PARTNERSHIP IN NONGAME WILDLIFE RESEARCH AND DATA MANAGEMENT FOR THE STATE OF ALASKA'S WILDLIFE CONSERVATION PLAN

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Partnership in Nongame Wildlife Research and Data Management for the State of Alaska's Wildlife Conservation Plan, 2004 – 2007

Ву

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Abstract

The Alaska Natural Heritage Program (AKNHP) entered into a partnership with the Alaska Department of Fish and Game's (ADF&G) nongame program to summarize biological, ecological, and distribution information on a number of species featured in their Comprehensive Wildlife Conservation Strategy (CWCS) to aid with informed decision-making regarding the conservation status of these animals. Between 2004 and 2006, AKNHP staff compiled and synthesized information on the biology and ecology of 92 select featured species and used this information to develop individual species status reports. Each report contains summarized current and historical information on individual species' life history traits, distribution, population abundance and trends, habitat preferences, level of protection, concerns, conservation status, and potential conservation and management actions at both state and global levels. We used the summarized information from each report to review and revise the Heritage Program state status ranks for individual species. During 2006 and 2007, we compiled and summarized range and distribution information to develop maps for 56 of the 92 featured species for which status reports were prepared. We compiled a full bibliography for all references cited during status report and map development. We developed a project web site that is accessible through the Alaska Natural Heritage Program web-page (http://aknhp.uaa.alaska.edu/zoology/Zoology ADFG.htm) and is linked to the Alaska Department of Fish and Game's CWCS web site (http://www.sf.adfg.state.ak.us/statewide/ngplan/NG_outline.cfm), where species status reports and range and distribution maps for individual species can be downloaded.

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Introduction

The Alaska Department of Fish and Game's statewide Comprehensive Wildlife Conservation Strategy (CWCS) was finalized in August 2005 and approved by the Director of the U.S. Fish and Wildlife Service in December, 2005, making Alaska eligible for future Congressional appropriations of State Wildlife Grants (SWG) funds. The overall goal of the CWCS is to conserve the diversity of Alaska's wildlife resources, focusing on those species with the greatest conservation need. In order to achieve this goal, the CWCS emphasizes species that are not commercially or recreationally hunted, trapped or fished, and wildlife populations, including select game populations that have specific conservation concerns.

The CWCS highlights the conservation needs of a large number of species, species groups, and species assemblages. These species and groups are termed "featured species" within the CWCS. Featured species were selected by experts, peers, and others with Alaskan expertise after applying criteria on vulnerability of a species, subspecies or distinct populations and addressing such factors as abundance, rarity, isolation, endemism, sensitivity to environmental disturbance, incidence of deformity or disease, representation, international importance, and formal designation as at risk (e.g., T&E). The Alaska CWCS Featured Species list includes fourteen taxonomic groups: amphibians and reptiles, marine fish, marine invertebrates, sea birds, marine mammals, terrestrial mammals, land birds, raptors, terrestrial invertebrates, water birds, shorebirds, freshwater fish, waterfowl, and freshwater invertebrates (ADF&G 2006).

The CWCS acknowledged that a serious impediment to the goal of better conserving broad arrays of species was the lack of information available on most Alaskan species and their habitats. Much of the research in the state has focused on game species that are important for commercial, recreational and subsistence users, while little attention has been focused on the state's other wildlife resources, including invertebrates, fish, amphibians, small mammals, and birds. Before the state could select appropriate planning targets and develop conservation strategies for the CWCS, information was needed on many of these nongame species. Unfortunately, even basic information about the biology, ecology, population abundance, trends and distribution of these species was sorely lacking. To that end, the Alaska Natural Heritage Program (AKNHP) entered into a partnership with the Alaska Department of Fish and Game's (ADF&G) nongame program to summarize biological, ecological, and distribution information on a

number of "featured species" to aid with informed decision-making regarding the conservation status of these animals.

Objectives

The objective of this project was to compile and synthesize biological, ecological and distribution information on select featured vertebrate and invertebrate species, as determined cooperatively by ADF&G and AKNHP. This summarized information was then to be used to develop species status reports, to review the Heritage Program conservation status ranks, to develop accurate range and distribution (occurrence) maps for individual species, to enter this information into the Heritage Program's Biotics database, and to make this information accessible to the public via web distribution.

Methods

This was a multi-year project, initiated in 2004 and culminating in 2007. Efforts during 2004-06 focused on developing individual featured species status reports. During 2006-07, we mapped the range and distribution of a subset of the species for which status reports were prepared. Methods for these two component parts of the project are described separately.

Species Status Reports:

We compiled and synthesized information on the biology and ecology of 92 select featured species and used this information to develop individual species status reports (Table 1). Each report contains summarized current and historical information on individual species' life history traits, distribution, population abundance and trends, habitat preferences, level of protection, concerns, conservation status, and potential conservation and management actions at both state and global levels. Reports are largely based on an extensive literature review of published and unpublished literature and personal communication with experts. We attempted to have reports reviewed by at least one expert in that taxa and their comments were incorporated into the final status report.

We used the summarized information from each report to review and revise the Heritage Program state status ranks for individual species (status rank definitions are provided in Table 2). All information contained within the species status reports, at both state and global levels, was incorporated into the Heritage Program's Biotics database, including a full bibliography for all literature citations.

Distribution Mapping:

We compiled and summarized range and distribution information for 56 featured species (Table 3); this represents a subset of the 92 species for which status reports were prepared (described above). Species to be mapped were selected cooperatively by ADF&G and AKNHP, and selection was based largely on high State (S) Ranks (e.g. S1 – S3 on a scale of S1 – S5, or species of conservation priority). Range and distribution information was compiled from published and unpublished literature, museum specimen data, and unpublished data and field notes obtained directly from researchers.

Range is defined as the total areal extent occupied by a given taxon and is usually estimated as the aggregation of all map units thought to be occupied by individuals of the target taxon in the study area (in this case, Alaska). NatureServe has already developed the initial overlay of published maps for many mammals, birds, and amphibians of the Western Hemisphere

(http://www.natureserve.org/getData/animalData.jsp). We modified the existing NatureServe range maps using occurrence data (described below) so they more accurately depicted the ranges of individual species. For all subspecies (for which there were no pre-existing range maps), we developed range maps based on descriptions from the literature and occurrence data.

Distribution is defined as the spatial arrangement of environments suitable for occupation by individuals of a given taxon and is usually estimated as a subset of all environments in the study area that regularly supports individuals. Distribution maps are finer in grain than range maps, with much interdigitation of suitable and unsuitable environments that are potentially occupied by individuals. To map the distribution of individual species we developed 1) an ArcGIS observations database and then 2) created "element occurrences" for individual species based on the observations data.

An element occurrence is the spatial representation of a species at a specific location, and is the foundation of NatureServe's biodiversity data model. An element occurrence (EO) generally delineates a species population and represents the georeferenced biological feature that is of conservation or management interest. Element occurrences are documented by observations from the published an unpublished literature, field notes, and voucher specimens (where appropriate). Hence, the first step in developing EOs is to compile all known observations for that species.

Guidelines and protocols for creating EOs are developed by NatureServe and utilized by Heritage Program biologists to characterize a species' distribution across its global range. EO guidelines are specific to individual species and/or species groups or taxa. For example, most small mammals are not wide-ranging and collections or observations from any natural habitat can typically be considered an EO because it is assumed that the habitat contributes to their conservation. For bats, sites such as caves and mines where breeding or wintering occurs (hibernacula) are also considered EOs. For birds, there must be evidence of breeding and/or nesting for the observation of a bird to be considered a breeding EO. In cases of colonial birds (e.g., terns), or birds with more than one nest site (e.g., eagles), the colony or nesting territory is considered a breeding EO. Any natural habitat where an amphibian or reptile is collected or observed constitutes an EO.

Non-breeding habitats are critical to the survival of some species, including mussel beds, hibernacula, migratory bird concentration sites, and bird rookeries. These are biologically important sites, where a catastrophic event at any one location could have a significant impact on an entire taxonomic group, and are identified as "species concentration sites". When appropriate, we also created EOs for specific concentration sites such as staging areas and foraging concentrations.

To develop the observations database and create element occurrence distribution maps, we:

1. Compiled, synthesized, and georeferenced individual species location information from published and unpublished sources and used this data to

- develop geographic coverages depicting species observations in an ArcGIS project.
- Filtered the observation data for duplicate records, erroneous or suspect location information, and tried to reconcile the numerous coordinate systems used to record locations from such diverse data sets.
- 3. Conferred with experts about data quality and/or the accuracy of mapped species depictions whenever necessary.
- 4. Using EO specifications developed by NatureServe for each taxon (http://www.natureserve.org/prodServices/eodata.jsp), we refined the observations data to reflect important life history stages and/or important species concentration sites (e.g., stopover areas, foraging concentrations, hibernacula).
- 5. Entered the EO records and associated attribute information into the Heritage Program's Biotics database (see Table 4 for a list of attribute fields).
- 6. Created a bibliography of sources for each data layer (observation points, EO areas and ranges).
- 7. Developed maps depicting range, distribution, and when applicable, life history stage or species concentration sites (EOs) for individual species.
- 8. Created metadata in accordance with AGDC standards for each data layer.

We developed a project web site that is accessible through the Alaska Natural Heritage Program web-page (http://aknhp.uaa.alaska.edu/zoology/Zoology_ADFG.htm) and is linked to the Alaska Department of Fish and Game's CWCS web site (http://www.sf.adfg.state.ak.us/statewide/ngplan/NG_outline.cfm). Species status reports and range and distribution maps for individual species can be downloaded from this site.

Results

Species Status Reports:

We developed status reports for 92 of the CWCS featured species: 35 birds, 23 mammals, 10 fishes, 6 amphibians, 1 reptile and 17 invertebrates (Table 1). We consulted numerous experts from throughout Alaska and elsewhere to help improve the quality and accuracy of individual reports (Table 5).

Species status reports are not included as an appendix to this report as they are extremely lengthy when collated. They are available in .pdf format at the project website (http://aknhp.uaa.alaska.edu/zoology/Zoology ADFG.htm) and have also been provided in CD-Rom format to accompany the delivery of this report.

During the course of developing status reports, we reviewed the Heritage Rank conservation status ranks for each species. Information summarized for the status reports greatly improved the quality and quantity of information that went into making ranking decisions. This review resulted in changes to 46 State (S) ranks. Additionally, we assigned state ranks to 28 species that were previously unranked (SNR). We suggested that 12 Global (G) ranks be changed and forwarded these recommendations to NatureServe for review by the chief zoologist. We also made global rank recommendations for 21 species that were previously not included in the NatureServe database.

Distribution Mapping:

Range and distribution maps for the 56 featured species are presented in Appendix I. Data sources used to develop maps included published and unpublished literature, museum specimen records, field notes and unpublished data obtained directly from researchers. We also obtained data from a number of existing databases. For birds, we accessed data from the USGS Breeding Bird Survey database and the Christmas Bird Count database. Amphibian data was compiled from the Southeast Alaska Amphibian Observations Database (R. Carstersen, pers. comm.) and the Alaska Atlas of Amphibians and Reptiles (S.O. MacDonald 2005). Appendix II contains a full bibliography of all data sources that were referenced to develop maps and populate the occurrence database.

Discussion

All information contained within the species status reports was incorporated into the Heritage Program's Biotics database, making this information available to a wide audience at both state and global levels. Individual species status reports are now accessible on-line through the AKNHP web-site. AKNHP also provides this information as a free service via data requests. All global level information was integrated into the NatureServe Explorer on-line encyclopedia of life (http://www.natureserve.org/explorer/). By providing life history, threat and conservation information to researchers, managers and the general public through NatureServe's web portal, we help to support the mission of the CWCS by providing accurate and transparent scientific data to decision makers.

Determining the relative risk of extinction confronting different animal species is essential for setting effective conservation priorities. Updating biological and ecological information for individual species greatly improved the quality of the information used to generate Heritage status ranks. Because Heritage (NatureServe) status ranks adhere to rigorous protocols for assessing species status, they are relied upon by numerous organizations, including federal agencies such as the U.S. Fish and Wildlife Service, U.S. Forest Service, state fish and game agencies, private conservation organizations, and industry groups.

Maps generated during this project represent current and historical knowledge, from a wide variety of sources, regarding the distribution and range of select featured species. These data sets offer the opportunity to graphically portray the overall native species diversity found within the state, as well as to consider regional, ecosystem, or biogeographical patterns exhibited by individuals or groups of organisms. We hope that this information will be used in land use planning decisions and to guide future research and inventory efforts.

Literature Cited

Alaska Department of Fish and Game. 2006. Our Wealth Maintained: A strategy for Conserving Alaska's Diverse Wildlife and Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 p.

Table 1. A list of 92 species featured in the CWCS for which AKNHP developed species status reports, 2004-2006. Also included are the global (G-rank) and state (S-rank) status ranks assigned to individual species prior to and post-review. Updated ranks highlighted in bold indicate that the rank was changed during the review process.

	Species	Scientific Name	G Rank prior to review	S Rank prior to review	G Rank reviewed	S Rank reviewed
	BIRDS					
1	Aleutian Tern	Onychoprion aleuticus	G4	S5B	G4	S3B
2	Arctic Tern	Sterna paradisaea	G5	S5	G5	S4B
3	Beringian Marbled Godwit	Limosa fedoa beringiae	G5T3?	S3?B	G5T3B	S2S3B
4	Black Oystercatcher	Haematopus bachmani	G5	S5	G5	S2S3B, S2N
5	Black-legged Kittiwake	Rissa tridactyla	G5	S3N, S5B	G5	S5B, S5N
6	Blackpoll Warbler	Dendroica striata	G5	S3B	G5	S4B
7	Bristle-thighed Curlew	Numenius tahitiensis	G2G3	S2B	G2	S2B
8	Brown Creeper	Certhia americana	G5	S4	G5	S4
9	Cliff Swallow	Hirundo pyrrhonota	G5	S5B	G5	S4B
10	Fork-tailed Storm-petrel	Oceanodroma furcata	G5	S5B, S3N	G5	S5B, S5N
11	Grey-cheeked Thrush	Catharus minimus	G5	S3B	G5	S3B
12	Hermit Thrush	Catharus guttatus	G5	S4B	G5	S5B
13	King Eider	Somateria spectabilis	G5	S2S3B, S2S3N	G5	S3B, S3N
14	Kittlitz's Murrelet	Brachyramphus brevirostris	G3G4	S3	G2	S2B, S2N
15	Leach's Storm-petrel	Oceanodroma leucorhoa	G5	S5B	G5	S5B
16	Lesser Yellowlegs	Tringa flavipes	G5	S5B	G5	S5B
17	Marbled Murrelet	Brachyramphus marmoratus	G3G4	S2S3	G3G4	S2S3
18	Northern Harrier	Accipiter cyaneus	G5	S4?B	G5	S3N, S4B
19	Olive-sided Flycatcher	Contopus cooperi	G4	S3B	G4	S3S4B
20	Pribilof Rock Sandpiper	Calcarius ptilocnemis ptilocnemis	G5T5?	S5?	G5T3	S3B, S2N
21	Queen Charlotte Goshawk	Accipiter gentilis laingi	G5T2	S2B, S2N	G5T2	S2B, S2N
22	Red-faced Cormorant	Phalacrocorax urile	G5	S5	G5	S3S4B, S3S4N
23	Red-legged Kittiwake	Rissa brevirostris	G2G3	S2S3	G2G3	S2S3B, S2N
24	Red-necked Grebe	Podiceps grisegena	G5	S5	G5	S4S5B, S4?N

Table 1 continued.

		G Rank prior	S Rank prior	G Rank	S Rank	
	Species	Scientific Name	to review	to review	reviewed	reviewed
25	Red-throated Loon	Gavia stellata	G5	S3B, S3N	G5	S3B, S2S3N
26	Rusty Blackbird	Euphagus carolinus	G5	S4B	G4	S3S4B, S3N
27	Short-eared Owl	Asio flammeus	G5	S5B, S3N	G5	S4S5B
28	Smith's Longspur	Calcarius pictus	G5	S3?B	G5	S3S4B
29	Snowy Owl	Bubo scandiacus	G5	S4	G5	S3B, S3N
30	Solitary Sandpiper	Tringa solitaria	G5	S4B	G5	S2B
31	Townsend's Warbler	Dendroica townsendi	G5	S3B	G5	S5B
32	Violet-green Swallow	Tachycineta thalassina	G5	S5B	G5	S4B
33	Wandering Tattler	Heteroscelus incanus	G5	S4B	G5	S3B
34	White-crowned Sparrow	Zonotrichia leucophrys	G5	S3N, S5B	G5	S5B
35	Yellow-billed Loon	Gavia adamsii	G4	S3B, S3N	G4	S2B, S2S3N
	TERRESTRIAL MAMMALS					
36	Alaska marmot	Marmota broweri	G4	S4	G4	S4
37	Big brown bat	Eptesicus fuscus	G4	S4	G5	SNA
38	California myotis	Myotis californicus	G5	S2?	G5	S1S3
39	Collared lemming	Dicrostonyx groenlandicus	G5	S4	G5	S4
	St. Lawrence Island collared lemming	D. g. exsul	G5T4	S4	G5T3	S 3
	Umnak Island collared lemming	D. g. stevensoni	GNR	SNR	G5T3	S3
	Unalaska Island collared lemming	D. g. unalascensis	GNR	SNR	G5T3	S 3
40	Ermine	Mustela erminea	G5	S?	G5	S5
	Suemez Island ermine	M. e. seclusa	G5T2?Q	S2S3Q	G5T2T3	S2S3
	Prince of Wales Island ermine	M. e. celenda	G5T4?	S4?	G5T4?	S3Q
	Kodiak Island ermine	M. e. kadiacensis	G5T4?	S4?	G5T4	S4
	Baranof Island ermine	M. e. initis	G5T3T4	S3S4	G5T3	S 3
	Admiralty Island ermine	M. e. salva	G5T3T4	S3S4	G5T3	S 3
41	Keen's myotis	Myotis keenii	G2G3	SH	G2G3	S1S3
42	Little brown bat	Myotis lucifugus	G5	S4?	G5	S3S4
43	Long-legged bat	Myotis volans	G5	SNR	G5	S1S3
44	Pribilof Island shrew	Sorex pribilofensis	G3	S2?	G3	S3
45	Prince of Wales flying squirrel	Glaucomys sabrinus griseifrons	G5T2?Q	S2?Q	G5T2	S2
46	Silver-haired bat	Lasionycteris noctivagans	G5	S3?B	G5	S1S3

Table 1 continued.

	Species	Scientific Name	G Rank prior to review	S Rank prior to review	G Rank reviewed	S Rank reviewed
47	St. Lawrence Island shrew	Sorex jacksoni	G3	S3	G3	S3
48	Tundra hare	Lepus othus	G4?	S4?	G3G4	S3S4
49	Wrangell Island red-backed vole	Myodes gapperi wrangeli	G5T2T3	S2S3	G5T2T3	S2S3
	MARINE MAMMALS					
50	Beluga - Cook Inlet pop. 4	Delphinapterus leucas Pop 4	G4T1T2	SNR	G4T1	S1
51	Bowhead	Balaena mysticetus	G4	S2	G3	S3
52	Harbor seal	Phoca vitulina richardsi	G5T5Q	S3?	G5T5Q	S4S5
53	Northern fur seal	Callorhinus ursinus	G3G4	S3	G3	S3
54	Northern Pacific right whale	Eubalaena glacialis	G1	S1	G1	S1
55	Northern sea otter	Enhydra lutris kenyoni	G4T4	S2S3	G4T4	S2S3
56	Pacific walrus	Odobenus rosmarus	G4	S?	G4	S4
57	Polar bear	Ursus maritimus	G4	SNR	G3G4	S3
58	Sperm whale	Physeter macrocephalus	G3G4	SNR	G3G4	S2S3
	FISHES					
59	Alaskan brook lamprey	Lampetra alaskensis	GNR	SNR	G3Q	S3Q
60	Arctic cod	Boreogadus saida	GNR	SNR	G5	S4S5
31	Arctic lamprey	Lampetra camtschatica	G4	S4S5	G4	S4
32	Capelin	Mallotus villosus	GNR	SNR	G5	S5
63	Crescent gunnel	Pholis laeta	GNR	SNR	G5	S4S5
64	Prowfish	Zaprora silenus	GNR	SNR	G4G5	S3S5
35	River lamprey	Lampetra ayresii	G4	S3	G4	S2
6	Threespine stickleback	Gasterosteus aculeatus	G5	S5	G5	S5
67	Trout perch	Percopsis omniscomaycus	G5	S3	G5	S3
8	Western brook lamprey	Lampetra richardsoni	G5	S1?	G4G5	S1S2
	AMPHIBIANS					
69	Columbia spotted frog	Rana luteiventris	G2G3	S2?	G4	S2?
70	Long-toed salamander	Ambystoma macrodactylum	G5	S2?	G5	S2?
71	Northwestern salamander	Ambystoma gracile	G5	S2?	G5	S2?
72	Roughskin newt	Taricha granulosa	G5	S2?	G5	S2?
73	Western toad	Bufo boreas	G4	S3?	G4	S2?

Table 1 continued.

	Species	Scientific Name	G Rank prior to review	S Rank prior to review	G Rank reviewed	S Rank reviewed
74	Wood frog	Rana sylvatica	G5	S3S4	G5	S3S4
	INVERTEBRATES					
75	A cave amphipod	Stygobromus quatsinensis	G2G3	SNR	G2G3	S2S3
76	A chaetognath	Sagitta elegans	GNR	SNR	G5	S5
77	A lugworm	Aren icoala pacifica	GNR	SNR	G5	S4S5
78	A mayfly	Rhithrogena ingalik	GNR	SNR	G1G3	S1S3
79	Baltic macoma	Macoma baltica	GNR	SNR	G5	S 5
30	Black Katy chiton	Katharina tunicata	GNR	SNR	G5	S 5
31	Eelgrass shrimp	Hippolyte clarki	GNR	SNR	G5	S 5
32	Eskimo arctic butterfly	Oeneis alpina	GNR	SNR	G3G4	S 3
33	Gordon's grasshopper	Melanoplus gordonae	GNR	SNR	G1G3	S1
34	Gorgonian corals	Gorgonacea	GNR	SNR	not ranked	not ranked
35	Gumboot chiton	Cryptochiton stelleri	GNR	SNR	G5	S 5
36	Pinto abalone	Haliotis kamtschatkana	GNR	SNR	G3G4	S2S3
37	Ram's-horn valvata	Valvata mergella	GNR	SNR	G2	S 1
38	Sitka periwinkle	Littorina sitkana	GNR	SNR	GNR	S 5
39	Treeline emerald dragonfly	Somatochlora sahlbergi	G4	S?	G4	S3S4
90	Yukon floater mussel	Anodonta beringiana	G4	SNR	G4	S3S4
91	Zerene fritillary butterfly	Speyeria zerene	GNR	SNR	G5	S2
	REPTILES					
92	Leatherback sea turtle	Dermochelys coriacea	G2	SNA	G2	S2

Table 2. Listed below are definitions for interpreting NatureServe global (G-ranks) and state (S-ranks) conservation status ranks. Global ranks reflect an assessment of the condition of the species across its entire range. State ranks reflect an assessment of the condition of the species across its state range .

Rank	Definition
GX/SX	Presumed Extinct (species)— Not located despite intensive searches and virtually no likelihood of rediscovery.
GH / SH	Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.
G1 / S1	Critically Imperiled —At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 / S2	Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3 / S3	Vulnerable —At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 / S4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 / S5	Secure—Common; widespread and abundant.

Variant Ranks

Rank	Definition		
G#G#	Range Rank—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. A G2G3 rank would indicate that there is a roughly equal chance of G2 or G3 and other ranks are much less likely. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).		
GNR	Unranked—Global rank not yet assessed.		
GNA	Not Applicable —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.		

Rank Qualifiers

Rank	Definition	
? Inexact Numeric Rank—Denotes some uncertainty about the numeric rank G3? - Believed most likely a G3, but some chance of either G2 or G4).		
Q	Questionable taxonomy—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.	
С	Captive or Cultivated Only—At present extant only in captivity or cultivation, or as a reintroduced population not yet established.	

Table 3. List of CWCS "Featured Species" for which range and distribution maps were created.

Ciea	Species	Scientific Name	S Rank
	BIRDS		
1	Aleutian Tern	Onychoprion aleuticus	S3B
2	Beringian Marbled Godwit	Limosa fedoa beringiae	S2S3B
	3		S2S3B,
3	Black Oystercatcher	Haematopus bachmani	S2N
4	Bristle-thighed Curlew	Numenius tahitiensis	S2B
5	Grey-cheeked Thrush	Catharus minimus	S3B
			S3B,
6	King Eider	Somateria spectabilis	S3N
_	IZOCO I- Ml-r	Describe as well as here investigation	S2B,
7	Kittlitz's Murrelet	Brachyramphus brevirostris	S2N
8	Marbled Murrelet	Brachyramphus marmoratus	S2S3
9	Olive-sided Flycatcher	Contopus cooperi	S3S4B
10	Pribilof Rock Sandpiper	Calcarius ptilocnemis ptilocnemis	S3B, S2N
10	Filbilot Rock Sandpiper	Calcarius pulocrientis pulocrientis	S2B,
11	Queen Charlotte Goshawk	Accipiter gentilis laingi	S2D,
	Queen enaneus comann	Treespicer germine ramigi	S3S4B,
12	Red-faced Cormorant	Phalacrocorax urile	S3S4N
			S2S3B,
13	Red-legged Kittiwake	Rissa brevirostris	S2N
			S3S4B,
14	Rusty Blackbird	Euphagus carolinus	S3N
15	Smith's Longspur	Calcarius pictus	S3S4B
16	Snowy Owl	Nyctea scandiaca	S3B, S3N
17	Solitary Sandpiper	Tringa solitaria	S2B
18	Wandering Tattler	Tringa solitaria Tringa incana	S3B
10	wandening rattier	Tringa incana	335
	MAMMALS		
19	Alaska Marmot	Marmota broweri	S4
20	Beluga whale - Cook Inlet pop. 4	Delphinapterus leucas Pop 4	S1
21	Bowhead	Balaena mysticetus	S3
22	California myotis	Myotis californicus	S2S3
23	Collared lemming	Dicrostonyx groenlandicus	S4
24	Keen's myotis	Myotis keenii	S21S3
25	Little brown bat	Myotis lucifugus	S3S4
			S2?B
26 27	Long-legged bat Northern fur seal	Myotis volans	S27B
		Callorhinus ursinus	S1
28	Northern Pacific right whale	Eubalaena glacialis	1
29	Northern sea otter	Enhydra lutris kenyoni	S2S3
30	Pacific walrus	Odobenus rosmarus	S4
31	Polar bear	Ursus maritimus	S3
32	Pribilof Island shrew	Sorex hydrodromus	S3
33	Prince of Wales flying squirrel	Glaucomys sabrinus griseifrons	S3
34	Silver-haired bat	Lasionycteris noctivagans	S1S3

Table 3 continued. List of CWCS "Featured Species" for which range and distribution maps were developed.

	Species	Scientific Name	S Rank
35	Sperm whale	Physeter macrocephalus	S2S3
36	St. Lawrence Island shrew	Sorex jacksoni	S3
37	Wrangell Island red-backed vole	Myodes gapperi wrangeli	S2S3
	FISHES		
38	Alaskan Brook lamprey	Lampetra alaskensis	S3Q
39	Arctic lamprey	Lampetra camtschatica	S4
40	River lamprey	Lampetra ayresii	S2
41	Trout perch	Percopsis omniscomaycus	S3Q
42	Western Brook lamprey	Lampetra richardsoni	S1S2
	AMPHIBIANS		
43	Columbia spotted frog	Rana luteiventris	S2?
44	Long-toed salamander	Ambystoma macrodactylum	S2?
45	Northwestern salamander	Ambystoma gracile	S2?
46	Roughskin newt	Taricha granulosa	S2?
47	Western toad	Bufo boreas	S2?
48	Wood frog	Rana sylvatica	S3S4
	INVERTERRATES		
49	INVERTEBRATES A cave amphipod	Stygobromus quatsinensis	S2S3
50	A mayfly	Rhithrogena ingalik	S1S3
51	Gordon's grasshopper	Melanoplus gordonae	S1
52	Pinto abalone	Haliotis kamtschatkana	S2S3
53	Ram's-horn valvata	Valvata mergella	S1
54	Treeline emerald dragonfly	Somatochlora sahlbergi	S3S4
55	Yukon floater mussel	Anodonta beringiana	S3S4
	REPTILES		
56	Leatherback	Dermochelys coriacea	S2

Table 4. List of attribute fields and definitions used to develop element occurrences.

FIELD NAME	DEFINITION	
SCI_NAME	Scientific name	
COM_NAME	Common name	
G_RANK	Global Heritage Status Ranks (G1 - G5)	
S_RANK	State Heritage Status Ranks (S1-S5)	
EL_CODE	Heritage Program Element (Species) Code	
DATA_SENS	Indicates if the data is sensitive to public use	
SITE_NAME	Site name of the nearest named location	
DIRECTIONS Directions to site, more specific site names		
LAT_DD	Latitude decimal degrees	
LONG_DD	Longitude decimal degrees	
DATUM	Datum of coordinates (NAD27 or NAD83)	
COORD_SOUR	Source of coordinates	
	LATLONG = latitude and longitude provided by source	
	UTM = UTM coordinates provided by source	
	MAP = coordinates obtained from map in source	
	DESCRIPTION = mapped in ARCGIS or TOPOZONE using a description of location; directions used	
	AK PLACES = coordinates assigned from AK place names dataset; site name used	
ACCURACY_M	The accuracy of the coordinates in meters. If no accuracy is provided use 100, 2000, 10000 meters based on the description of the location.	
PRECISION	The precision of the location and implied accuracy of the resultant mapped location.	
	S = SECONDS = within 100 m	
	M = MINUTES = within 2000 m	
	G = GENERAL = within 10 km	
	U = UNKNOWN = unknown	
OBSERVER	Observer(s) name	
REFERENCE	Short citation for data source	
RSOURCE_CO	laska Natural Heritage Program database reference code for data source	
DATE_	Observation or collection date (first date in range of dates)	
YEAR_RANGE	Year or range of years particular record was observed or collected	
OTHER_DATE	Other dates particular record was observed or collected	
ABUND_COMM	Comments referring to abundance data	
SURVEY_MET	Survey method used	
EO_TYPE	Type of Observation	
MIN_ELEVAT Minimum elevation		
ESA_STAT	Endangered Species Act Status	
SPECIMEN	Indicates if a specimen was collected	
COLL_COMM	Collector name, specimen ID# number if provided and other comments on the specimen collected	
LIFE_STAGE	Life history stage - e.g. adult, subadult, egg mass	
HAB_COMM	Habitat comments	
GEN_COMM	General comments	

Table 5. List of featured species, expert reviewer's and reviewer's affiliation.

Species	Reviewer (s)	Reviewer Affiliation
BIRDS		
Aleutian Tern	Bob Gill	USGS, Alaska Science Center, Anchorage, AK
Arctic Tern	Jeremy Hatch	University of Massachusetts at Boston, Boston, MA
Black Oystercatcher	David Tessler	Nongame program, ADFG, Anchorage, AK
Black-legged Kittiwake	David Irons	USFWS, Anchorage, AK
Blackpoll Warbler	Dan Gibson	University of Alaska Museum, Fairbanks, AK
Bristle-thighed Curlew	Bob Gill	USGS, Alaska Science Center, Anchorage, AK
Brown Creeper	Dan Gibson	University of Alaska Museum, Fairbanks, AK
Cliff Swallow	Charles Brown	University of Oklahoma at Tulsa, Tulsa, OK
Fork-tailed Storm-petrel	P. Dee Boersma	UW, Seattle, WA
Grey-cheeked Thrush	Steve Matsuoka	Migratory Bird Management, USFWS, Anchorage, AK
Hermit Thrush	Mary Willson	Juneau, AK
Kittlitz's Murrelet	Kathy Kuletz, Tom Van Pelt	Migratory Bird Management, USFWS, Anchorage, AK
Leach's Storm-petrel	G. Vernon Byrd, Arthur Kettle	AK Maritime NWR, USFWS, Homer, AK
Lesser Yellowlegs	Lee Tibbitts	USGS, Alaska Science Center, Anchorage, AK
Northern Harrier	Carol McIntyre	Denali National Park, NPS, Denali Park, AK
Olive-sided Flycatcher	John Wright	Alaska Bird Observatory, Fairbanks, AK
Pribilof Rock Sandpiper	Stan Senner	Audubon Alaska, Anchorage, AK
Queen Charlotte Goshawk	Kim Titus	Alaska Department of Fish and Game, AK
Red-faced Cormorant	Douglas Causey	Museum of Comparative Zoology, Harvard University, Cambridge, MA
Red-legged Kittiwake	G. Vernon Byrd	AK Maritime NWR, USFWS, Homer, AK
Red-necked Grebe	Tamara Mills	Migratory Bird Management, USFWS, Anchorage, AK
Red-throated Loon	Joel Schmutz	Alaska Biological Science Center, USGS, Anchorage, AK
Rusty Blackbird	Chris Harwood	Kanuti NWR, USFWS, Fairbanks, AK
Short-eared Owl	Jack Whitman	Nongame program, ADFG, Fairbanks, AK
Smith's Longspur	Debbie Nigro, Melanie Cook	BLM, Fairbanks, AK; NPS, AK
Snowy Owl	Jack Whitman	Alaska Department of Fish and Game, AK
Solitary Sandpiper	Lee Tibbitts	USGS, Alaska Science Center, Anchorage, AK
Townsend's Warbler	Steve Matsuoka	Migratory Bird Management, USFWS, Anchorage, AK
Violet-green Swallow	Charles Brown	University of Oklahoma at Tulsa, Tulsa, OK
Wandering Tattler	Bob Gill	USGS, Alaska Science Center, Anchorage, AK
Yellow-billed Loon	Susan Earnst	USGS Forest and Rangeland Ecosystem Science Center, ID

Table 5 continued. List of featured species, expert reviewer's and reviewer's affiliation.

Species	Reviewer (s)	Reviewer Affiliation
TERRESTRIAL MAMMALS		
		Museum of Southwestern Biology, University of New Mexico,
Alaska marmot	Stephen MacDonald	Albuquerque, NM
Big brown bat	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
California myotis	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
Collared lemming	Stephen MacDonald	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
Ermine	Stephen MacDonald	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
Keen's myotis	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
Little brown bat	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
Long-legged bat	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
Prince of Wales flying squirrel	Stephen MacDonald	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
Silver-haired bat	John Hayes, Julia Boland	Oregon State University, Corvallis, OR
St. Lawrence Island shrew		
Wrangell Island red-backed vole	Stephen MacDonald	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
MARINE MAMMALS		
Beluga - Cook Inlet pop. 4	Brad Smith, Kim Shelden, Dave Rugh	Protected Resources Division, NOAA; Alaska Fisheries Science Center, NOAA, Seattle, WA; National Marine Mammal Laboratory, NOAA
Bowhead	Steve MacLean	The Nature Conservancy, Anchorage, AK
Northern Pacific right whale	Phil Clapham, Kim Shelden	Northeast Fisheries Science Center, Woods Hole, MA; Alaska Fisheries Science Center, NOAA, Seattle, WA
Northern sea otter	Angela Doroff	Marine Mammals Management, USFWS, Anchorage, AK
Pacific walrus	David Tessler	Nongame program, ADFG, Anchorage, AK
Polar bear	Steven Amstrup	Alaska Biological Science Center, USGS, Anchorage, AK
Sperm whale	Jan Straley	University of Alaska Southeast, Juneau, AK
FISHES		
Alaskan brook lamprey	Claude Renaud	Canadian Museum of Nature, University of Ottawa, Ottawa, ONT
Arctic cod	Mike Kelly	Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK

Table 5 continued. List of featured species, expert reviewer's and reviewer's affiliation.

Species	Reviewer (s)	Reviewer Affiliation
		Canadian Museum of Nature, University of Ottawa, Ottawa,
Arctic lamprey	Claude Renaud	ONT
Capelin	Bruce Wright, Mayumi Arimitsu	Conservation Science Institute, Wasilla, AK; USGS, Juneau, AK
Crescent gunnel	Grant Hughes	Royal BC Museum, Victoria, BC
Prowfish	Catherine Mecklenburg	Point Stephens Research, Auke Bay, AK
River lamprey	Richard Beamish	Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC
Threespine stickleback	Frank von Hippel	University of Alaska Anchorage, Anchorage, AK
Western brook lamprey	Richard Beamish	Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC
AMPHIBIANS		
Columbia spotted frog	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
Long-toed salamander	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
Northwestern salamander	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
Roughskin newt	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
Western toad	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
Wood frog	Stephen MacDonald, Blain Anderson	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM; NPS, Anchorage, AK
INVERTEBRATES		
A cave amphipod	Kent Carlson	Karst Biosciences, Middletown, MD
A chaetognath	Christine Baier	Alaska Fisheries Science Center, NOAA, Seattle, WA
A mayfly	Dan Rinella, Dan Bogan	Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK
Baltic macoma	M. Dethier	Friday Harbor Laboratories, University of Washington, Seattle, WA
Black Katy chiton	Nora Foster	University of Alaska Fairbanks, Fairbanks, AK
Eelgrass shrimp	Bruce Wing	Auke Bay Laboratory, NOAA, Juneau, AK

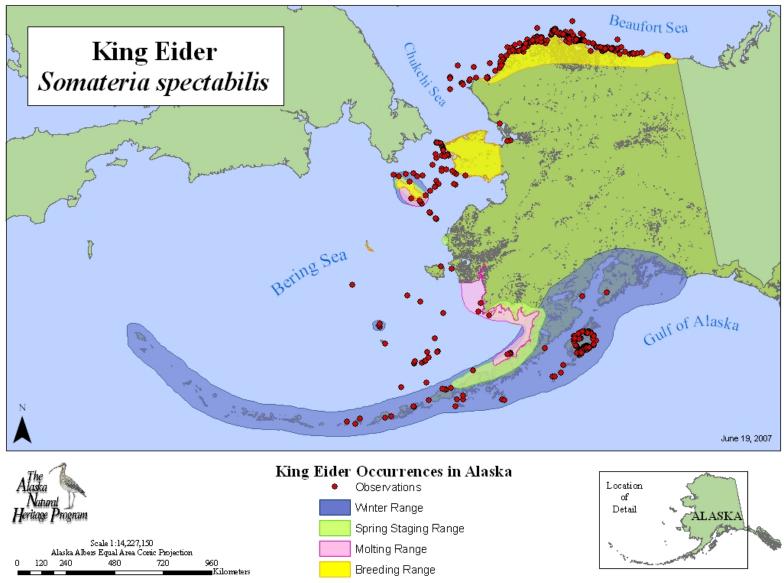
Table 5 continued. List of featured species, expert reviewer's and reviewer's affiliation.

Species	Reviewer (s)	Reviewer Affiliation
		Institute of Arctic Biology, University of Alaska Fairbanks,
Eskimo arctic butterfly	Kenelm Philip	Fairbanks, AK
Gordon's grasshopper	Dennis Fielding	USDA, Fairbanks, AK
Gorgonian corals	Jon Heifetz	Auke Bay Laboratory, NOAA, Juneau, AK
Gumboot chiton	Ginny Eckert	University of Alaska Southeast, Juneau, AK
Pinto abalone	Anne Salomon	University of Washington
Ram's-horn valvata	Terrence Frest	Deixis Consultants, Seattle, WA
Sitka periwinkle	E. G. Boulding, H. J. Lee	University of Guelph, Guelph, ONT
Treeline emerald dragonfly	Syd Cannings	NatureServe Yukon, Whitehorse, YT
Yukon floater mussel	Steve Smith	University of Alaska Anchorage, Anchorage, AK
Zerene fritillary butterfly	Kenelm Philip	Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK
REPTILES		
Leatherback sea turtle	Cheryl Ryder	NMFS, Seattle, WA

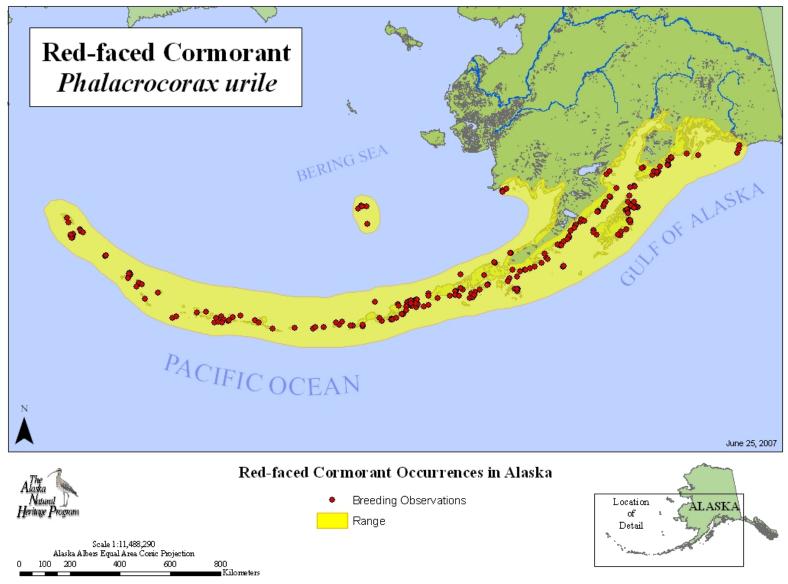
RANGE AND DISTRIBUTION MAPS

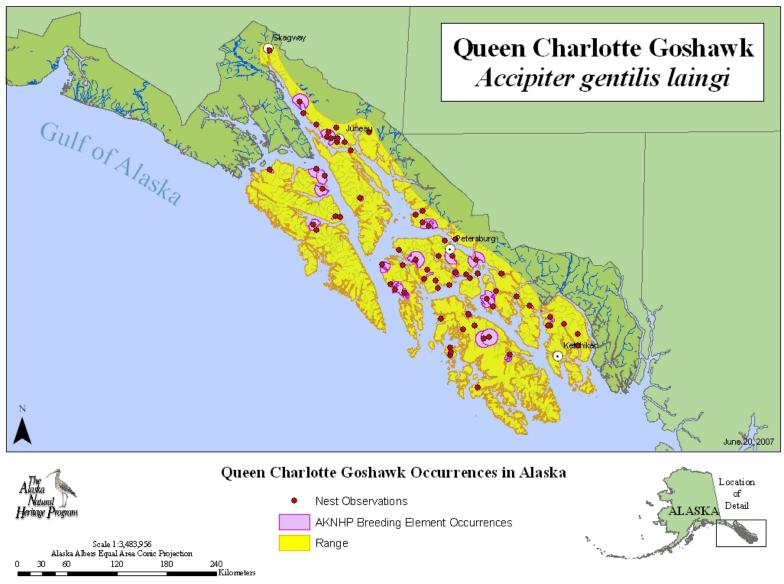
Appendix I

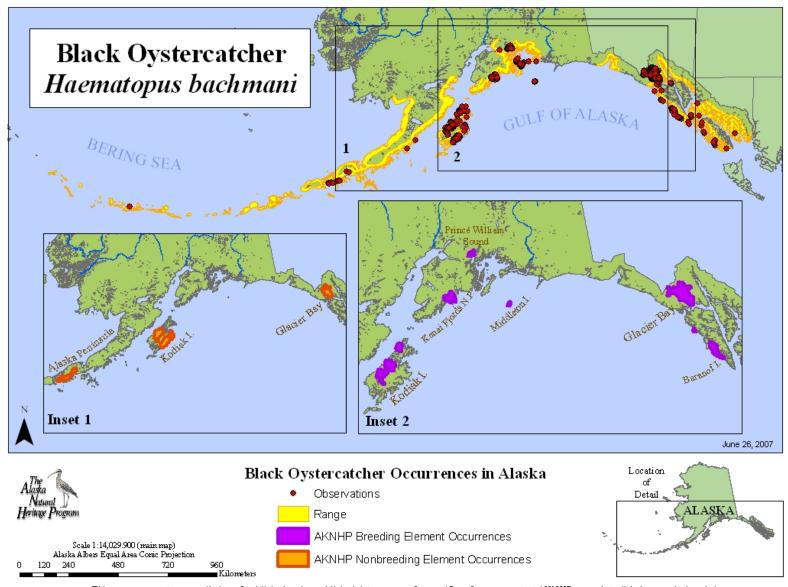
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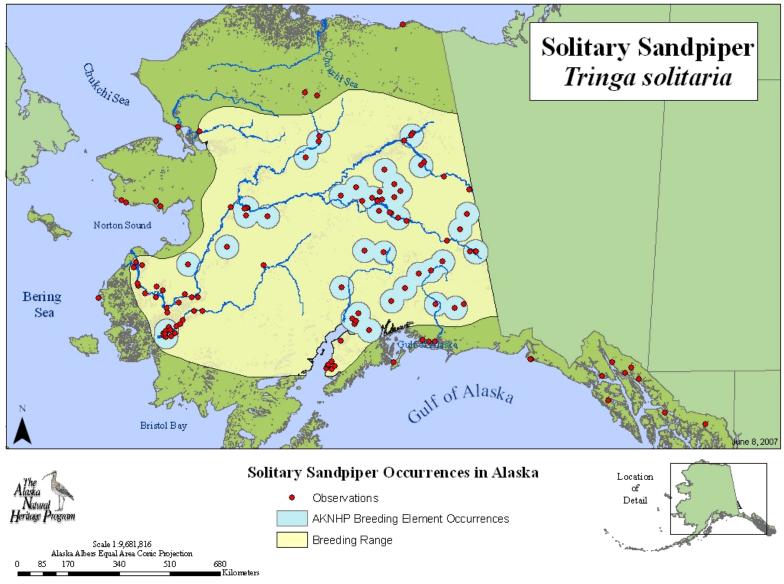


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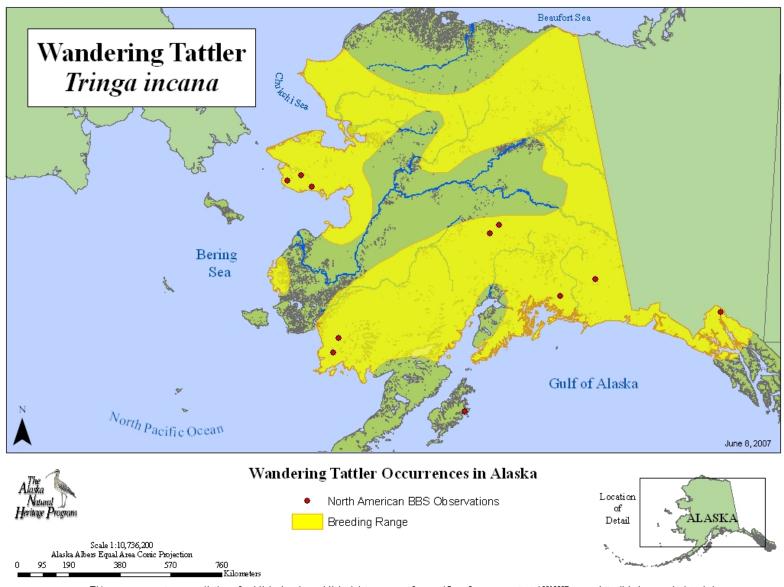




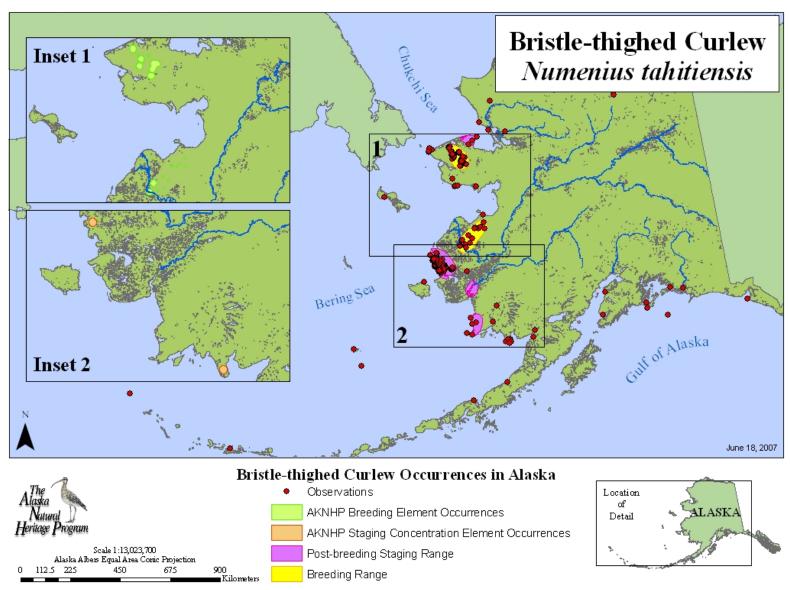




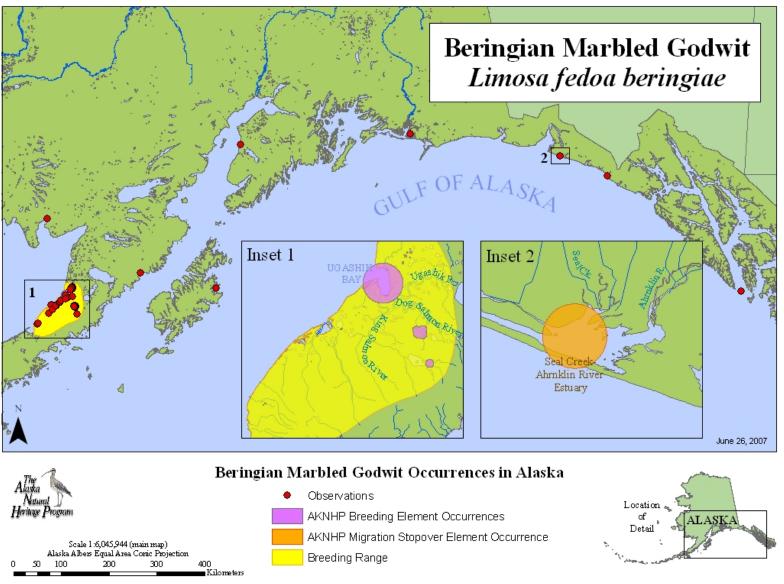
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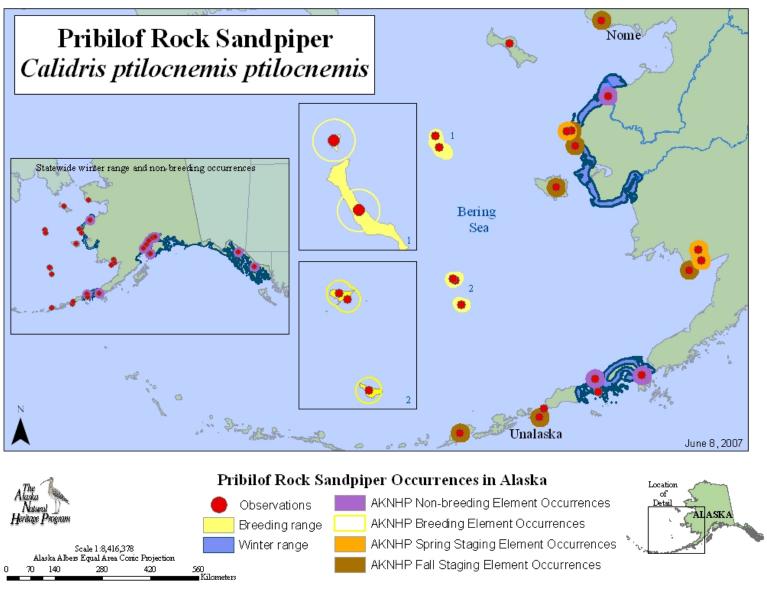
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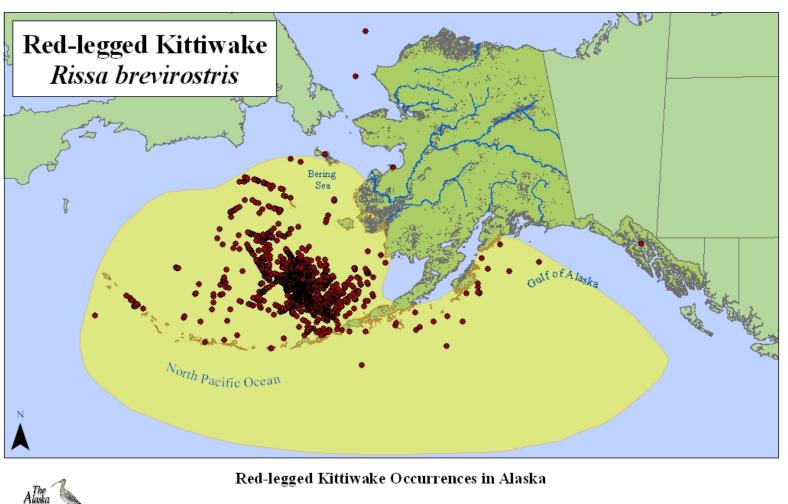


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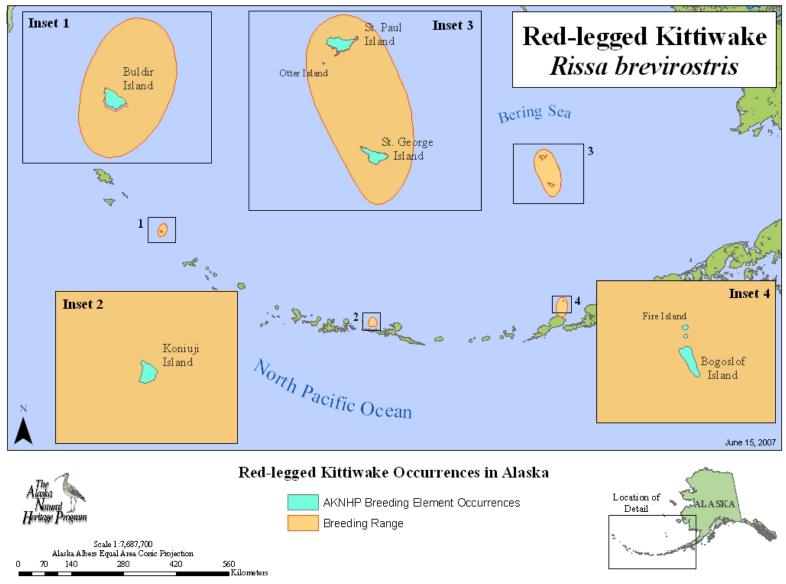


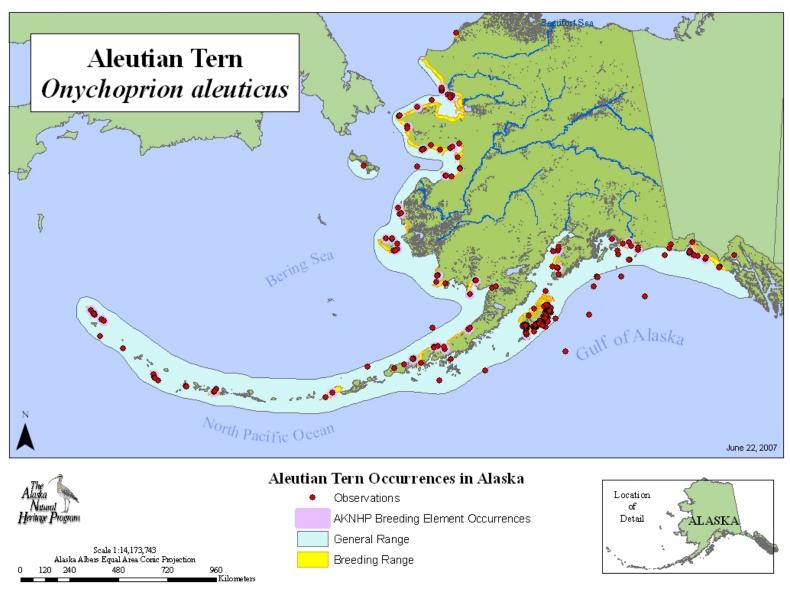
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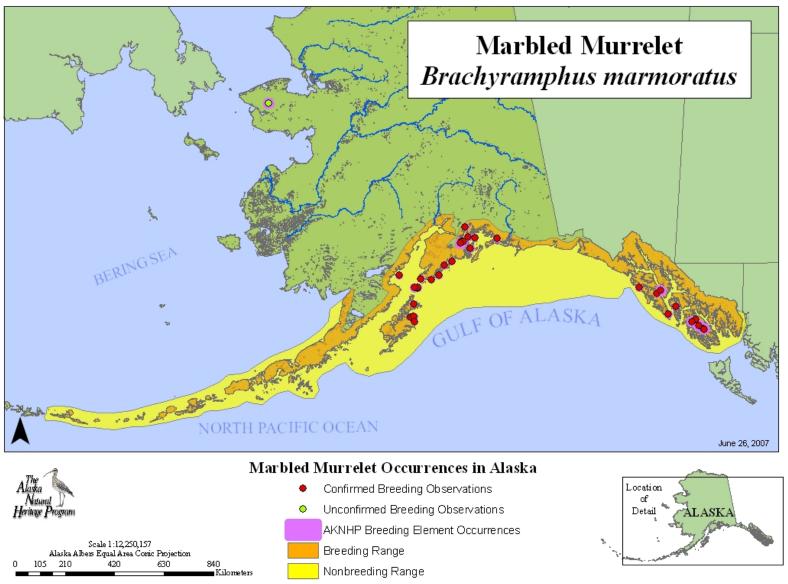


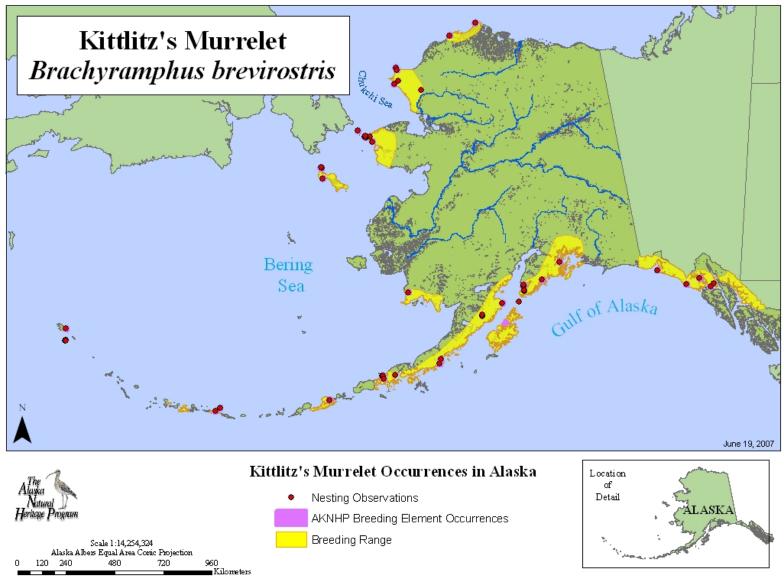


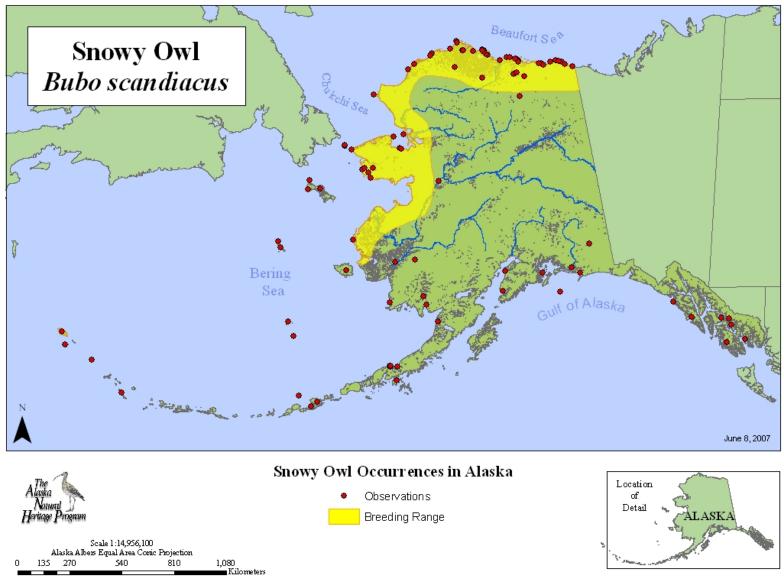




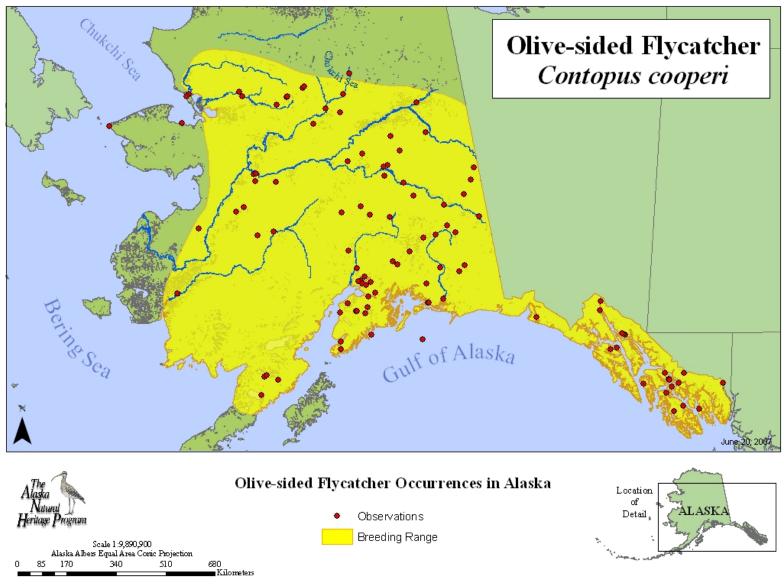




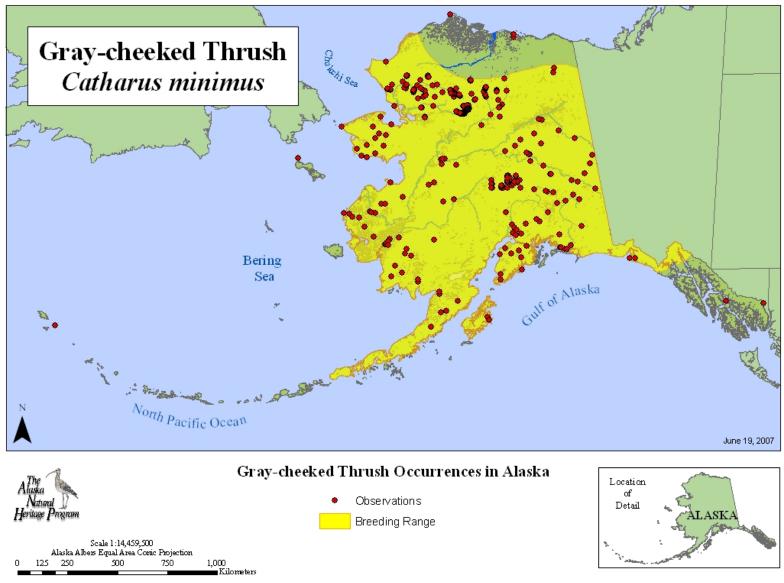


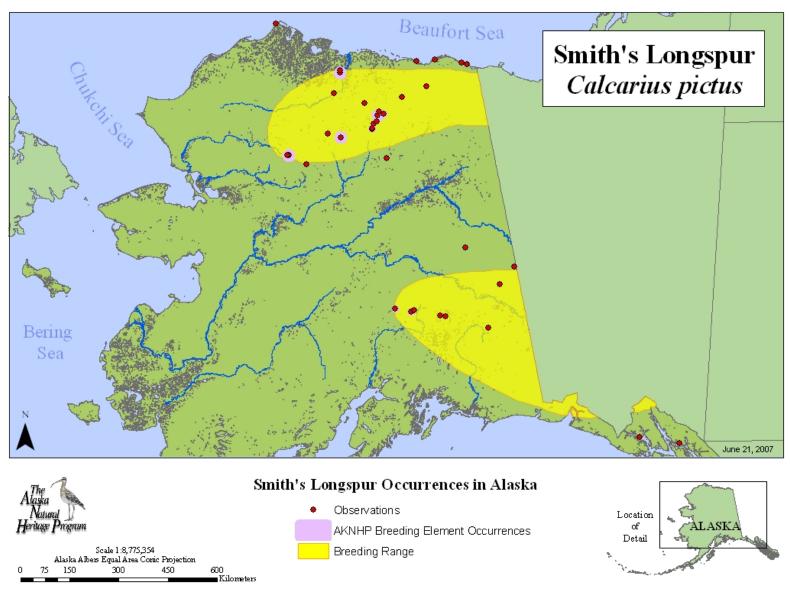


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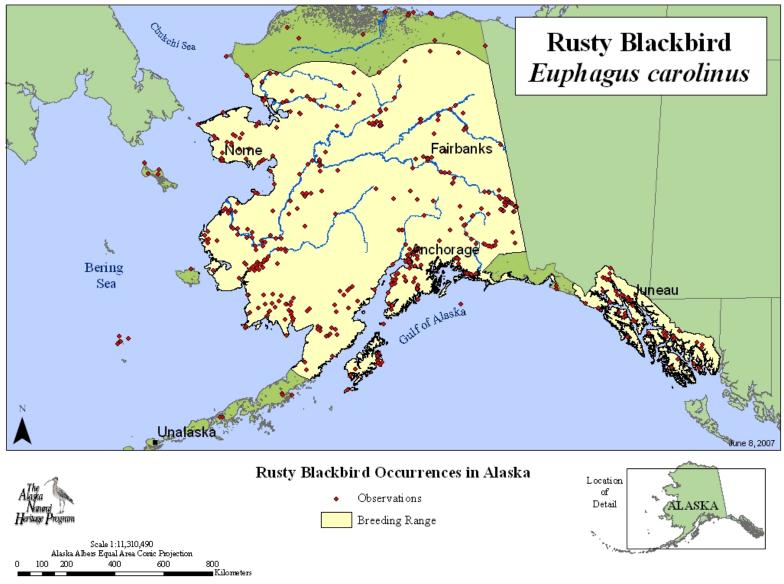


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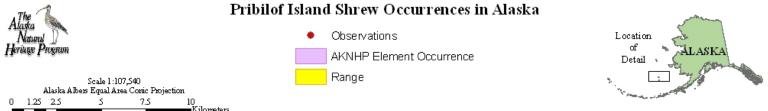


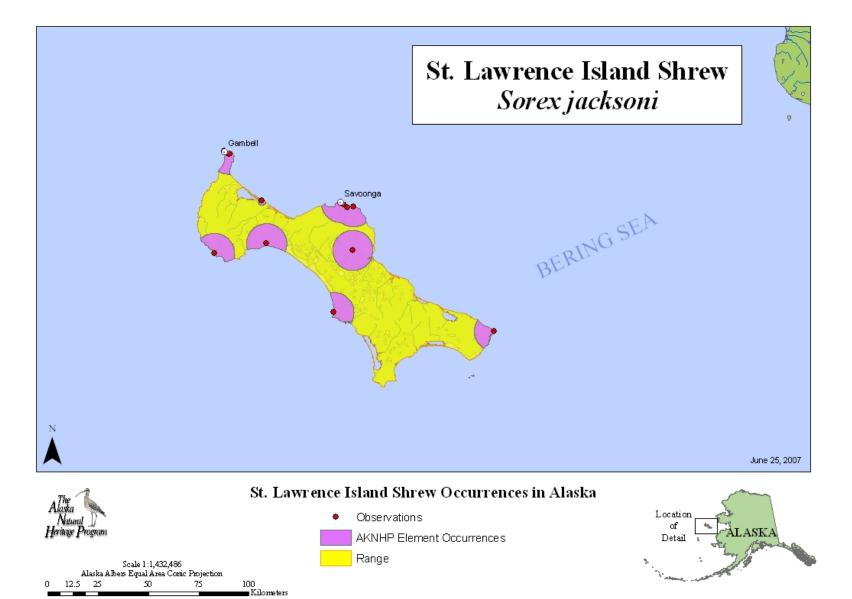
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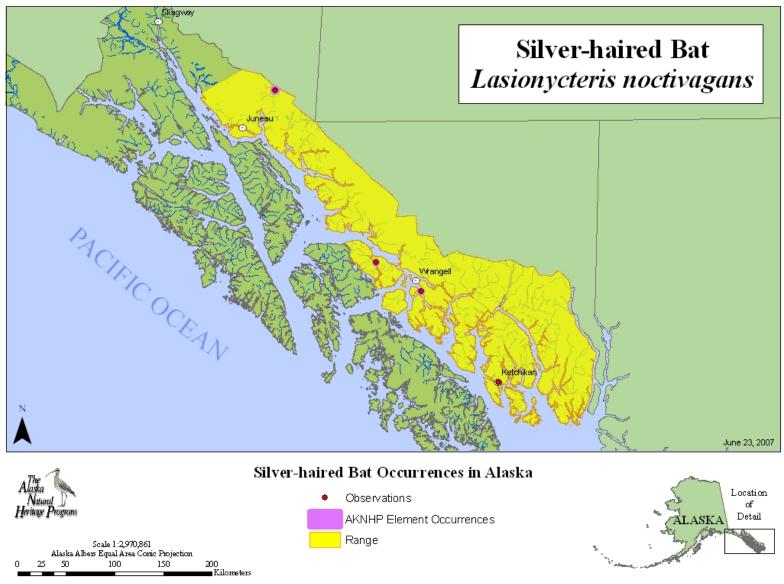
Appendix I

Mammals



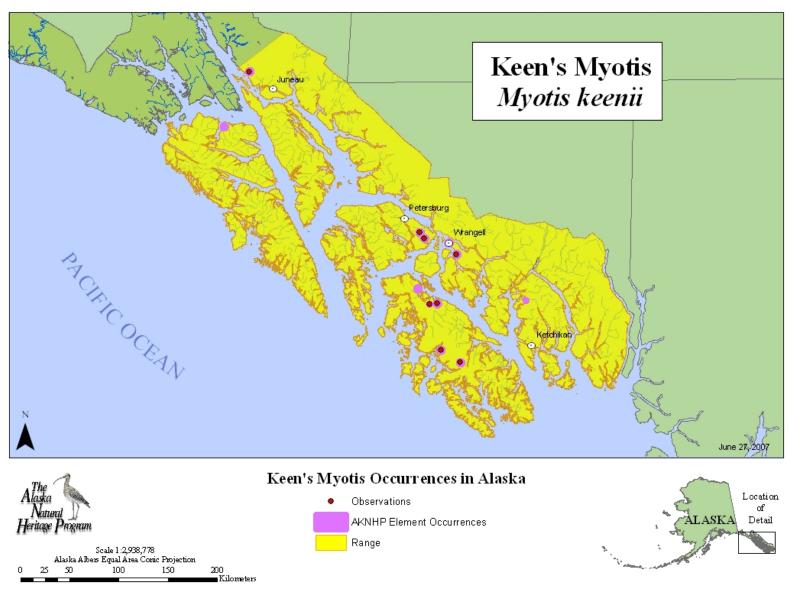




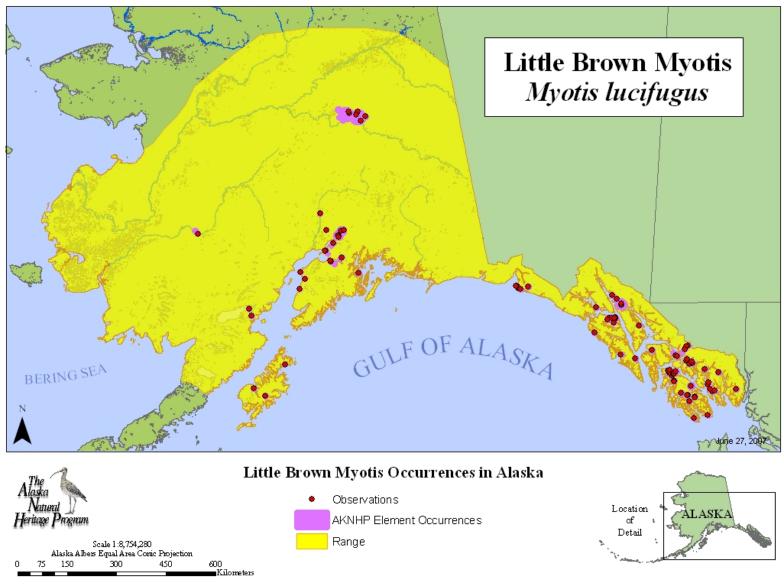




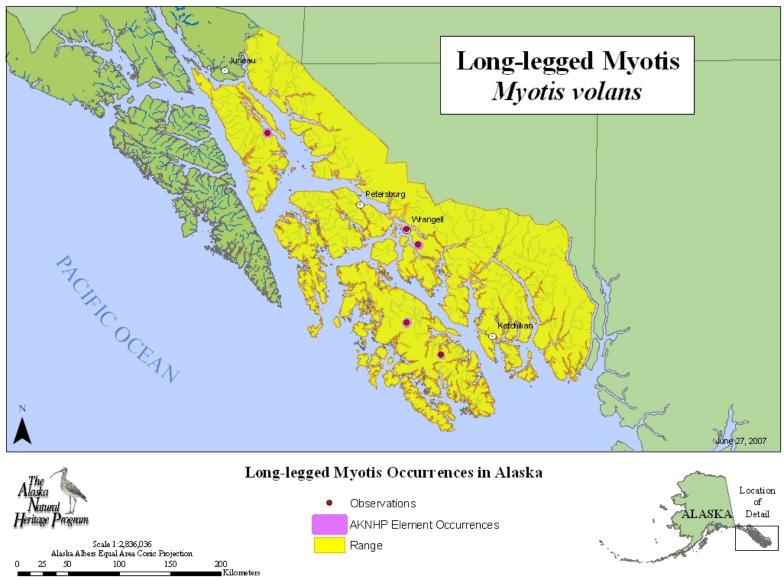
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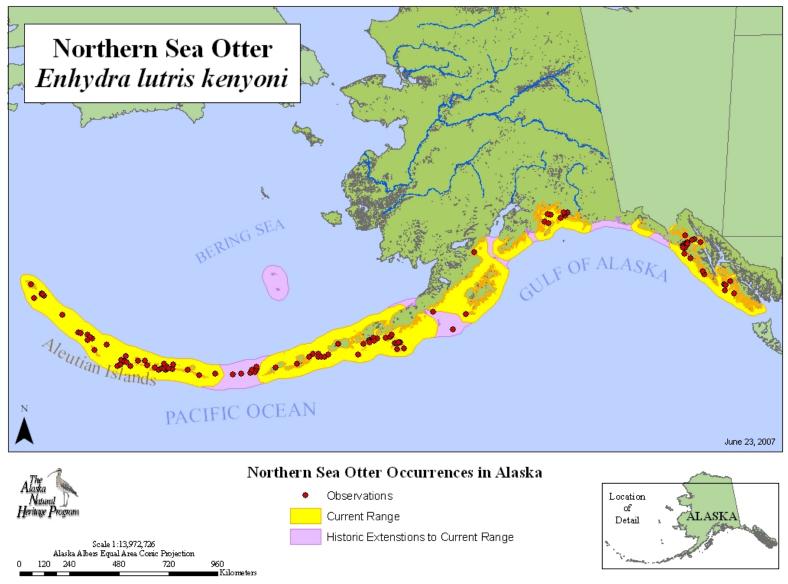


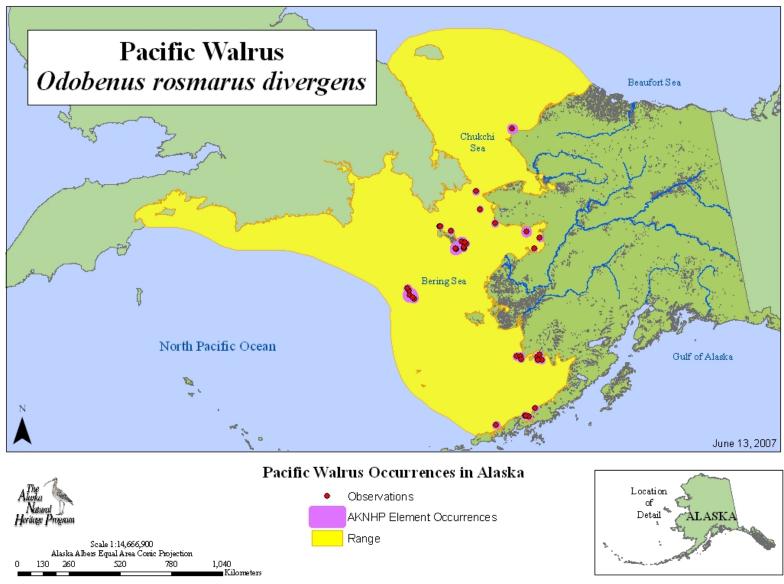
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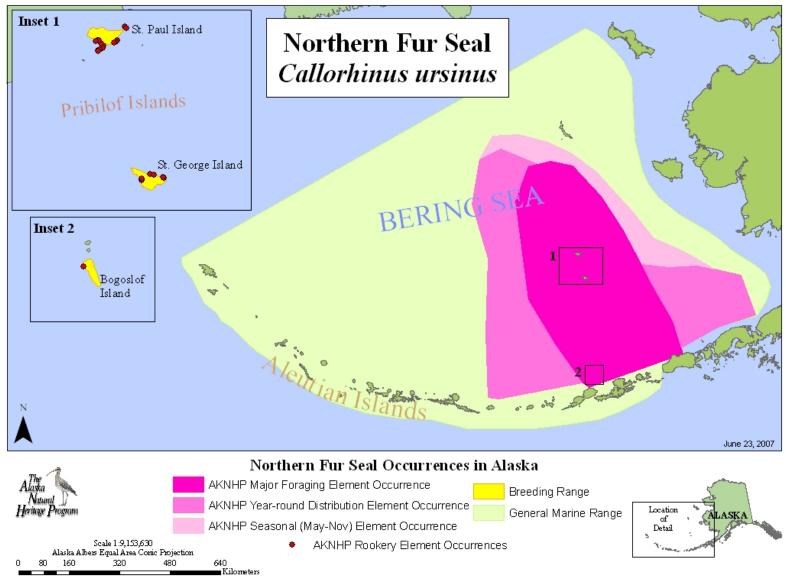


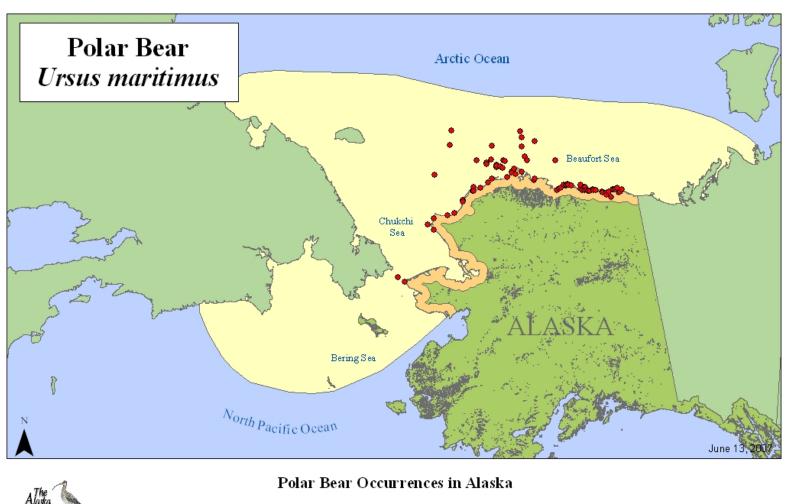
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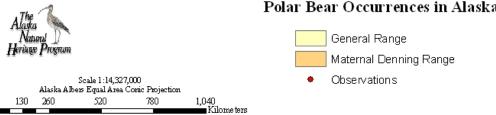


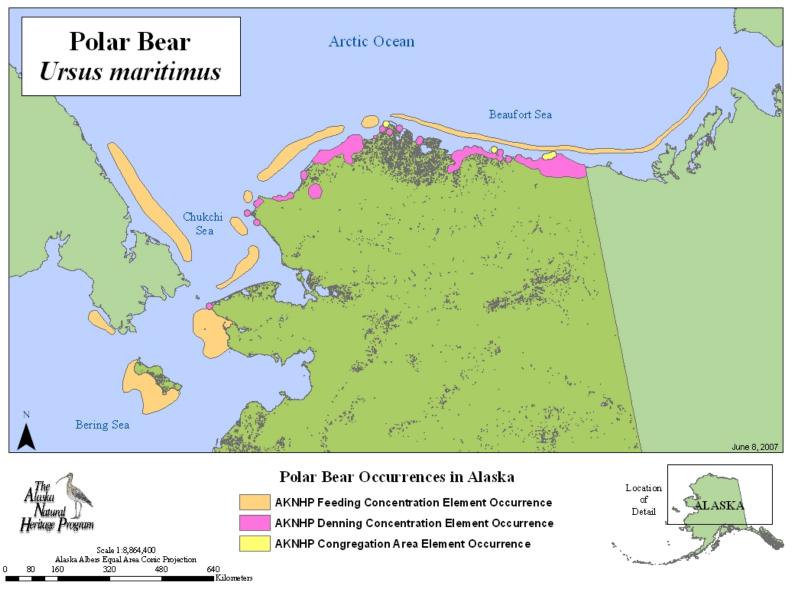


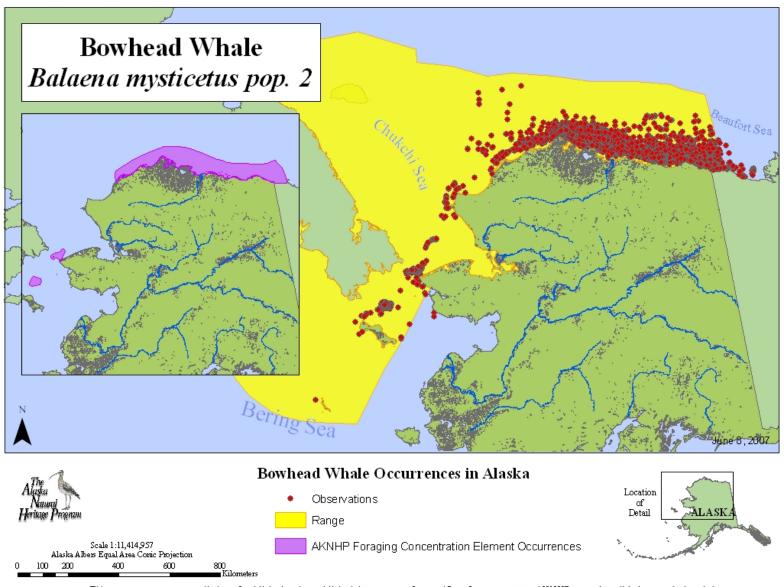


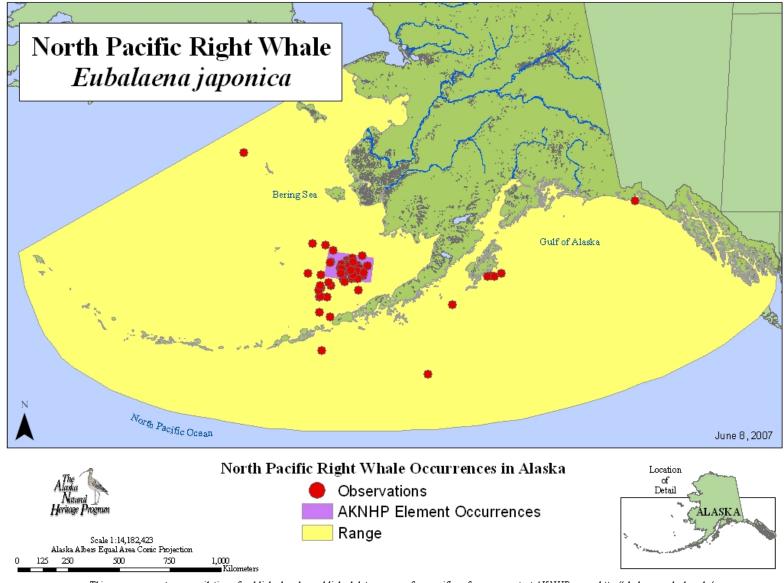


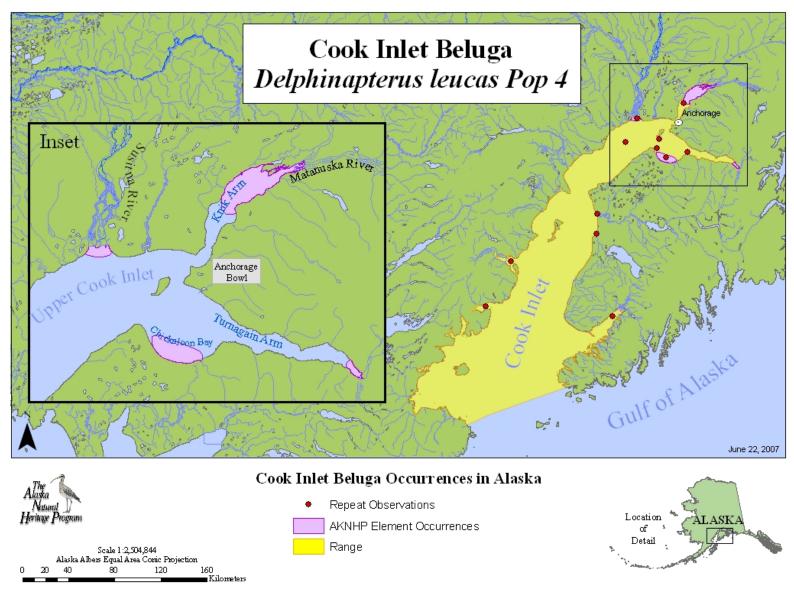




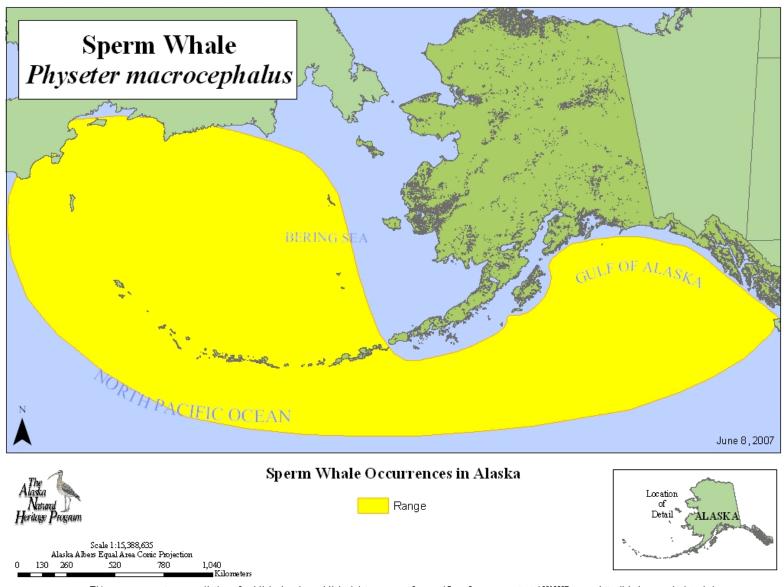




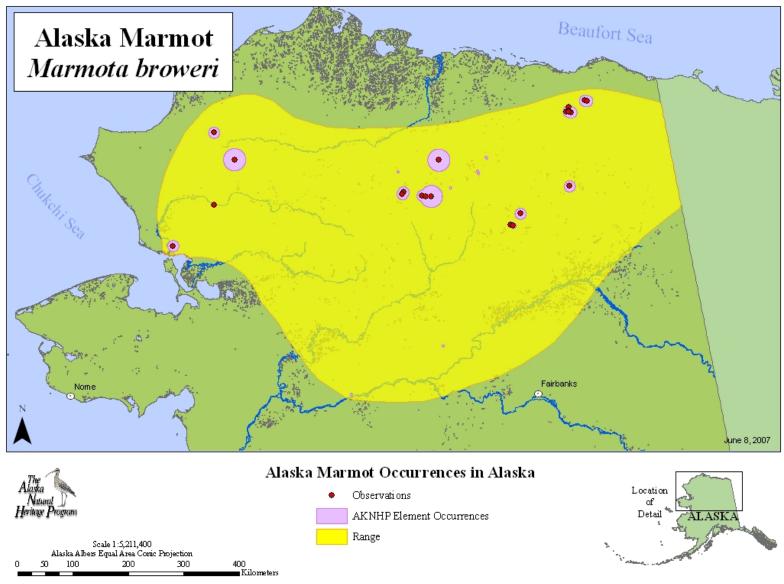


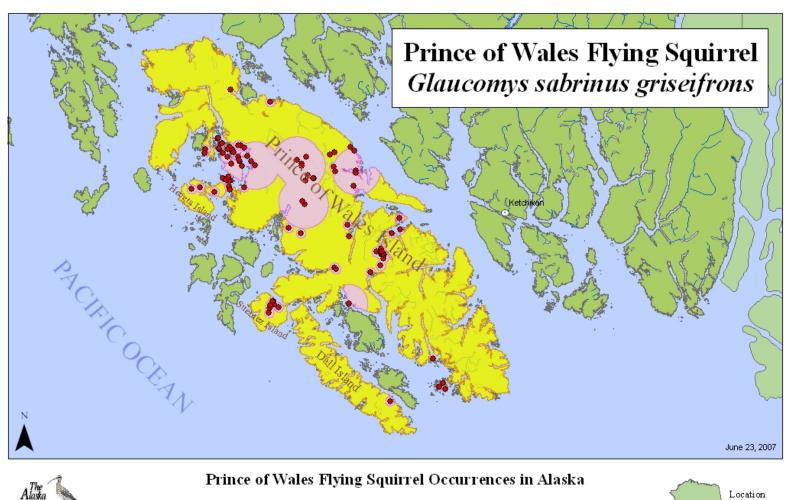


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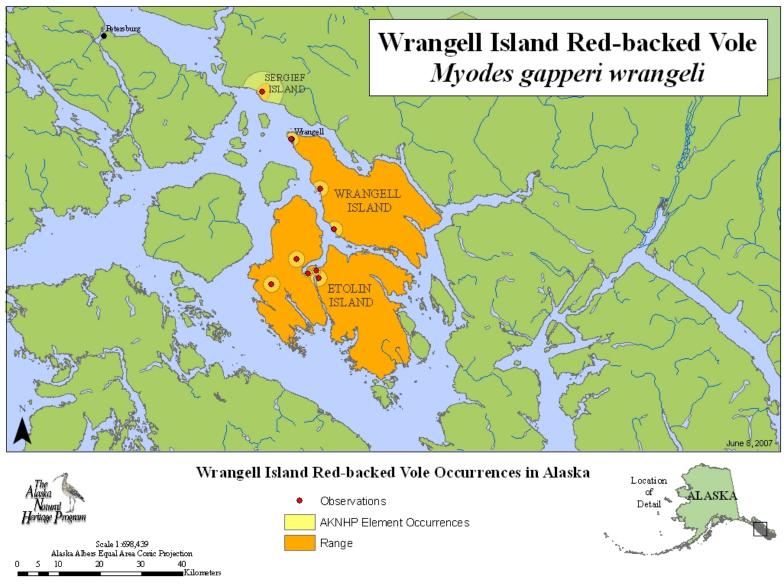


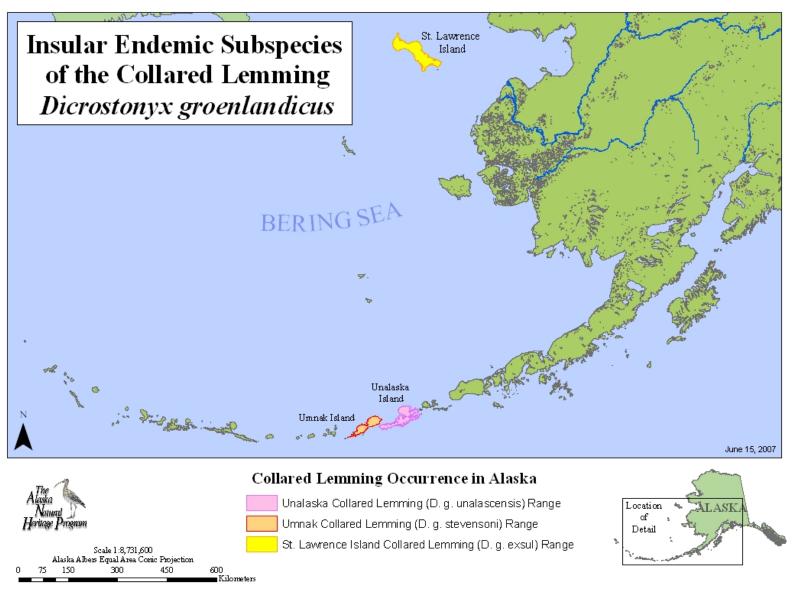
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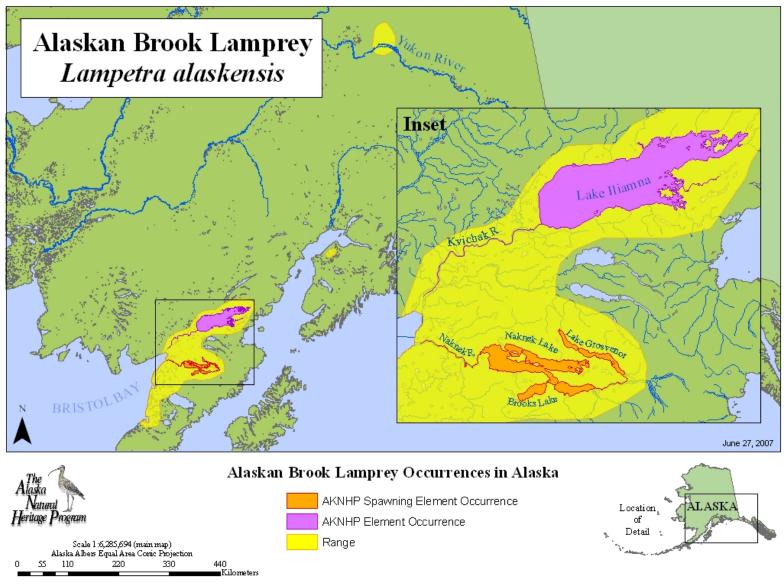


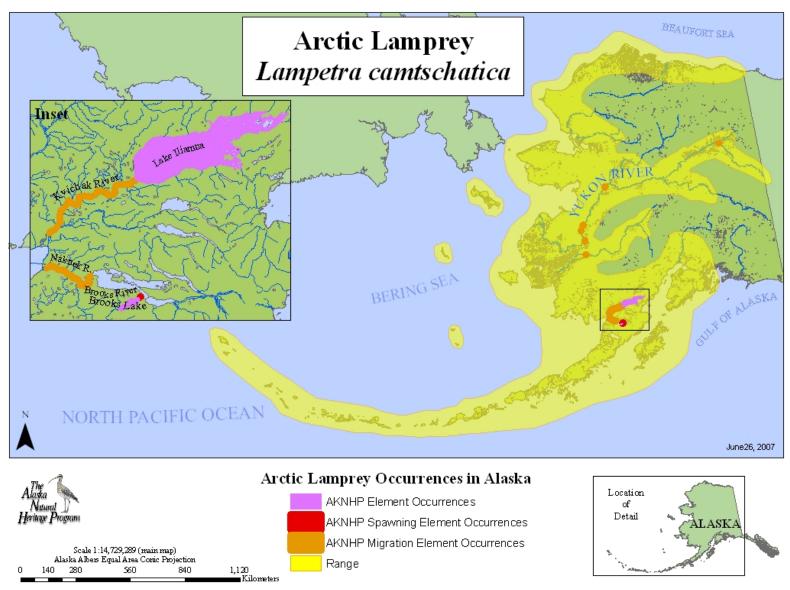


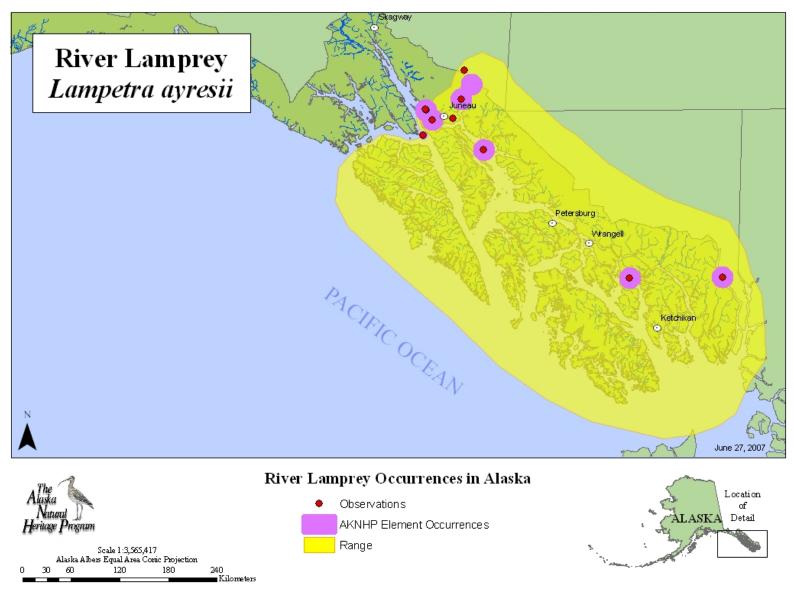
Partnership in Nongame Wildlife Research - AKNHP

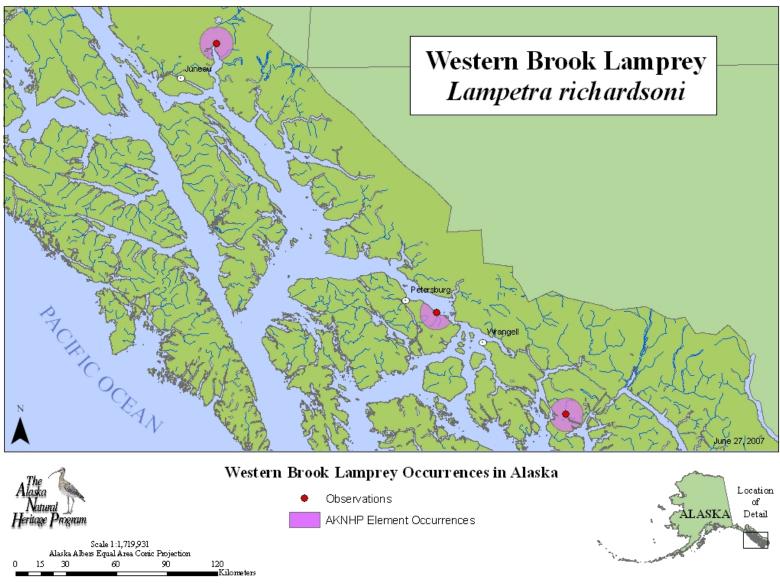
Appendix I

Fishes

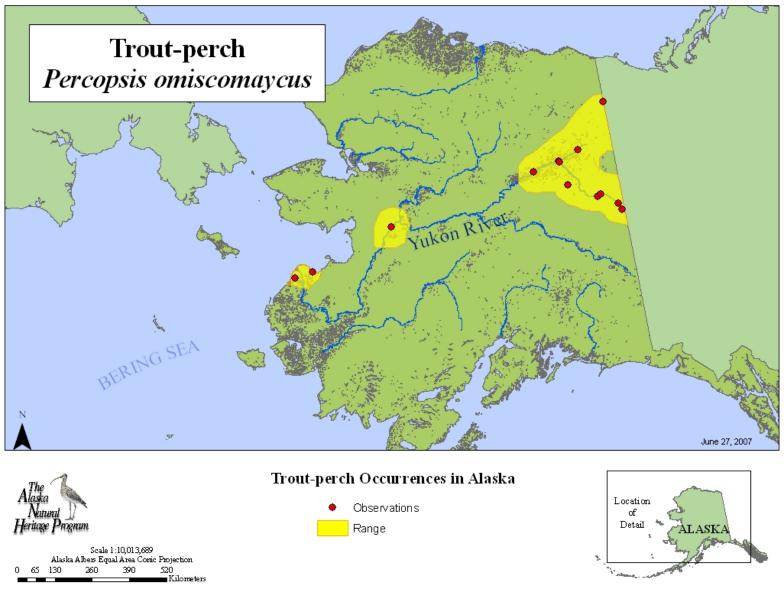






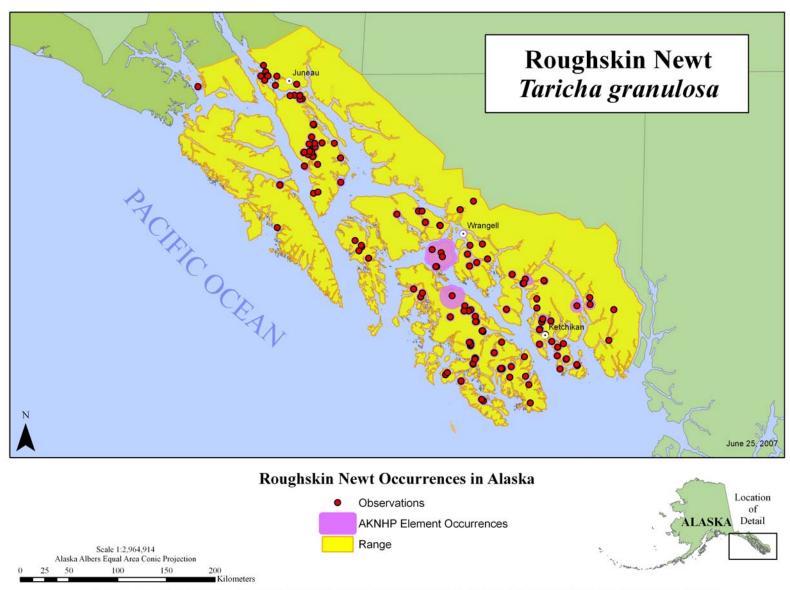


This map represents a compilation of published and unpublished data sources; for specific references contact AKNHP or see http://aknhp.uaa.alaska.edu/

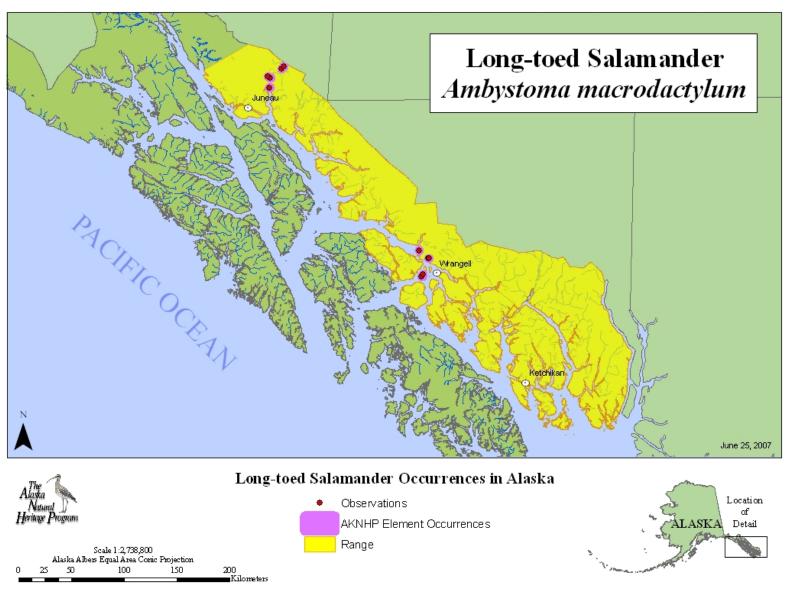


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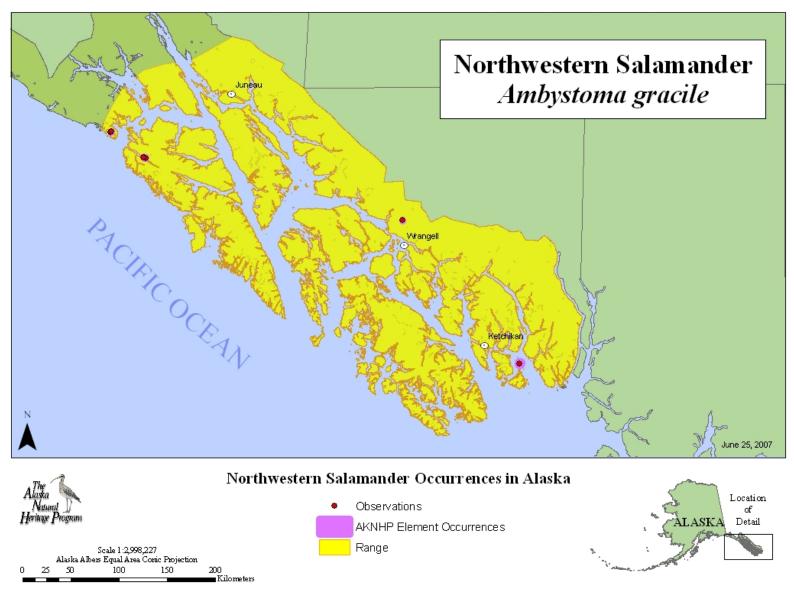
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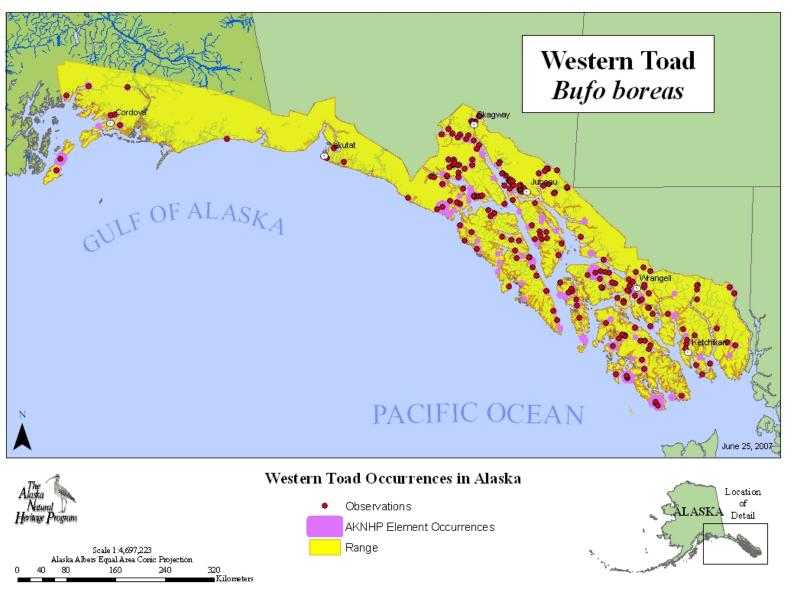


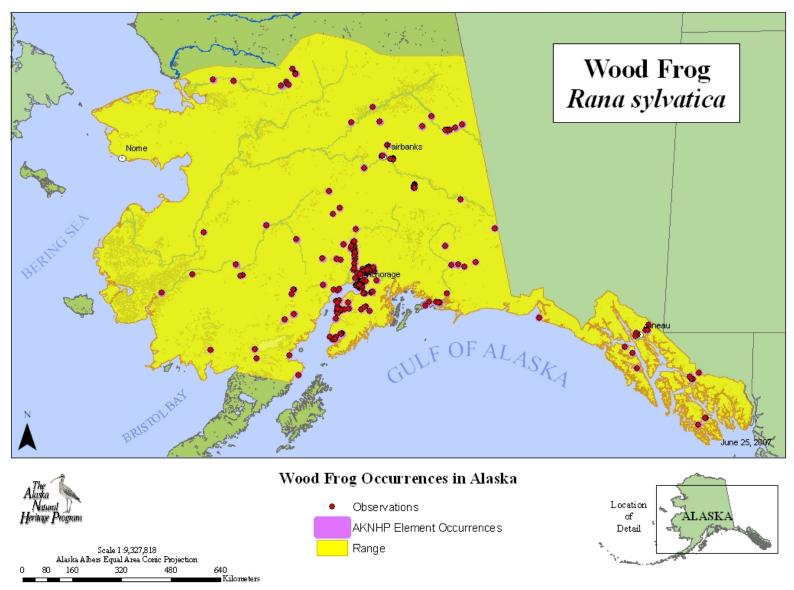
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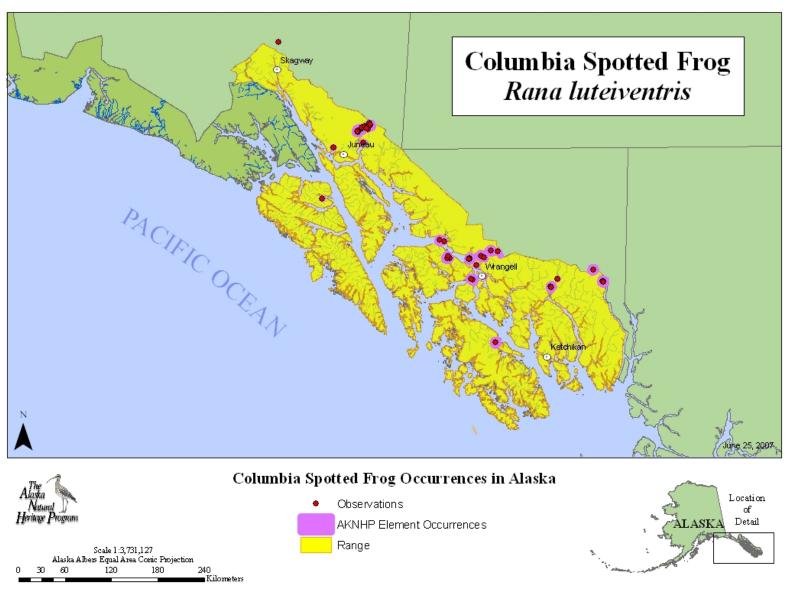
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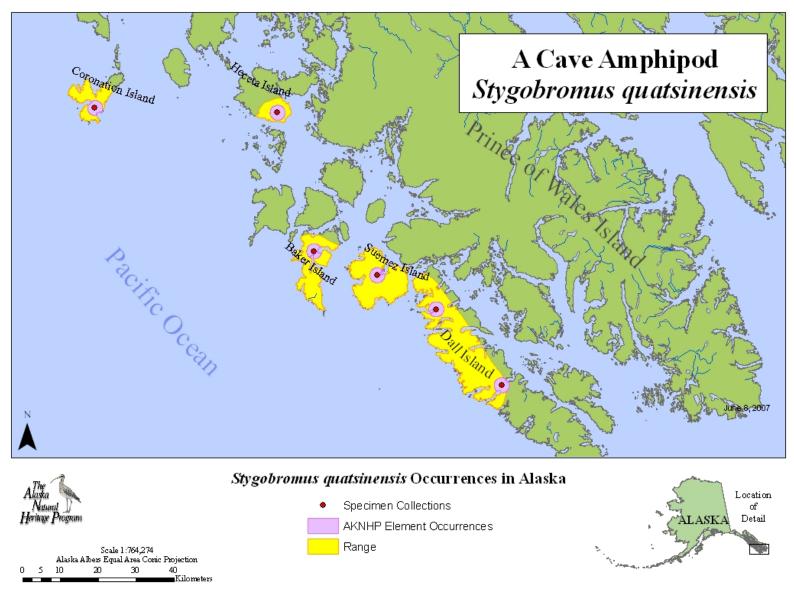


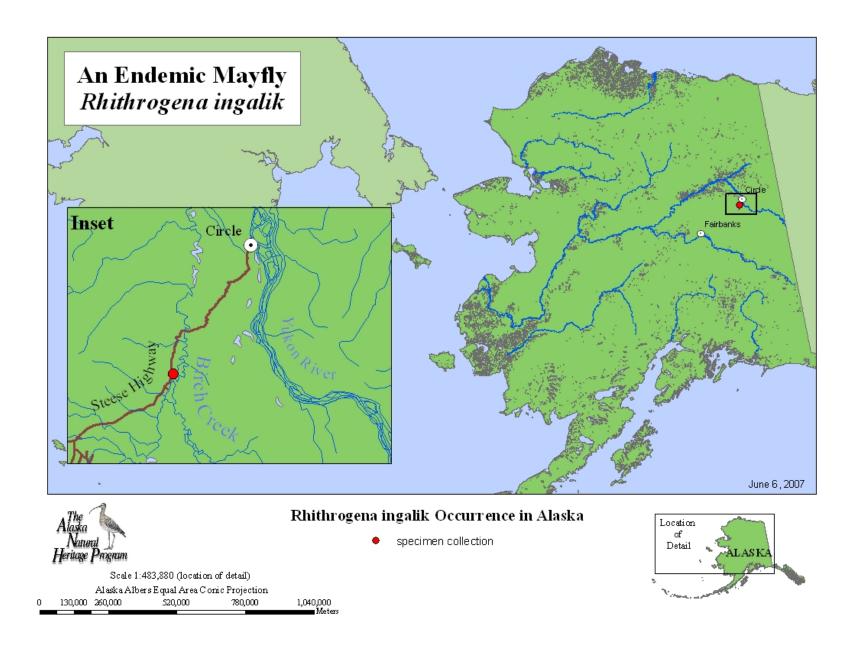
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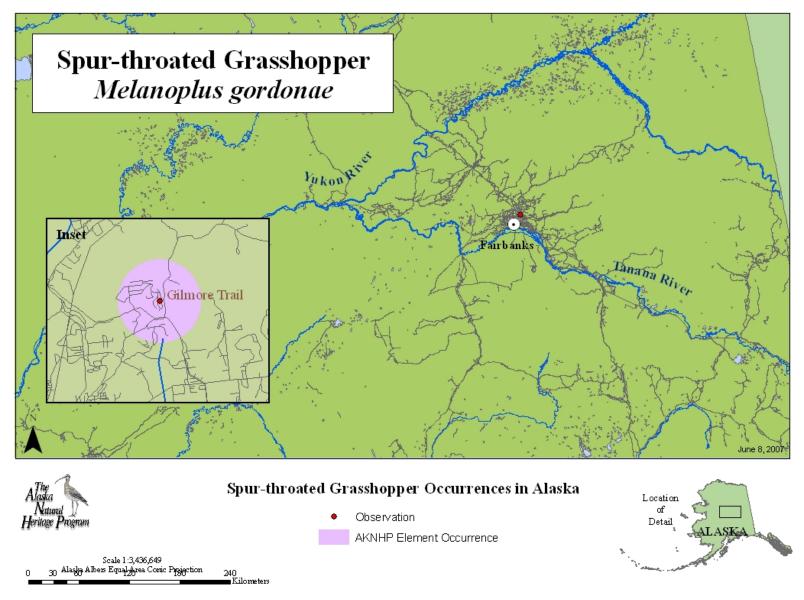


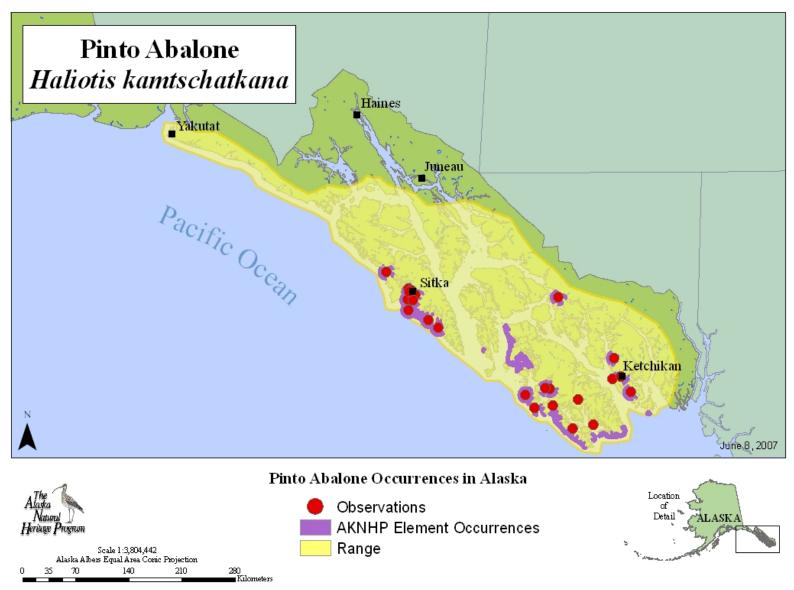
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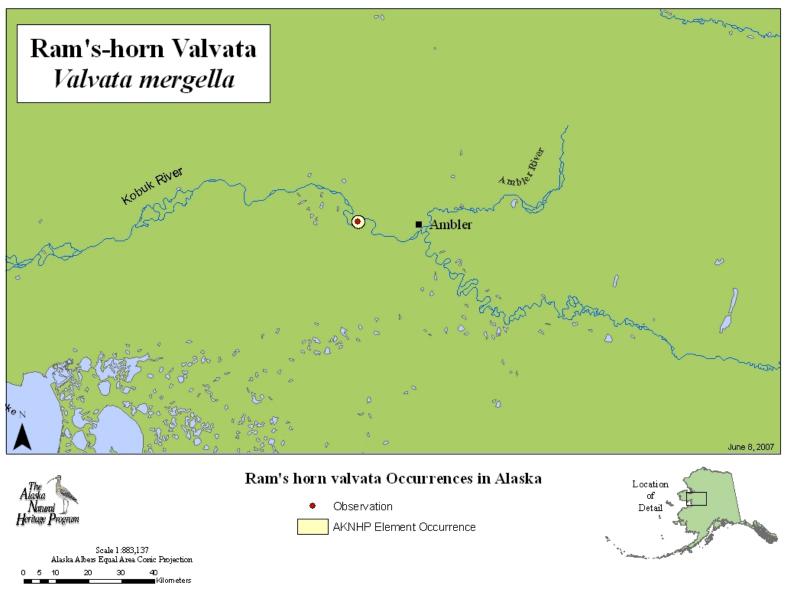
Invertebrates

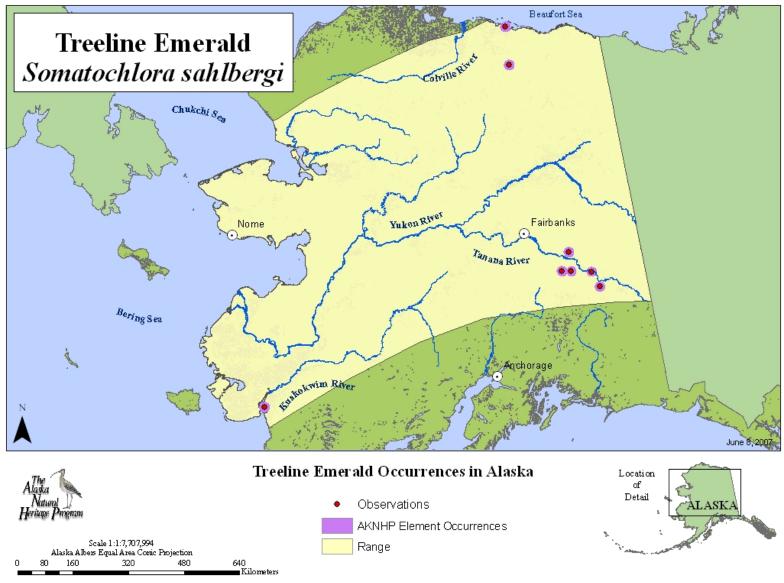


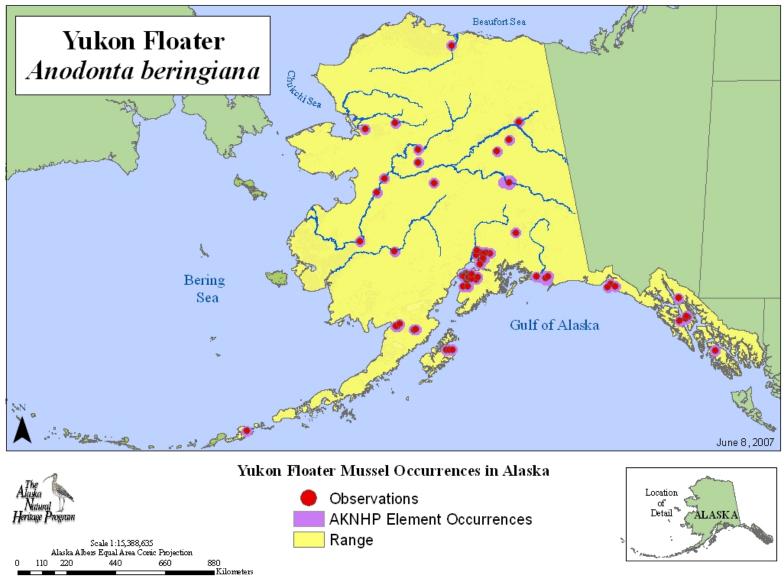






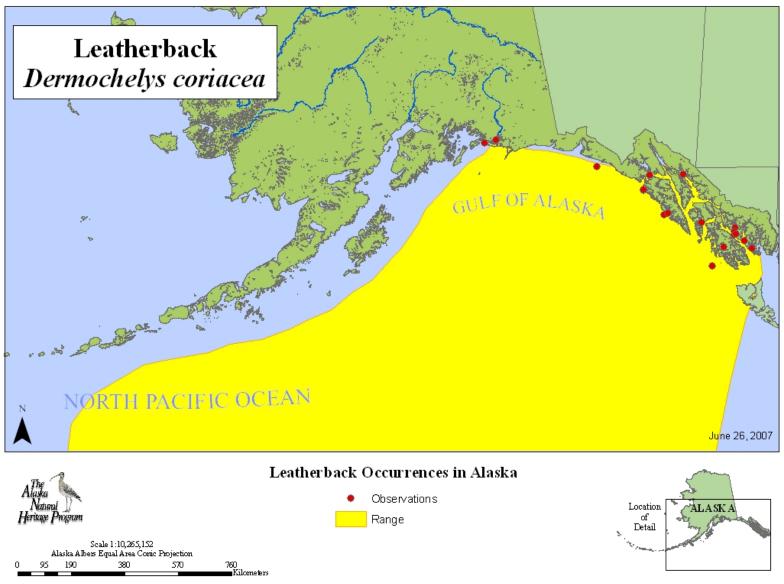






Appendix I

Reptiles



Appendix II

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Common name

Full Bibliography for AKNHP Element Occurrence Data Sources 2006-2007

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Adler, C. D. and S. Savage. 1999. Landbird inventories during fall migration at bible camp Becharof National Wildlife Refuge, Alaska July-September 1998. U.S. Fish and Wildlife Service, Alaska Peninsula/Becharof National Wildlife Refuge Complex. Unpubl. 3	Gray-cheeked Thrush, Olive-sided Flycatcher
Ainley, D. G. 1984. Cormorants: Family Phalacrocoracidae. Pp. 92-101. In: Seabirds of Eastern North Pacific and Arctic Waters. Haley, D., Ed. Pacific Search Press, Seattle WA.	Red-faced Cormorant
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Alaska Department of fish and Game. 1985. Broad whitefish life history and habitat requirements Arctic, Western, and Interior regions.	Broad whitefish
Alaska Department of Fish and Game. 2006. Our Wealth Maintained: A strategy for conserving Alaska's Diverse Wildlife and Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. 824 pages. Appendix 4Available at http://sf.adfg.state.ak.us/statewide/ngplan/files/Seabirds.pdf. Accessed on 6/22/2007	Red-faced Cormorant
Alaska Fisheries Science Center (AFSC). 2003. Cetacean Survey. AFSC Quarterly Research Reports July-September. Alaska Fisheries Science Center. Seattle, WA. http://www.afsc.noaa.gov/Quaterly/jas2003/divrtsNMML2.htm http://www.afsc.noaa.gov/Quaterly/jas2003/divrtsNMML2.htm http://www.afsc.noaa.gov/Quaterly/jas2003/divrtsNMML2.htm http://www.afsc.noaa.gov/Quaterly/jas2003/divrtsNMML2.htm	Sperm whale
Alaska Geographic Society. 1996. Mammals of Alaska: a comprehensive guide from the publishers of Alaska Geographic. 176p.	Alaska marmot, Sperm whale
Alaska Natural Heritage Program. 2006. Alaska Amphibian Database. Compiled for the Alaska Natural Heritage Program under contract with the Alaska Dept of Fish and Game. Assembled by Sanjay Pyare, University of Alaska Southeast, Juneau, AK. From multiple datasets provided by many contributors.	Columbia spotted frog, Rough-skinned newt, Western toad, Wood frog, Long-toed salamander, Northwestern salamander
Alaska Regional Response Team 1997 Unified Plan Volume II Subarea Contingency Plans- Biological Resources. Available online at: http://www.akrrt.org/plans.shtml Accessed 2/21/07.	Pacific walrus, Polar bear

Reference Common name Alaska Science Center 20007. USGS Priority Species for Conservation. Gray-cheeked Thrush Gray Cheeked Thrush. Available online at: Thrushhttp://www.absc.usgs.gov/research/bpif/priority_spp.html#G RAY-CHEEKED%20THRUSH. Accessed on 4/2/2007. Alaska Shorebird Working Group (ASWG). 2002. Summaries of ongoing Pribilof Rock Sandpiper or new studies of Alaska shorebirds during 2002. Compiled and edited by Bob Gill. Available online at: http://shorebirdplan.fws.gov/RegionalShorebird/downloads/ASWGa bstractsDec%2002.pdf Albin, D.P. 1977. The fisheries and fish habitat of the Gulkana River, Pacific lamprey Alaska. Bureau of Land Management, Anchorage, AK. Alt, K. 1976. Age and growth of Alaskan broad whitefish, Coregonus Broad whitefish nasus. Trans. Am. Fish. Soc. 4: 526-528. Alt, K.T. 1971. Annual Progress Report for a Life history study of sheefish Broad whitefish and whitefish in Alaska. Study R-II. Federal aid in fish restoration projects. Alaska Department of fish and game. Division of sport fish. Juneau. Alaska. Trout perch, Alt, K.T. 1972. A life history study of sheefish and whitefish in Alaska. Federal aid in fish restoration, project F-9-4, study R-II. Alaska Bering cisco. Department of Fish and Game, division of sport fish, Juneau, Broad whitefish Alaska Alt, K.T. 1973. A life history study of sheefish and whitefish in Alaska. Broad whitefish, Federal aid in fish restoration. Sport fish division. Volume 14--Bering cisco Study R-II project F-9-5. Alaska Department of Fish and Game. Juneau, Alaska. Bering cisco Alt, K.T. 1973. Contributions to the biology of the Bering cisco (Coregonus laurettae) in Alaska. J. Fish. Res. Board Can. 30: 1885-1888. **Broad whitefish** Alt, K.T. 1974. A life history study of sheefish and whitefish in Alaska. Federal aid in fish restoration, division of sport fish, study R-II. Alaska Department of Fish and Game, Juneau, Alaska. Alt, K.T. 1975. A life history study of sheefish and whitefish in Alaska. Bering cisco, Federal aid in fish restoration, sport fish division, study R-II, volume Broad whitefish 16. Alaska Department of Fish and Game, Juneau, Alaska. Alt, K.T. 1978. Life history study of sheefish in Alaska. Federal aid in fish Broad whitefish restoration, R-II, volume 19. Alaska Department of Fish and

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Alaska blackfish,
Alaska brook lamprey,
Arctic lamprey,
Bering cisco,
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