

The growing number of species of concern in the Salish Sea suggests ecosystem decay is outpacing recovery

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Abstract

Species of concern are native species, sub-species or ecologically significant units that warrant special attention to ensure their conservation. The number of species of concern within the Salish Sea is used by the US Environmental Protection Agency and Environment Canada as a transboundary ecosystem indicator (called "Marine Species at Risk"). Within the Salish Sea, four jurisdictions assess which species require special efforts to ensure protection and survival of the population: the Province of British Columbia, the State of Washington, the Canadian Federal Government, and the United States Federal Government. As of December 1, 2015, there were 125 species at risk in the Salish Sea. Between 2002 (when the list was first compiled) and 2008, the number of listed species grew at an average annual rate of 1% from 60 to 64. It then made a precipitous jump to 113 listed species in 2011 (an average annual growth rate of 15% for 3 years) and has since continued to grow at an average annual rate of 2.6%. Some of the increase seen can be attributed to better understanding of the number of fish, reptile, bird and mammal species known to use the Salish Sea; however, most additions represent new listings due to concern about population declines. The number of species of concern provides a crude indicator of ecosystem health, permits cross checking of species of concern between jurisdictions, suggests where more research is needed to assess species status or causes of decline, and highlights where transboundary approaches could benefit species recovery. Assuming listing efforts have been consistent, the increasing number of species of concern within the Salish Sea over the last 13 years suggests ecosystem recovery efforts are being outpaced by ecosystem decay.

Introduction

Species of concern are native species, sub-species or ecologically significant units that warrant special attention to ensure their conservation. Also known as marine species at risk, the number of species of concern in the Salish Sea is used by the United States Environmental Protection Agency and Environment Canada as a transboundary ecosystem indicator (Marine Species at Risk; <http://www2.epa.gov/salish-sea/marine-species-risk>). For ecosystems like the Salish Sea that span international boundaries and include multiple jurisdictions, an ecosystem-based list of species of concern serves many functions. It acts as a crude indicator of ecosystem health, permits cross checking of species of concern between jurisdictions, suggests where more research is needed to assess species status or causes of decline, and highlights where transboundary approaches could benefit species recovery (Gaydos and Gilardi, 2003). Four jurisdictions within the bi-national, 16,925 square kilometer Salish Sea (Gaydos et al., 2008) have processes for assessing and listing species that require special initiatives to ensure protection and survival of the population. These include the Province of British Columbia, the State of Washington, the Canadian Federal Government, and the United States Federal Government. This work reviews invertebrates, fish, reptiles, birds and mammals that use the Salish Sea marine ecosystem and are listed as species of concern by one or more jurisdiction. Also it compares listings between jurisdictions and between current findings and prior lists developed in 2002, 2004, 2006, 2008, 2011 and 2013 (Gaydos and Gilardi, 2003; Brown and Gaydos, 2005; Brown and Gaydos, 2007; Gaydos and Brown, 2009; Gaydos and Brown, 2011; and Gaydos and Zier, 2014).

Methods

Species that use the Salish Sea marine ecosystem and were listed by one or more jurisdiction as of December 1, 2015 were included. Listed fish, bird, and mammal species were included if they occurred on published lists of birds, mammals (Gaydos and Pearson, 2011) and fishes (Pietsch and Orr, 2015) dependent upon the Salish Sea. Listed reptiles were included if the listing agency identified the Salish Sea as critical habitat for the species. Invertebrates were included if listing data indicated their distribution included the Salish Sea. Specifically, listing classifications and the processes for listing in each jurisdiction are described below.

British Columbia

In the Province of British Columbia, species are assigned a risk of extinction. Species are placed on Red, Blue or Yellow lists. Red-listed species are those that have been legally designated as Endangered or Threatened under the

provincial Wildlife Act, are extirpated, or are candidates for such designation. Blue-listed species are those not immediately threatened, but are of concern because of characteristics that make them particularly sensitive to human activities or natural events. Yellow-listed species are all species not included on the Red or Blue lists. For the purpose of this study, Red and Blue-listed species were considered species of concern (<http://speciesatriskbc.ca/>). When British Columbia ranks species, each species is assigned a global rank (applies across its range), a national rank (for each nation within its range, such as Canada), and a sub-national rank (for each province). In British Columbia, the Conservation Data Centre within the Ministry of Sustainable Resource Management assigns the provincial rank. Within the marine ecosystem, British Columbia currently only assesses mammals, birds, reptiles and freshwater fishes that also use marine habitat. Important to this study, conspicuously absent are marine fishes and marine invertebrates. All credible sources of information concerning species distribution, abundance, trends, and threats are considered in provincially ranking species in British Columbia.

Washington State

In Washington State, the Washington Fish and Wildlife Commission (Commission) lists species of concern under the provisions of Washington Administrative Code (WAC) 232-12-297 (Endangered, Threatened, and Sensitive Wildlife Species Classification). Listing occurs in much the same stepwise procedure as occurs at the U.S. federal level. Species can be listed as either endangered (seriously threatened with extinction throughout all or a significant portion of its range within the state), threatened (likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state) or sensitive (vulnerable or declining and likely to become endangered or threatened in a significant portion of its range within the state). Listing can be initiated in one of three ways: (1) the Washington Department of Fish and Wildlife (WDFW) initiates a species status review; (2) the WDFW receives a petition from a citizen (at which point the agency has 60 days to either initiate the classification process or deny the petition, based on the best available scientific data); or (3) the Commission requests the WDFW to review a species of concern. Listings are based solely on the biological status of the species in the wild, as indicated by the preponderance of scientific data available. When the listing process is initiated, the WDFW publishes a public notice in the Washington State Register and calls for scientific information relevant to the species' status. Then WDFW prepares a draft species status report, which reviews relevant information on the status of the species in Washington, addresses factors affecting its status, and makes a preliminary listing recommendation. The public and the scientific community is given 90 days to review and comment on the draft status report and listing recommendation, and the WDFW can hold one or more public meetings during the public review period. At the close of the public comment period, WDFW addresses comments, completes the final status report and listing recommendation and submits them to the Commission. The final species status report, agency classification recommendation, and State Environmental Policy Act (SEPA) documents are made available to the public at least 30 days prior to the Commission meeting. Once a species is listed, WDFW writes and implements a recovery plan for threatened or endangered species, or a management plan for sensitive species. A review of the species' status is conducted by the WDFW at least once every five years. The WDFW maintains a list of Candidate species, which are those species that will be reviewed for possible listing as endangered, threatened, or sensitive. Important to this study, marine invertebrates and fishes can only receive candidate status in Washington State as (WAC) 232-12-297 does not permit State listing of marine invertebrates and fishes. Species listed as candidates, sensitive, threatened or endangered are included in this study (<http://wdfw.wa.gov/conservation/endangered/>).

Canada

In Canada, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) creates a federal assessment of species at risk using an international ranking system adapted from the World Conservation Union in Switzerland. COSEWIC is composed of government and non-government members, members from academic institutions, and one member with expertise in Aboriginal traditional knowledge. Species designations are made using a formal status report review process. Experts are commissioned to write status reports on the biology, population status, range, and possible threats facing the species or subspecies in question using the best available scientific, community, and Aboriginal traditional knowledge. COSEWIC meets at least once annually to consider new and updated status reports and to make status determinations. If deemed necessary and appropriate, emergency listing can be made ahead of COSEWIC's regular general meeting and decisions made are later ratified based upon a full report. As listed by COSEWIC, risk categories for species include extinct (a species that no longer exists), extirpated (no longer exists in the wild in Canada, but exists elsewhere), endangered (facing imminent extinction or extirpation), threatened (likely to become endangered if limiting factors are not reversed), special concern (characteristics make species particularly sensitive to human activities or natural events), not at risk, or data deficient (insufficient information to support status designation). Species that are suspected of being at some risk of extinction or

extirpation, but have not yet been reviewed by COSEWIC are placed on a Candidate List and as time and resources permit, COSEWIC commission's status reports for these species so that an assessment can be undertaken. Currently, species listed by COSEWIC as "endangered," "threatened," or "special concern" do not receive legal recognition from the federal government. Under the Canadian federal Species at Risk Act (SARA), the federal Cabinet ultimately decides whether COSEWIC designated species should get legal protection under SARA. These decisions are made after consultations with affected stakeholders and other groups. In this study, species listed under COSEWIC (<http://www.cosewic.gc.ca/>) or SARA (<http://www.registrelep-sararegistry.gc.ca/>) as Candidates, Special Concern, Threatened, or Endangered are included as species of concern and are identified accordingly.

United States

In the United States, the U.S. Fish and Wildlife Service (USFWS, Department of the Interior) and the National Oceanic and Atmospheric Administration (NOAA-Fisheries, Department of Commerce) (hereinafter referred to as "the Agencies") share responsibility for identifying species of concern under the provisions of the Federal Endangered Species Act (ESA), enacted in 1973. A species is listed either as endangered (a species that is in danger of extinction throughout all of or a significant portion of its range) or threatened (one that is likely to become endangered in the foreseeable future) when it is determined to be negatively impacted by any or all of the following factors: 1) current or imminent destruction or degradation of its habitat or range; 2) over-extraction for any purpose or by any means; 3) population-level impacts of disease or predation; 4) existing regulatory mechanisms that are inadequate to protect the species; or 5) other natural or anthropogenic factors significantly impeding the species' survival. The process for listing a species can be initiated by the Agencies or by a petition from the public. The Agencies initiate the process by publishing a "notice of review" that identifies a "candidate for listing" any species in the United States that it believes meets the definition of threatened or endangered, or for which its status in the wild warrants review and consideration under the ESA. If the Agencies receive a petition for listing a species from the public they have 90 days to review the petition and determine whether or not there is substantial information indicating that the listing may be warranted. At this point, the species is called a "Candidate for Listing," and the Agencies then have one year to determine whether or not to propose listing for the species. During this review period, the Agencies seek biological information to help complete the status review. If the Agencies decide that a species warrants listing under the ESA, a proposed rule is published in the Federal Register for a 60-day public comment period. Information received is analyzed and considered, and within one year of a listing proposal, one of three possible actions is taken: 1) a species is listed as threatened or endangered because the best available scientific data supports the listing; 2) the proposal is withdrawn because the best available scientific data do not support the listing; or 3) the proposal review period is extended for an additional six months if there is substantial disagreement within the scientific community concerning the listing. In addition to being not listed, listed as threatened and listed as endangered, species also can be listed as a species of concern. These are species about which the Agencies have concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA (Federal Register 9 (73): 19975-19979). The status of a listed species is reviewed at least every five years to determine if federal protection is still warranted. This project lists candidate species, species of concern and those listed as threatened or endangered (<http://www.fws.gov/endangered/> and <http://www.nmfs.noaa.gov/pr/species/esa/>).

Results

As of December 1, 2015, 125 native species, sub-species or ecologically significant units that depend on the Salish Sea marine ecosystem were listed by one or more jurisdiction as species of concern (Table 1). These included five invertebrates (Table 2), 43 fishes (Table 3), two reptiles (Table 4), 59 birds (Table 5), and 16 mammals (Table 6). Of the 125 species listed, no one jurisdiction listed them all (Table 7). The number of species listed in the Salish Sea has continued to grow since 2002 (Fig. 1). Between 2002 (when the list was first compiled) and 2008, the number of listed species grew at an average annual rate of 1% from 60 to 64. It then made a precipitous jump to 113 listed species in 2011 (an average annual growth rate of 15% for 3 years) and has since continued to grow at an average annual rate of 2.6%.

Between 2013 and 2015, 12 new species were added to the list. This included three invertebrates including two species of moth that we realized use the marine environment, the Edward's Beach (*Anarta eedwardsii*) and Sand-verbena (*Copablepharon fuscum*), and the Gooseneck barnacle (*Pollicipes polymerus*), which was listed as a COSEWIC Candidate species by the Canadian Federal Government. For fish, the Pacific Lamprey (*Entosphenus tridentatus*) and the Longfin smelt (*Spirinchus thaleichthys*) were added. Seven bird species also were added: the Black scoter (*Melanitta americana*), Black-legged kittiwake (*Rissa tridactyla*), Long-billed dowitcher

(*Limnodromus scolopaceus*), Eared grebe (*Podiceps nigricollis*), Parasitic jaeger (*Stercorarius parasiticus*), Pectoral sandpiper (*Caldris melanotos*), and Semipalmated sandpiper (*Caldris pusilla*). Conversely, two fish species were removed, the Pacific Ocean perch (*Sebastes alutus*) and the Puget Sound / Strait of Georgia DPS of Coho Salmon (*Oncorhynchus kisutch*) as were three birds, the Belted kingfisher (*Megaceryle alcyon*), Cackling goose (*Branta hutchinsii*), and Snowy owl (*Bubo scandiacus*).

Discussion

No one jurisdiction lists 100% of the total number of species of concern within the Salish Sea, supporting the concept that a comprehensive jurisdiction-wide list is needed to portray a more complete view of the actual number of species of concern within the ecosystem (Table 7). While it is a crude indicator of ecosystem health, the increasing number of species of concern within the Salish Sea that we have identified since 2002 suggests ecosystem recovery efforts are being outpaced by ecosystem decay (Bierregard et al., 2001). In particular, the addition of moth species not previously considered as Salish Sea species of concern highlights the need to think about the Salish Sea ecosystem broadly across national boundaries as well as across taxa. Not only is the 2015 dataset a reminder to intensify conservation efforts to prevent further ecosystem decay, but it also emphasizes how important it is to comprehensively identify species of concern to more realistically assess ecosystem health and better target recovery efforts.

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Table 1: Species of concern in the Salish Sea in 2015 by listing jurisdiction

	British Columbia	Washington State	CANADA	U.S.A.	TOTAL
INVERTEBRATES	2	2	5	0	5
FISHES	7	22	30	12	43
REPTILES	1	2	2	2	2
BIRDS	48	15	26	1	59
MAMMALS	13	10	16	5	16
TOTAL	71	51	79	20	125

Table 2: Invertebrate Species of Concern in the Salish Sea (2015)

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Abalone, Pinto (Northern)	<i>Haliotis kamtschatkana</i>	Red List	Candidate	Endangered (COSEWIC and SARA)	Species of Concern to Not Listed
Barnacle, Gooseneck	<i>Pollicipes polymerus</i>			Not Listed to Candidate (COSEWIC)	
**Moth, Edwards' Beach	<i>Anarta edwardsii</i>			Endangered (COSEWIC)	
**Moth, Sand-verbena	<i>Copablepharon fuscum</i>			Endangered (COSEWIC)	
Olympia oyster	<i>Ostrea conchaphila</i>	Blue list	Candidate	Special Concern (COSEWIC and SARA)	

*Items in bold represent legal status changes made between November 15, 2013 and December 1, 2015.

**Two moth species were just identified as using marine habitat and were listed prior to November 15, 2013.

Table 3: Fish Species of Concern in the Salish Sea (2015)

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
American shad	<i>Alosa sapidissima</i>			Candidate (COSEWIC)	
Basking Shark	<i>Cetorhinus maximus</i>			Endangered (COSEWIC and SARA)	Species of Concern to Not Listed
Dogfish, North Pacific Spiny	<i>Squalus suckleyi</i>			Special Concern (COSEWIC)	
Eulachon	<i>Thaleichthys pacificus</i>	Blue List	Candidate	Endangered (Central Pacific Coast & Fraser River) (COSEWIC)	Threatened
Lamprey, Pacific	<i>Entosphenus tridentatus</i>			Not Listed to Candidate (COSEWIC)	
Lamprey, River	<i>Lampetra ayresii</i>		Candidate		Species of Concern
Pacific Cod	<i>Gadus macrocephalus</i>		Candidate (South & Central Puget Sound)	Candidate (COSEWIC)	Species of Concern
Pacific Hake (Puget Sound / Georgia Basin)	<i>Merluccius productus</i>		Candidate		Species of Concern
Pacific Herring	<i>Clupea pallasii</i>		Candidate		
***Pacific Ocean Perch	<i>Sebastes alutus</i>			Candidate to Not Listed (COSEWIC)	
Pacific Sardine	<i>Sardinops sagax</i>			Special Concern (SARA)	
Rockfish, Black	<i>Sebastes melanops</i>		Candidate		
Rockfish, Bocaccio (Puget Sound / Georgia Basin)	<i>Sebastes paucispinis</i>		Candidate	Threatened to Endangered (COSEWIC)	Endangered

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Rockfish, Brown	<i>Sebastes auriculatus</i>		Candidate		
Rockfish, Canary (Puget Sound / Georgia Basin)	<i>Sebastes pinniger</i>		Candidate	Threatened (COSEWIC)	Threatened
Rockfish, China	<i>Sebastes nebulosus</i>		Candidate		
Rockfish, Copper	<i>Sebastes caurinus</i>		Candidate		
Rockfish, Darkblotched	<i>Sebastes crameri</i>			Special Concern (COSEWIC)	
Rockfish, Greenstriped (Puget Sound)	<i>Sebastes elongatus</i>		Candidate		
Rockfish, Quillback	<i>Sebastes maliger</i>		Candidate	Threatened (COSEWIC)	
Rockfish, Redstripe (Puget Sound)	<i>Sebastes proriger</i>		Candidate		
Rockfish, Rougheye Type I & II	<i>Sebastes aleutianus</i> , previously known as only one species			Special Concern (COSEWIC and SARA)	
Rockfish, Tiger	<i>Sebastes nigrocinctus</i>		Candidate		
Rockfish, Widow	<i>Sebastes entomelas</i>		Candidate	Candidate (COSEWIC)	
Rockfish, Yelloweye (Puget Sound / Georgia Basin)	<i>Sebastes ruberrimus</i>		Candidate	Special Concern (COSEWIC and SARA)	Threatened
Rockfish, Yellowtail	<i>Sebastes flavidus</i>		Candidate	Candidate (COSEWIC)	
Salmon, Chinook (Puget Sound)	<i>Oncorhynchus tshawytscha</i>		Candidate		Threatened
Salmon, Chum (No Specific DPS or ESU)	<i>Oncorhynchus keta</i>			Candidate (COSEWIC)	

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Salmon, Chum (Summer-Run Hood Canal)	<i>Oncorhynchus keta</i>		Candidate		Threatened
Salmon, Coho (Interior Fraser River)	<i>Oncorhynchus kisutch</i>			Endangered (COSEWIC)	
***Salmon, Coho (Puget Sound/Strait of Georgia)	<i>Oncorhynchus kisutch</i>				Species of Concern to Not Listed
Salmon, Pink	<i>Oncorhynchus gorbuscha</i>			Candidate (COSEWIC)	
Salmon, Sockeye (Cutlus Lake)	<i>Oncorhynchus nerka</i>			Endangered (COSEWIC)	
Salmon, Sockeye (Sakinaw Lake)	<i>Oncorhynchus nerka</i>			Endangered (COSEWIC)	
**Sculpin, Spinynose	<i>Asemichthys taylori</i>			Data Deficient (COSEWIC)	
**Shark, Blue	<i>Prionace glauca</i>			Data Deficient (COSEWIC)	
Shark, Bluntnose Sixgill	<i>Hexanchus griseus</i>			Special Concern (COSEWIC and SARA)	
**Shark, Brown Cat	<i>Apisturus brunneus</i>			Data Deficient (COSEWIC)	
Shortspine Thornyhead	<i>Sebastolobus alascanus</i>			Candidate (COSEWIC)	
Smelt, Longfin	<i>Spirinchus thaleichthys</i>			Candidate (COSEWIC)	
Sturgeon, Green	<i>Acipenser medirostris</i>	Red List		Special Concern (COSEWIC and SARA)	Threatened
Sturgeon, White (Lower Fraser River)	<i>Acipenser transmontanus</i>	Red List		Threatened (COSEWIC)	

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Sturgeon, White (Middle Fraser River)	<i>Acipenser transmontanus</i>	Red List		Endangered (COSEWIC)	
Sturgeon, White (Upper Fraser River)	<i>Acipenser transmontanus</i>	Red List		Endangered (COSEWIC and SARA)	
Trout, Bull	<i>Salvelinus confluentus</i>	Blue List	Candidate	Special Concern (South Coast BC Populations) (COSEWIC); Candidate (Pacific Populations) (COSEWIC)	Threatened
Trout, Cutthroat	<i>Oncorhynchus clarkii clarkii</i>	Blue List		Not Listed to Candidate (COSEWIC)	
Trout, Steelhead (Puget Sound / Georgia Basin)	<i>Oncorhynchus mykiss</i>			Candidate (COSEWIC)	Threatened
Walleye Pollock (S. Puget Sound)	<i>Theragra chalcogramma</i>		Candidate		

*Items in bold represent legal status changes made between November 15, 2013 and December 1, 2015.

**Data Deficient species not included on list total, but presented

***Delisted species not included on list total, but presented in table

Table 4: Reptile Species of Concern in the Salish Sea (2015)

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Green Sea Turtle	<i>Chelonia mydas</i>		Threatened	Candidate (COSEWIC)	Threatened
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	Red List	Endangered	Endangered (COSEWIC and SARA)	Endangered

Table 5: Avian Species of Concern in the Salish Sea (2015)

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
American Avocet	<i>Recurvirostra americana</i>	Blue List			
American Bittern	<i>Botaurus lentiginosus</i>	Blue List			
American Golden Plover	<i>Pluvialis dominica</i>	Blue List		Not Listed to Candidate (COSEWIC)	
American Kestrel	<i>Falco sparverius</i>			Candidate (COSEWIC)	
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	Blue List		Special Concern (COSEWIC and SARA)	
Bald Eagle	<i>Haliaeetus leucocephalus</i>		Sensitive		Species of Concern to Delisted due to Recovery (2007)
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	Blue List		Special Concern (COSEWIC and SARA)	
**Belted Kingfisher	<i>Megasceryle alcyon</i>			Candidate to Not Listed (COSEWIC)	
Black Scoter	<i>Melanitta americana</i>	Not Listed to Blue List			

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Black-footed Albatross	<i>Phoebastria nigripes</i>	Blue List		Special Concern (COSEWIC and SARA)	
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Not Listed to Red List			
Brant	<i>Branta bernicla</i>	Blue List			
**Cackling Goose	<i>Branta hutchinsii</i>	Blue List to Yellow List			
California Gull	<i>Larus californicus</i>	Blue List			
Canada Goose, Dusky	<i>Branta canadensis occidentalis</i>	Red List			
Caspian Tern	<i>Hydroprogne caspia</i>	Blue List			
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>	Blue List	Candidate	Candidate to Special Concern (COSEWIC)	
Common Murre	<i>Uria aalge</i>	Red List	Candidate		
Cormorant, Brandt's	<i>Phalacrocorax penicillatus</i>	Red List	Candidate		
Cormorant, Double-crested	<i>Phalacrocorax auritis</i>	Blue List			
Cormorant, Pelagic	<i>Phalacrocorax pelagicus pelagicus</i>	Red List			
Dowitcher, Long-billed	<i>Limnodromus scolopaceus</i>			Not Listed to Candidate (COSEWIC)	
Dowitcher, Short-billed	<i>Limnodromus griseus</i>	Blue List		Not Listed to Candidate (COSEWIC)	
Forster's Tern	<i>Sterna forsteri</i>	Red List		Data Deficient (COSEWIC)	
Great Blue Heron, Pacific	<i>Ardea herodias fannini</i>	Blue List		Special Concern (COSEWIC and SARA)	
Grebe, Clark's	<i>Aechmophorus clarkii</i>	Red list	Candidate		

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Grebe, Eared	<i>Podiceps nigricollis</i>	Not Listed to Blue List			
Grebe, Horned	<i>Podiceps auritus</i>			Special Concern (COSEWIC)	
Grebe, Western	<i>Aechmophorus occidentalis</i>	Red List	Candidate	Candidate to Special Concern (COSEWIC)	
Green Heron	<i>Butorides virescens</i>	Blue List			
Gyr Falcon	<i>Falco rusticolus</i>	Blue List			
Hudsonian Godwit	<i>Limosa haemastica</i>	Red List		Candidate (COSEWIC)	
Killdeer	<i>Charadrius vociferus</i>			Candidate (COSEWIC)	
Long-billed Curlew	<i>Numenius americanus</i>	Blue List		Special Concern (COSEWIC and SARA)	
Long-tailed Duck	<i>Clangula hyemalis</i>	Blue List			
Loon, Common	<i>Gavia immer</i>		Sensitive		
Loon, Yellow-billed	<i>Gavia adamsii</i>	Blue List		Candidate (COSEWIC)	Candidate to Not Listed
Marbled Murrelet	<i>Brachyramphus marmoratus marmoratus</i>	Blue List	Threatened	Threatened (COSEWIC and SARA)	Threatened
Northern Fulmar	<i>Fulmarus glacialis</i>	Red List			
Owl, Short-eared	<i>Asio flammeus</i>	Blue List		Special Concern (COSEWIC and SARA)	
**Owl, Snowy	<i>Bubo scandiacus</i>	Blue List to Yellow List			
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	Not Listed to Red List			
Pelican, American White	<i>Pelecanus erythrorhynchos</i>	Red List	Endangered		
Pelican, Brown	<i>Pelecanus occidentalis</i>		Endangered		

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Peregrine Falcon, American	<i>Falco peregrinus anatum</i>	Red List	Sensitive	Special Concern (COSEWIC and SARA)	
Peregrine Falcon, Peale's	<i>Falco peregrinus pealei</i>	Blue List	Sensitive	Special Concern (COSEWIC and SARA)	
Phalarope, Red-necked	<i>Phalaropus lobatus</i>	Blue List		Candidate to Special Concern (COSEWIC)	
Puffin, Horned	<i>Fatercula corniculata</i>	Red List			
Puffin, Tufted	<i>Fatercula cirrhata</i>	Blue List	Candidate to Endangered		Not Listed to Under Review
Purple Martin	<i>Progne subis</i>	Blue List	Candidate		
Red Knot	<i>Calidris canutus roselaari</i>	Red List		Threatened (COSEWIC and SARA)	
Rough-legged Hawk	<i>Buteo lagopus</i>	Blue List			
Sandhill Crane	<i>Grus canadensis</i>		Endangered		
Sandpiper, Buff-breasted	<i>Tryngites subruficollis</i>			Special Concern (COSEWIC)	
Sandpiper, Pectoral	<i>Calidris melanotos</i>			Not Listed to Candidate (COSEWIC)	
Sandpiper, Semipalmated	<i>Calidris pusilla</i>			Not Listed to Candidate (COSEWIC)	
Shearwater, Buller's	<i>Puffinus bulleri</i>	Blue List			
Shearwater, Flesh-footed	<i>Puffinus carneipes</i>	Blue List			
Shearwater, Pink-footed	<i>Puffinus creatopus</i>	Blue List		Threatened (COSEWIC and SARA)	
Surf Scoter	<i>Melanitta perspicillata</i>	Blue List			

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Tundra Swan	<i>Cygnus columbianus</i>	Blue List			
Wandering Tattler	<i>Tringa incana</i>	Blue List		Candidate (COSEWIC)	

*Items in bold represent legal status changes made between November 15, 2013 and December 1, 2015.

** Delisted species not included on list total, but presented in table.

Table 6: Mammal Species of Concern in the Salish Sea (2015)

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Baird's Beaked Whale	<i>Berardius bairdii</i>			Candidate (COSEWIC)	
Cuvier's Beaked Whale	<i>Ziphius cavirostris</i>			Candidate (COSEWIC)	
Fin Whale	<i>Balaenoptera physalus</i>	Red List	Endangered	Threatened (COSEWIC and SARA)	Endangered
Gray Whale (E. North Pacific Stock)	<i>Eschrichtius robustus</i>	Blue List	Sensitive	Special Concern (COSEWIC and SARA)	
Grizzly bear	<i>Ursus arctos</i>	Blue List	Endangered	Special Concern (COSEWIC)	Threatened
Harbor Porpoise	<i>Phocoena phocoena</i>	Blue List	Candidate	Special Concern (COSEWIC and SARA)	
Humpback Whale (N. Pacific)	<i>Megaptera novaeangliae</i>	Blue List	Endangered	Special Concern (COSEWIC); Threatened (SARA)	Endangered
Killer Whale (N. Residents)	<i>Orcinus orca</i>	Red List	Endangered	Threatened (COSEWIC and SARA)	
Killer Whale (Offshore)	<i>Orcinus orca</i>	Red List	Endangered	Threatened (COSEWIC and SARA)	
Killer Whale (S. Residents)	<i>Orcinus orca</i>	Red List	Endangered	Endangered (COSEWIC and SARA)	Endangered

Common Name	Scientific Name	British Columbia	Washington State	Canada	U.S.A.
Killer Whale (Transients)	<i>Orcinus orca</i>	Red List	Endangered	Threatened (COSEWIC and SARA)	
Northern Elephant Seal	<i>Mirounga angustirostris</i>	Not Listed to Red List		Candidate (COSEWIC)	
Northern Fur Seal	<i>Callorhinus ursinus</i>	Red List		Threatened (COSEWIC)	
Pacific White-sided Dolphin	<i>Lagenorhynchus obliquidens</i>			Candidate (COSEWIC)	
Sea Otter, Northern	<i>Enhydra lutris kenyoni</i>	Blue List	Endangered	Special Concern (COSEWIC and SARA)	Species of Concern
Steller Sea-lion (Eastern Population)	<i>Eumetopias jubatus</i>	Blue List	Threatened to None	Special Concern (COSEWIC and SARA)	

* Items in bold represent legal status changes made between November 15, 2013 and December 1, 2015.

Table 7: Percentage of species of concern listed by jurisdiction over time

	British Columbia	Washington State	CANADA	U.S.A.	Species of Concern
2002 (Gaydos and Gilardi, 2003)	47%	73%	28%	30%	60
2004 (Brown and Gaydos, 2005)	50%	73%	36%	31%	63
2006 (Brown and Gaydos, 2007)	49%	73%	40%	33%	63
2008 (Gaydos and Brown, 2009)	48%	70%	44%	42%	64
2011 (Gaydos and Brown, 2011)	55%	44%	56%	29%	113
2013 (Gaydos and Zier, 2014)	58%	44%	61%	22%	119
2015 (Current Study)	57%	41%	63%	16%	125

Figure 1: Number of species of concern in the Salish Sea over time

