

Species of Concern within the Salish Sea Marine Ecosystem: changes from 2002 to 2008

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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 an ecosystem can be used as a crude measure of ecosystem health and it illustrates where cross-jurisdiction work is needed to recover declining species. Within the bi-national Puget Sound Georgia Basin marine ecosystem, an area also known as the Salish Sea, four jurisdictions assess which species require special initiatives 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 September 1, 2008, 64 species of concern were listed by one or more of these jurisdictions; one more than in 2006 when this list was last compiled and four more than in 2002 when this list was first compiled. Since 2006, three new species were added to the list and two were removed. Rougheye rockfish (*Sebastes aleutianus*) were listed as a species of special concern by the Canadian Federal Government as was the bluntnose sixgill shark (*Hexanchus griseus*). Additionally, Puget Sound steelhead (*Oncorhynchus mykiss*) were listed as threatened by the U.S. Federal Government. The shortspine thornyhead fish (*Sebastolobus alascanus*) changed from Canadian Federal Government candidate status to not-listed and was removed and two stocks of Pacific herring (*Clupea pallasii*) were consolidated into one due to removal of the Cherry Point stock from U.S. Federal Candidate status. Using unpublished estimates on species richness for the ecosystem, approximately 0.1% of invertebrates (3/3000), 13% of fishes (28/219), 18% of birds (23/128) and 45% (9/20) of mammals that utilize the Salish Sea marine waters are listed by one or more jurisdiction as species of concern. In light of projected increased population growth, on-going habitat modifications and expected climate change, the number of species of concern for this ecosystem is likely to increase if listing efforts remain consistent for all four jurisdictions. Increased and improved bi-national efforts to recover declining populations of species and recover this ecosystem are urgently needed to stop the insidious loss of species and ecosystem decay.

Introduction

Species of concern are native species, sub-species or ecologically significant units that warrant special attention to ensure their conservation. Within ecosystems spanning international boundaries and 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 and highlights where transboundary approaches could benefit species recovery (Gaydos and Gilardi, 2003). Four jurisdictions within the bi-national Puget Sound Georgia Basin marine ecosystem, an area also known as the Salish Sea (Fraser et al., 2006) 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 compiles a list of invertebrates, fishes, reptiles, birds and mammals that utilize the Salish Sea marine ecosystem and are listed as species of concern by more or more jurisdiction. Also it compares listings between jurisdictions and updates prior lists developed in 2002 (Gaydos and Gilardi, 2003), 2004 (Brown and Gaydos, 2005) and 2006 (Brown and Gaydos, 2007).

Methods

Species that utilize marine habitat in the Puget Sound Georgia Basin and were listed by one or more jurisdiction were included. Listing status as of September 1, 2008 was used. Specifically, the processes for listing and listing classifications within each jurisdiction are as follows:

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 are considered species of concern. 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. These provincial ranks are updated annually. Within the marine ecosystem, British Columbia currently only assesses mammals, birds, reptiles and freshwater fishes that also utilize 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 species of concern are listed by the Washington Fish and Wildlife Commission (Commission) 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. A species could 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. The 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, the 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, the 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 by Department Policy, which are those species that will be reviewed for possible listing as endangered, threatened, or sensitive. Marine invertebrates and fishes can only receive candidate status in Washington State. Species listed as candidates, sensitive, threatened or endangered are included in this study.

Canada

In Canada, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) creates a federal listing 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 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 of "special concern" do not receive legal recognition from the federal government. Under the 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 and SARA are included 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 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 as 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 does not support the listing; or 3) the proposal review period is extended for an additional 6 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.

Results

As of September 2008, 64 species in the Georgia Basin Puget Sound marine ecosystem were listed by one or more jurisdiction as species of concern (Table 1). These included 3 invertebrates (Table 2), 28 fishes (Table 3), one reptile (Table 4), 23 birds (Table 5), and 9 mammals (Table 6). As in 2002, 2004 and 2006 each jurisdiction underestimated the total number of species of concern within the entire marine ecosystem. Of the 64 species listed by one or more jurisdiction, Washington State listed 70% of them, the Province of British Columbia listed 48%, the Canadian Federal Government identified 44%, and the U.S. Federal Government identified 42% (Table 7).

Between 2006 and 2008 three additional species were added to this list. The Rougheye rockfish (*Sebastes aleutianus*) and the bluntnose sixgill shark (*Hexanchus griseus*) were listed as a species of special concern by the Canadian Federal Government and Puget Sound steelhead (*Oncorhynchus mykiss*) were listed as threatened by the U.S. Federal Government (Table 3). Species deleted from this list included the shortspine thornyhead fish (*Sebastolobus alascanus*), which changed from Canadian Federal Government candidate status to not listed and two stocks of herring (*Clupea pallasii*) that were consolidated into one due to removal of the Cherry Point stock from U.S. Federal candidate status (Table 3). Additionally, the listing status for 12 previously included species was changed by one or more jurisdiction (Tables 3, 5 and 6).

Discussion

Listing of species is an active process. Although only 1 net species, sub-species or ecologically significant unit was added to the total number of species listed by one or more jurisdiction in the Salish Sea, between September 2006

and September 2008 listing status changed for 16 species. Three species were new additions to the list, one was removed from the list and 12 species had one or more jurisdiction change their status without causing them to be removed from the list. The Province of British Columbia changed listings for 2 species (Table 6), the State of Washington changed listings for 1 species (Table 5), the Canadian Federal Government changed listing for 8 species (Tables 3, 5 and 6) and the US Federal Government changed listing for 8 species (Tables 3 and 5).

To the best of our knowledge, this is the only ecosystem-based list of species of concern developed and tracked for the Salish Sea marine ecosystem. Combining all listed species within the ecosystem portrays a more comprehensive view of the actual species of concern within the ecosystem. Since 2002, no one jurisdiction has listed all of the species of concern. This is not surprising due to differences in species abundance and distribution within the ecosystem as well as jurisdictional differences in listing criteria. The percentage of total species of concern listed by jurisdiction has not differed greatly since 2002 (Table 7). Assuming that agencies within the different jurisdictions are actively working to keep up with species listing, the consistent percentage of total species listed by jurisdiction suggests that differences in listing, rather than in species abundance and distribution within the ecosystem, are responsible for differences in the percentage of total species listed.

A transboundary, multi-jurisdiction list of species of concern can be used as an indicator of ecosystem health. Using unpublished SeaDoc Society data on species richness for the ecosystem, approximately 0.1% of invertebrates (3/3000), 13% of fishes (28/219), 18% of birds (23/128) and 45% (9/20) of mammals that utilize the Salish Sea marine waters are listed by one or more jurisdiction as species of concern. Similar lists are not available for comparison from other marine ecosystems however the high proportion of species of concern is suggestive of ecosystem decay (Bierregard et al., 2001). In light of projected increased population growth, on-going habitat modifications and expected climate change, the number of species of concern for this ecosystem is likely to increase if listing efforts remain consistent for all four jurisdictions. Increased and improved bi-national efforts to recover declining populations of species and recover this ecosystem are urgently needed to stop the insidious loss of species and ecosystem decay.

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Table 1: Marine ecosystem species identified as species of concern in 2008 by jurisdiction

	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.	TOTAL
INVERTEBRATES	0	3	2	2	3
FISHES	2	21	10	12	28
REPTILES	1	1	1	1	1
BIRDS	19	11	6	8	23
MAMMALS	9	9	9	4	9
TOTAL	31	45	28	27	64

Table 2: Invertebrate Species of Concern in the Georgia Basin Puget Sound Marine Ecosystem

SPECIES	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.
Newcomb's littorine snail (<i>Algamorda newcombiana</i>)		Candidate		Species of Concern
Olympia oyster (<i>Ostrea conchaphila</i>)		Candidate	Special Concern (COSEWIC, SARA)	
Pinto (Northern) Abalone (<i>Haliotis kamtschatkana</i>)		Candidate	Threatened (COSEWIC, SARA)	Species of Concern

Table 3: Fish Species of Concern in the Georgia Basin Puget Sound Marine Ecosystem

SPECIES	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.
Eulachon (<i>Thaleichthys pacificus</i>)	Blue List	Candidate	Candidate (COSEWIC; status report expected in 2010)	Not Listed to Candidate
Pacific cod (<i>Gadus macrocephalus</i>)		Candidate		
Pacific hake (<i>Merluccius productus</i>)		Candidate		Species of Concern
Pacific herring (<i>Clupea pallasii</i>)		Candidate		
Rockfish, Black (<i>Sebastes melanops</i>)		Candidate		
Rockfish, Bocaccio (<i>Sebastes paucispinis</i>)		Candidate	Threatened (COSEWIC)	Not listed to Candidate
Rockfish, Brown (<i>Sebastes auriculatus</i>)		Candidate		
Rockfish, Canary (<i>Sebastes pinniger</i>)		Candidate	Not listed to Threatened (COSEWIC)	Not listed to Candidate
Rockfish, China (<i>Sebastes nebulosus</i>)		Candidate		
Rockfish, Copper (<i>Sebastes caurinus</i>)		Candidate		
Rockfish, Greenstriped (<i>Sebastes elongatus</i>)		Candidate		Not listed to Candidate
Rockfish, Quillback (<i>Sebastes maliger</i>)		Candidate		
Rockfish, Redstripe (<i>Sebastes proriger</i>)		Candidate		Not listed to Candidate
Rockfish, Rougheye (<i>Sebastes aleutianus</i>)			Not listed to Special Concern (COSEWIC)	
Rockfish, Tiger (<i>Sebastes nigrocinctus</i>)		Candidate		
Rockfish, Widow (<i>Sebastes entomelas</i>)		Candidate	Not listed to Candidate (COSEWIC)	
Rockfish, Yelloweye (<i>Sebastes ruberrimus</i>)		Candidate		Not listed to Candidate
Rockfish, Yellowtail (<i>Sebastes flavidus</i>)		Candidate	Candidate (COSEWIC)	
Salmon, Chinook (<i>Oncorhynchus tshawytscha</i>), Puget Sound		Candidate		Threatened

SPECIES	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.
Salmon, Chum (<i>Oncorhynchus keta</i>), Summer Run Hood Canal		Candidate		Threatened
Salmon, Coho (<i>Oncorhynchus kisutch</i>), Interior Frasier River			Endangered (COSEWIC)	
Salmon, Coho (<i>Oncorhynchus kisutch</i>), Puget Sound and Strait of Georgia				Species of Concern
Salmon, Sockeye (<i>Oncorhynchus nerka</i>), Cultus Lake			Endangered (COSEWIC)	
Salmon, Sockeye (<i>Oncorhynchus nerka</i>), Sakinaw Lake			Endangered (COSEWIC)	
Shark, Bluntnose sixgill (<i>Hexanchus griseus</i>)			Not listed to Special Concern (COSEWIC)	
Shortspine Thornyhead (<i>Sebastolobus alascanus</i>)			Candidate (COSEWIC) to Not Listed	
Trout, Bull (<i>Salvelinus confluentus</i>)	Blue List	Candidate		Threatened
Trout, Steelhead (<i>Oncorhynchus mykiss</i>) Puget Sound				Not listed to Threatened
Walleye Pollock (<i>Theragra chalcogramma</i>)		Candidate		

*Items in bold represent legal status changes made between September 2006 and September 2008.

Table 4: Reptile Species of Concern in the Georgia Basin Puget Sound Marine Ecosystem

Species	British Columbia	Washington State	Canada	U.S.A.
Sea Turtle, Leatherback (<i>Dermochelys coriacea</i>)	Red List	Endangered	Endangered (COSEWIC, SARA)	Endangered

Table 5: Avian Species of Concern in the Georgia Basin Puget Sound Marine Ecosystem

SPECIES	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S. A.
American Golden Plover (<i>Pluvialis dominica</i>)	Blue List			
Ancient Murrelet (<i>Synthliboramphus antiquus</i>)	Blue List		Special Concern (COSEWIC, SARA)	
Bald Eagle (<i>Haliaeetus leucocephalus</i>)		Threatened to Sensitive		Threatened to Species of Concern
Canada Goose, Aleutian (<i>Branta canadensis leucopareia</i>)				Species of Concern
Caspian Tern (<i>Hydroprogne caspia</i>)	Blue List			
Cassin's Auklet (<i>Ptychoramphus aleuticus</i>)	Blue List	Candidate		Species of Concern
Common Loon (<i>Gavia immer</i>)		Sensitive		
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</i>)	Red List			
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, SARA)	
Long-billed Curlew (<i>Numenius americanus</i>)	Blue List		Special Concern (COSEWIC, SARA)	
Marbled Murrelet (<i>Brachyramphus marmoratus marmoratus</i>)	Red List	Threatened	Threatened (COSEWIC, SARA)	Threatened
Pelican, Brown (<i>Pelecanus occidentalis</i>)		Endangered		Endangered
Peregrine Falcon, American (<i>Falco peregrinus anatum</i>)	Red List	Sensitive	Threatened to Special Concern (COSEWIC); Threatened (SARA)	Species of Concern

Species	British Columbia	Washington State	Canada	U.S.A.
Peregrine Falcon, Peale's (<i>Falco peregrinus pealei</i>)	Blue List	Sensitive	Special Concern (COSEWIC, SARA)	Species of Concern
Phalarope, Red-necked (<i>Phalaropus lobatus</i>)	Blue List			
Short-billed Dowitcher (<i>Limnodromus griseus</i>)	Blue List			
Surf Scoter (<i>Melanitta perspicillata</i>)	Blue List			
Tufted Puffin (<i>Fratercula cirrhata</i>)	Blue List	Candidate		Species of Concern
Western Grebe (<i>Aechmophorus occidentalis</i>)	Red List	Candidate		

***Items in bold represent legal status changes made between September 2006 and September 2008.**

Table 6: Mammalian Species of Concern in the Georgia Basin Puget Sound Marine Ecosystem

SPECIES	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.
Gray Whale (<i>Eschrichtius robustus</i>)	Blue List	Sensitive	Special Concern (COSEWIC, SARA)	
Harbor Porpoise (<i>Phocoena phocoena</i>)	Blue List	Candidate	Special Concern (COSEWIC, SARA)	
Humpback whale, N. Pacific (<i>Megaptera novaeangliae</i>)	Blue List	Endangered	Threatened (COSEWIC, SARA)	Endangered
Killer Whales, N. Residents (<i>Orcinus orca</i>)	Red List to Blue List	Endangered	Threatened (COSEWIC, SARA)	
Killer Whales, Offshore (<i>Orcinus orca</i>)	Blue List	Endangered	Special Concern (COSEWIC, SARA)	
Killer Whales, S. Residents (<i>Orcinus orca</i>)	Red List	Endangered	Endangered (COSEWIC, SARA)	Endangered
Killer Whales, Transients (<i>Orcinus orca</i>)	Red List	Endangered	Threatened (COSEWIC, SARA)	
Sea Otter, northern (<i>Enhydra lutris</i>):	Red List	Endangered	Threatened to Special Concern (COSEWIC) , Threatened (SARA)	Species of Concern
Steller Sea-lion (eastern population) (<i>Eumetopias jubatus</i>)	Red List to Blue List	Threatened	Special Concern (COSEWIC, SARA)	Threatened

*Items in bold represent legal status changes made between September 2004 and September 2006.

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

	BRITISH COLUMBIA	WASHINGTON STATE	CANADA	U.S.A.	TOTAL SPECIES LISTED
2002*	47%	73%	28%	30%	60
2004**	50%	73%	36%	31%	63
2006***	49%	73%	40%	33%	63
2008****	48%	70%	44%	42%	64

*Gaydos and Gilardi, 2003

**Brown and Gaydos, 2005

***Brown and Gaydos, 2007

****Current data