	1		3	2	4
Northern Pintail	WAT	1		3	2	4
Redhead	WAT	1		3	2	
Red-necked Grebe	WAT	1		3	2	4
Wood Duck	WAT	1		4	3	2
Bufflehead	WAT	2		4	1	3
Common Goldeneye	WAT	2		4	1	3
Eared Grebe	WAT	1			2	
Hooded Merganser	WAT	1		4	3	2
Horned Grebe	WAT	1			2	
Ring-necked Duck	WAT	1		3	2	4
Mountain Whitefish	WFI			1	3	2
Red-naped Sapsucker	WOO	2	1			
Pileated Woodpecker	WOO	2	1			
Downy Woodpecker	WOO		1			

5. Conclusions

Habitat impacts from dam construction and operation in the Columbia Basin have resulted in impacts to a large number of species. Although restoration and creation of habitat to mitigate impacts will broadly benefit most or all of these species, there are specific actions that can be undertaken to benefit species that are considered a high priority.

Potential actions are well developed for *recovery* species and actions are coordinated with recovery strategies that are either published or in preparation. In many cases FWCP is participating in recovery planning. *Focal* species are also a conservation concern and have been impacted by dam construction or operation. Categories of feasible actions have been defined for these species. Finally, *inventory* species are those that have been impacted by dam construction or operation but require additional baseline inventory or other work before feasible actions can be identified.

Stratifying species into *recovery, focal* and *inventory* action categories allows FWCP to align resources with priorities, based on a species' recovery status, the extent of dam impacts, the feasibility of possible actions, as well as the extent of inventory and knowledge gaps.

6. References

Adama, D., and M.-A. Beaucher. 2006. Population Monitoring and Recovery of the Northern Leopard Frog (*Rana pipiens*) in Southeast British Columbia, 2000 to 2005. Prepared for: Columbia Basin Fish and Wildlife Compensation Program, Columbia Basin Trust, Creston Valley Wildlife Management Area, Ministry of Environment, and the Northern Leopard Frog Recovery Team.

Adams, I., T. Antifeau, M. Badry, L. Campbell, A. Dibb, O. Dyer, W. Erickson, C. Hoodicoff, L. Ingham, A. Jackson, K. Larsen, T. Munson, N. Newhouse, B. Persello, J. Surgenor, K. Sutherland, J. Steciw, and R. Weir. 2002. Draft national recovery strategy for American Badger, *jeffersonii* subspecies, (*Taxidea taxus jeffersonii*). Recovery of Nationally Endangered Wildlife, Ottawa, ON.

Adams, I. T., and T. A. Kinley. 2004. Badger. Accounts and measures for managing Identified Wildlife – Accounts V. 2004. BC Ministry of Environment, Victoria, BC.

BC Ministry of Environment. 2008. Recovery strategy for the badger (*Taxidea taxus*) in British Columbia. British Columbia Recovery Strategy Series, Victoria, BC.

BC Ministry of Environment. 2009. Conservation framework: conservation priorities for species and ecosystems. Ecosystems Branch, Environmental Stewardship Division, Ministry of Environment, Victoria, BC.

BC Ministry of Environment. 2011. Mountain caribou recovery action plan. http://www.env.gov.bc.ca/wld/speciesconservation/mc/index.html

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, A. C. Stewart, and M. C. E. McNall. 2001. The birds of British Columbia, Volume 4: passerines, wood-warblers through old world sparrows. BC Ministry of Environment, Lands and Parks, Victoria, BC, and Canadian Wildlife Service, Delta, BC.

Cooper, J. M., C. Siddle, and G. Davidson. 1998. Status of the Lewis' Woodpecker (*Melanerpes lewis*) in British Columbia. BC Ministry of Environment Wildlife Working Report No. WR-91.

COSEWIC. 2002b. COSEWIC status report - Western Screech-owl. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

COSEWIC. 2002b. Update COSEWIC report on Yellow-breasted Chat (*Icteria virens*). Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

COSEWIC 2003. COSEWIC assessment and update status report on the white sturgeon (*Acipenser* transmontanus) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.

COSEWIC. 2009. COSEWIC assessment and update status report on the Northern Leopard Frog *Lithobates pipiens* in Canada. Committee on the Status of Endangered Wildlife in Canda, Ottawa, ON.

COSEWIC. 2010. Assessment and status report on the Lewis's Woodpecker *Melanerpes lewis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.

Dulisse, J. D. and I. Manley. 2010. Lewis' Woodpecker in the Pend D'Oreille wildfire zone 2008 and 2009. Prepared for: Fish and Wildlife Compensation Program, Nelson, BC.

Fish and Wildlife Compensation Program. 2011a. Columbia Basin Plan. Available at: http://www.fwcpcolumbia.ca/version2/index.php

Fish and Wildlife Compensation Program. 2011b. *FWCP: Columbia Species Rating and Database Tool.* Background report to accompany the Excel™-based tool.

Gebauer, M. 2004. Yellow-breasted chat. Accounts and measures for managing Identified Wildlife – Accounts V. 2004. BC Ministry of Environment, Victoria, BC.

Ketcheson, M. V., K. Misurak, V. Lipinski, G. Kernaghan, K. Lessard, T. Dool, L. Bradley, and E. White. 2005. Columbia basin BC Hydro footprint mapping: BC Hydro reference number DFIM040. Prepared for: Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.

MacDonald, A. D. 2009. Fish & wildlife compensation program: executive summary.

Machmer, M., and S. Ogle. 2006. Survey for endangered Yellow-breasted Chat breeding occurrence, habitat and productivity in southeastern BC. Prepared for: Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.

Manley, I., and J. Krebs. 2009. Wildlife impacts due to BC Hydro dams in the Columbia basin. Fish and Wildlife Compensation Program, Nelson, BC.

Manning, T. 2008. Hoodoo/Hofert property wildlife tree creation. Prepared for: Fish and Wildlife Compensation Program, Nelson, BC, and the Nature Trust of British Columbia, Cranbrook, BC.

Mountain Caribou Science Team. 2005. Mountain caribou in British Columbia: a situation analysis. Prepared for Species at Risk Coordination Office, Victoria, BC.

Newhouse, N. 2006. East Kootenay badger project summary report. Prepared for: Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.

National Recovery Team for White Sturgeon. 2009. Recovery strategy for white sturgeon (*Acipenser transmontanus*) in Canada [Proposed]. In Species at Risk Act Recovery Strategy Series. Ottawa: Fisheries and Oceans Canada. Draft.

Northcote, T. C. 1973. Some impacts of man on Kootenay Lake and its salmonids. Great Lakes Fishery Commission, Technical Report 2, Ann Arbor, Michigan.

Ohanjanian, I.A. 1997. The northern leopard frog, *Rana pipiens*, in the Creston Valley Wildlife Management Area. Prepared for: the Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.

Ohanjanian, I. A., and K. Paige. 2004. Northern leopard frog. Accounts and measures for managing Identified Wildlife – Accounts V. 2004. BC Ministry of Environment, Victoria.

Porto, L. 2008. White sturgeon populations in the BC Hydro dam footprint impacts area. Prepared for: Fish and Wildlife Compensation Program – Columbia Basin, Nelson, BC.

Prince, A. 2001. Local knowledge of Columbia River fisheries in British Columbia, Canada. Report prepared for Columbia-Kootenay Fisheries Renewal Partnership, Cranbrook, B.C. Prepared by Westslope Fisheries, Cranbrook, B.C. 50 p. + 1 app.

Spalding, D. J. 2000. The early history or woodland caribou (*Rangifer tarandus caribou*) in British Columbia. BC Ministry of Environment Wildlife Bulletin No. B-100.

RL&L Environmental Services Ltd. 1996a. The distribution and status of white sturgeon in isolated waterbodies within the Columbia River Basin in B.C. 1995 Study Results. Report to B.C. Ministry of Environment, Lands and Parks.

RL&L Environmental Services Ltd. 1996b. Columbia River white sturgeon investigations – 1995 study results. Prepared for B. C. Hydro, Kootenay Generation, Vancouver, B.C. and B.C. Ministry of Environment, Lands and Parks, Nelson Region. RL&L Report No. 377F: 94 p. + 6 app.

RL&L Environmental Services Ltd. 1998a. The status of white sturgeon in Kootenay Lake and Duncan Reservoir, B.C., 1994-1996 study results. Report prepared for B.C. Ministry of Environment, Lands and Parks. R.L. & L. Report No. KD-515F: 36 p. + 3 app.

RL&L Environmental Services Ltd. 1998b. White sturgeon investigations in Arrow Reservoir and Slocan Lake, B.C., 1997 study results. Report prepared for B.C. Ministry of Environment, Lands and Parks. R.L. & L. Report No. 584F: 27 p. + 4 app.

RL&L Environmental Services Ltd. 2000. A summary of white sturgeon investigations in isolated water bodies within the Columbia River Basin in B.C. 1995 to 1999. Report to B.C. Ministry of Environment, Lands and Parks.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Bulletin of the Fisheries Research Board of Canada 184.

Western Screech-Owl, *macfarlanei* subspecies Recovery Team. 2008. Recovery strategy for the Western Screech-Owl, *macfarlanei* subspecies (*Megascops kennicottii macfarlanei*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC.

Utzig, G. and D.Schmidt 2011. BC Hydro dam footprint impact summary. Draft. Prepared for: Fish and Wildlife Compensation Program: Columbia Basin, Nelson, BC.

Appendix A Actions Identified for Recovery Species

		Research & Information Acquisition			Species-Based Actions			Habitat-Based Actions			Land Securement		
Species	Guild	Inventory	Assessment (e.g., targets)	Integrated habitat planning	Translocate / Reintroduce	Alternate Predator Prey Man	Other	Habitat Creation	Hagitat restoration	Restore connectivity	Habitat Acquisition	Habitat Stewardship	Monitoring & Evaluation
American Badger	CAR	-	-	-	2	-	-	-	2	1	2	2	-
Caribou	UNG	2	-	2	2	1	-	-	2	2	2	-	2
Lewis' Woodpecker **	WOO	2	-	2	-	-	-	2	1	-	2	2	-
Northern Leopard Frog	AMP	2	-	-	1	-	-	2	2	2	2	2	-
Western Screech-owl **	OWL	2	-	-	-	-	-	2	-	-	2	1	-
White Sturgeon	BEN	-	-	-	1	-	-	-	2	2	-	-	2
Yellow-breasted Chat	WAR	2	-	-	-	-	-	-	2	-	2	1	-

* Priority wetland species - *Canadian Intermountain Joint Venture*
** Priority landbird - *Northern Rockies Bird Conservation Region (Partners in Flight)*

1 = First Priority Action
2 = Second Priority Action(s)

I: Indicator sp

Appendix B Actions Identified for Focal Species

		Research & Information Acquisition			Species-Based Actions			Habitat-Based Actions			Land Securement		
Species	Guild	Inventory	Assessment (e.g., targets)	Integrated habitat planning	Translocate / Reintroduce	Alternate Predator Prey Man	Other	Habitat Creation	Hagitat restoration	Restore connectivity	Habitat Acquisition	Habitat Stewardship	Monitoring & Evaluation
Vaux's Swift **	AER	2	-	2	-	-	-	1	-	-	-	2	2
Col. Spotted Frog	AMP	-	-	2	-	-	-	-	-	-	-	2	1
Painted Turtle	AMP	2	-	-	-	-	-	2	2	2	2	1	2
Western Toad	AMP	2	-	1	-	-	-	2	-	2	2	2	2
Northern Myotis	BAT	-	-	-	-	-	-	-	-	-	2	-	2
Silver-haired Bat	BAT	2	-	2	-	-	-	-	1	-	-	2	2
Townsends Big-eared bat	BAT	2	-	2	-	-	-	-	-	-	-	1	2
Burbot (Kootenay Lake)	BEN	-	2	-	1	-	-	2	2	2	-	-	2
Burbot (Other)	BEN	-	2	-	-	-	-	2	2	2	2	-	1
Grey Wolf	CAR	2	-	2	-	2	-	-	-	2	-	-	1
Grizzly Bear	CAR	2	-	2	-	2	-	-	2	1	2	2	2
Wolverine	CAR	2	-	2	-	-	-	-	-	1	-	-	2
Rainbow Trout (insectivorous-Fluvial)	INS	-	-	-	-	-	-	2	1	-	-	-	2
Rainbow Trout (insectivorous-LL)	INS	-	-	-	-	-	-	-	1	-	-	-	2
Rainbow Trout (insectivorous-SL)	INS	-	1	-	-	-	-	2	-	-	-	-	2
Westslope cutthroat trout	INS	-	-	-	-	-	-	2	1	-	-	2	2
Bull Trout	PIS	2	1	-	-	-	-	2	1	-	-	-	2
Rainbow Trout (piscivorous-LL)	PIS	2	1	-	-	-	-	2	1	-	-	-	2
Kokanee	PLK	-	2	-	-	-	2	-	1	-	-	-	2
Osprey	RAP	-	-	-	-	-	-	-	-	-	-	1	2
Bighorn Sheep	UNG	2	-	-	2	-	-	-	1	2	2	2	2
Elk	UNG	2	-	2	-	2	-	-	1	2	2	2	2
Moose	UNG	2	-	-	-	1	-	-	2	-	2	2	2
Mule Deer	UNG	2	-	-	-	2	-	-	1	-	2	2	2
White-tailed Deer	UNG	2	-	-	-	1	-	-	2	2	2	2	2
American Bittern *	WAD	2	-	1	-	-	-	-	2	-	2	2	2
Great Blue Heron *	WAD	2	-	2	-	2	-	-	2	-	2	1	2
Bobolink **	WAR	2	-	-	-	-	-	-	2	-	2	1	2
Yellow Warbler	WAR	2	-	-	-	-	-	-	1	-	-	-	2
American White Pelican *	WAT	-	-	2	-	-	-	2	-	-	-	1	2
Common Loon *	WAT	2	-	-	-	-	-	2	-	-	-	1	2
Harlequin Duck	WAT	2	-	2	-	-	-	-	2	-	-	1	2
Western Grebe *	WAT	2	-	2	-	-	-	-	1	-	-	-	2

* Priority wetland species - *Canadian Intermountain Joint Venture*
** Priority landbird - *Northern Rockies Bird Conservation Region (Partners in Flight)*

1 = First Priority Action
2 = Second Priority Action(s)

I: Indicator sp

Appendix C Actions Identified for Inventory Species

		Research & Information Acquisition			Species-Based Actions			Habitat-Based Actions			Land Securement		
Species	Guild	Inventory	Assessment (e.g., targets)	Integrated habitat planning	Translocate / Reintroduce	Alternate Predator Prey Man	Other	Habitat Creation	Hagitat restoration	Restore connectivity	Habitat Acquisition	Habitat Stewardship	Monitoring & Evaluation
Barn Swallow	AER	1	-	-	-	-	-	-	-	-	2	2	-
Black Swift **	AER	1	-	2	-	-	-	-	-	-	-	-	-
Violet-green Swallow	AER	1	-	-	-	-	-	2	-	-	-	2	-
Northern Rough-winged Swallow **	AER	1	-	-	-	-	-	-	-	-	-	2	-
Cliff Swallow	AER	1	-	2	-	-	-	-	-	-	-	2	-
Tree Swallow	AER	1	-	-	-	-	-	-	-	-	-	2	-
Wood Frog	AMP	1	-	-	-	-	-	-	-	2	-	-	-
California Myotis	BAT	1	-	-	-	-	-	-	-	-	-	-	-
Long-eared Myotis	BAT	1	-	-	-	-	-	-	-	-	-	-	-
Hoary Bat	BAT	1	-	2	-	-	-	-	-	-	-	2	-
Long-legged Myotis	BAT	1	-	-	-	-	-	-	-	-	-	-	-
American Marten	CAR	1	-	-	-	-	-	-	-	-	-	-	-
Fisher	CAR	1	-	2	2	-	-	-	2	2	2	2	-
Northern River Otter	CAR	1	-	-	-	-	-	-	-	2	-	-	I
Brown Creeper	FLY	1	-	2	-	-	-	-	2	-	-	-	-
Eastern Kingbird	FLY	1	-	-	-	-	-	-	-	-	-	-	-
Chestnut-backed Chickadee	FLY	1	-	2	-	-	-	-	2	-	-	-	-
Red-eyed Vireo	FLY	1	-	-	-	-	-	-	-	-	-	-	-
Veery	FLY	1	-	-	-	-	-	-	2	-	-	-	-
Willow Flycatcher (a.k.a. Traill's	FLY	1	-	-	-	-	-	-	2	-	-	-	-
Olive-sided Flycatcher **	FLY	1	-	2	-	-	-	-	-	-	-	-	-
Hammond's Flycatcher **	FLY	-	-	-	-	-	-	-	-	-	-	-	1
Pacific-slope Flycatcher	FLY	1	-	2	-	-	-	-	-	-	-	-	-
American Dipper **	FLY	1	-	-	-	-	-	-	-	-	-	-	I
Western Wood-pewee **	FLY	1	-	2	-	-	-	-	-	-	-	-	-
White-breasted Nuthatch	FLY	1	-	-	-	-	-	2	2	-	-	-	-

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		Research & Information Acquisition			Species-Based Actions			Habitat-Based Actions			Land Securement		
Species	Guild	Inventory	Assessment (e.g., targets)	Integrated habitat planning	Translocate / Reintroduce	Alternate Predator Prey Man	Other	Habitat Creation	Hagitat restoration	Restore connectivity	Habitat Acquisition	Habitat Stewardship	Monitoring & Evaluation
Band-tailed Pigeon	GAM	1	-	-	-	-	-	-	-	-	2	2	-
Ruffed Grouse **	GAM	1	-	-	-	-	-	-	2	-	2	2	-
Dusky Grouse	GAM	1	-	-	-	-	-	-	2	-	-	-	I
Rufous Hummingbird **	HUM	1	-	-	-	-	-	-	-	-	2	2	I
Leopard dace	NMI	1	-	-	-	-	-	-	-	-	-	-	-
Umatilla dace	NMI	1	-	-	-	-	-	-	-	-	-	-	-
Barred Owl	OWL	1	-	-	-	2	-	-	-	-	-	-	-
Northern Pygmy-owl **	OWL	1	-	2	-	-	-	2	-	-	-	-	-
Short-eared Owl **	OWL	1	-	-	-	-	-	-	-	-	-	2	-
Northern Harrier *	RAP	1	-	-	-	-	-	-	2	-	-	-	I
Bald Eagle	RAP	-	-	-	-	-	-	-	-	-	-	2	1
Torrent sculpin	SCL	1	-	-	-	-	-	-	-	-	-	-	-
Columbia sculpin	SCL	1	-	-	-	-	-	-	-	-	-	-	-
Malheur mottled sculpin	SCL	1	-	-	-	-	-	-	-	-	-	-	-
Shorthead sculpin	SCL	1	-	-	-	-	-	-	-	-	-	-	-
Black Tern *	SHO	-	-	-	-	-	-	1	2	-	-	-	2
Black-necked Stilt	SHO	1	-	-	-	-	-	-	-	-	-	-	-
Wilson's Snipe (formerly Common	SHO	1	-	-	-	-	-	-	-	-	-	2	-
Herring Gull	SHO	1	-	-	-	-	-	-	-	-	-	-	-
Semi-palmated Sandpiper	SHO	1	-	-	-	-	-	2	-	-	-	2	-
Western Sandpiper	SHO	1	-	-	-	-	-	2	-	-	-	2	-
Common Tern	SHO	1	-	-	-	-	-	-	-	-	-	-	-
Killdeer	SHO	1	-	2	-	-	-	-	-	-	-	2	-
American Water Shrew	SMA	1	-	-	-	-	-	-	-	-	-	-	-
Mountain sucker	SUC	1	-	-	-	-	-	-	-	-	-	-	-
Virginia Rail *	WAD	1	-	-	-	-	-	-	2	-	2	2	-

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Black-throated Green Warbler	WAR	1	-	-	-	-	-	-	-	-	2	2	-
Purple Finch	WAR	1	-	2	-	-	-	-	-	-	-	-	-
American Redstart	WAR	1	-	-	-	-	-	-	-	-	-	-	I
Blackpoll Warbler **	WAR	-	-	-	-	-	-	-	-	-	-	-	1
Connecticut Warbler	WAR	1	-	-	-	-	-	-	-	-	2	2	-
Yellow-headed Blackbird	WAR	1	-	-	-	-	-	-	2	-	2	2	I
Greater Scaup	WAT	1	-	2	-	-	-	-	-	-	-	-	-
Barrow's Goldeneye *	WAT	1	-	-	-	-	-	2	-	-	2	2	-
Bufflehead *	WAT	-	-	-	-	-	-	2	-	-	-	-	1
Common Goldeneye	WAT	1	-	-	-	-	-	-	-	-	-	-	-
American Coot	WAT	1	-	2	-	-	-	-	-	-	-	2	-
Blue-winged Teal	WAT	1	-	2	-	-	-	-	2	-	-	2	-
Canvasback	WAT	1	-	2	-	-	-	-	2	-	-	2	-
Cinnamon Teal *	WAT	1	-	2	-	-	-	-	2	-	-	2	-
Hooded Merganser *	WAT	-	-	-	-	-	-	1	-	-	-	-	-
Horned Grebe *	WAT	1	-	-	-	-	-	2	2	-	-	2	-
Belted Kingfisher **	WAT	1	-	-	-	-	-	-	-	-	-	2	-
Lesser Scaup *	WAT	1	-	2	-	-	-	-	-	-	-	2	-
Northern Pintail	WAT	1	-	2	-	-	-	-	-	-	-	2	-
Pied-billed Grebe	WAT	1	-	2	-	-	-	-	2	-	-	2	-
Redhead *	WAT	1	-	2	-	-	-	-	2	-	-	2	-
Ring-necked Duck *	WAT	-	-	-	-	-	-	-	-	-	-	-	1
Wood Duck	WAT	1	-	-	-	-	-	2	-	-	-	-	I
Pygmy Whitefish	WFI	1	-	-	-	-	-	-	-	-	-	-	-
Pileated Woodpecker	WOO	-	-	2	-	-	-	-	-	-	-	-	I
Red-naped Sapsucker **	WOO	-	-	-	-	-	-	-	-	-	-	-	I

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