BIOLOGICAL OPINION

2012 SHELL ENVIRONMENTAL BASELINE STUDIES – COASTAL CHUKCHI SEA AND ONSHORE

Consultation with
Shell Gulf of Mexico, Inc.
Anchorage, Alaska

Prepared by:
Fairbanks Fish and Wildlife Field Office
U. S. Fish and Wildlife Service
101 12th Ave, Room 110
Fairbanks, AK 99701

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1. INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) on Shell Gulf of Mexico, Inc. (Shell) proposed environmental baseline studies in nearshore waters near Wainwright, Alaska and undeveloped areas of the National Petroleum Reserve-Alaska (NPR-A) that would require permits from BLM. Additionally, incidental take of polar bears (*Ursus maritiums*) and Pacific walrus (*Odobenus rosmarus divergens*) would require letters of authorization (LOA) from the Service's Marine Mammal Management office. The Service may also issue special LOAs to appropriately-trained individuals which authorize intentional taking of polar bears for both human and bear safety pursuant to 101(a)(4)(A), 109(h), and 112(c). This BO describes the effects of the proposed actions on threatened Steller's *(Polysticta stelleri*) and spectacled (*Somateria fischeri*) eiders, polar bears, polar bear critical habitat, and candidate species Pacific walrus and yellow-billed loons (*Gavia adamsii*) pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

Background

Section 7(a)(2) of the ESA, (16 U.S.C. § 1531 et seq.), requires that Federal agencies shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of designated critical habitat. When the actions of a Federal agency may adversely affect a protected species, that agency (i.e., the action agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the Service, depending upon the protected species that may be affected. In addition to proposing to conduct studies in NPR-A, Shell is requesting authorization for incidental take pursuant to section 101(a)(5) of the Marine Mammal Protection Act (MMPA) for polar bears and Pacific walrus and intentional take of polar bears pursuant to sections 101(a)(4)(A), 109(h), and 112(c) of the MMPA that could occur during environmental baseline surveys in the Chukchi Sea and along the Chukchi Sea coast in the NPR-A in 2012 (Figure 2.1). Letters of Authorization (LOAs) for incidental and intentional take of polar bears and Pacific walrus are issued by the Marine Mammals Management (MMM) office in Anchorage.

Related section 7 Consultations

In the Chukchi Sea, we previously consulted on effects of oil and gas activities on polar bears in the Programmatic Biological Opinion for Polar Bears on Chukchi Sea Incidental Take Regulations (Chukchi Sea ITRs BO), dated June 3, 2008. Thus, no further consultation on the incidental take of polar bears is necessary. Polar bear critical habitat was designated and the Pacific walrus was made a candidate after finalization of the Chukchi Sea BO. As such, this consultation amends the Chukchi Sea ITRs BO to include an analysis of effects of the proposed Action on polar bear critical habitat and a conference opinion for Pacific walrus in the Chukchi Sea.

After evaluating the impacts of the proposed project to Steller's eiders, yellow-billed loons, Pacific walrus, polar bear critical habitat and spectacled eider critical habitat, the Service concludes that adverse impacts to these species would be discountable and that the proposed action is *not likely to adversely affect* Steller's eiders, yellow-billed loons, or Pacific walrus and is *not likely to adversely affect* polar bear critical habitat or spectacled eider critical habitat.

Finally, the Service concludes that the proposed activities may adversely affect spectacled eiders and polar bears but *are not reasonably likely to jeopardize the continued existence of spectacled eiders or polar bears by reducing appreciably the likelihood of survival and recovery of these species in the wild by reducing their reproduction, numbers, and distribution*.

2. PROPOSED ACTION

Shell is proposing to continue a variety of baseline environmental research in 2012 as part of a multi-year effort that began in 2010. The current proposed study area extends further inland than in previous years. The proposed study program includes surveys and assessments designed to gather additional data relative to baseline or existing environmental conditions at selected locales just offshore of, and on the Chukchi Sea coastline, adjacent onshore lands, and further inland (Figure 2.1). The timeframe for this project is June through October 2012.

The primary objective of the proposed 2012 research is to gather additional data to further develop Shell's understanding of the physical, biological, and social environment in areas where potential onshore infrastructure may be necessary for future development of oil and gas resources at Shell's Outer Continental Shelf (OCS) prospects in the Chukchi Sea. Characterizing the baseline conditions would be necessary to support environmental impact assessment, development planning, and permitting.

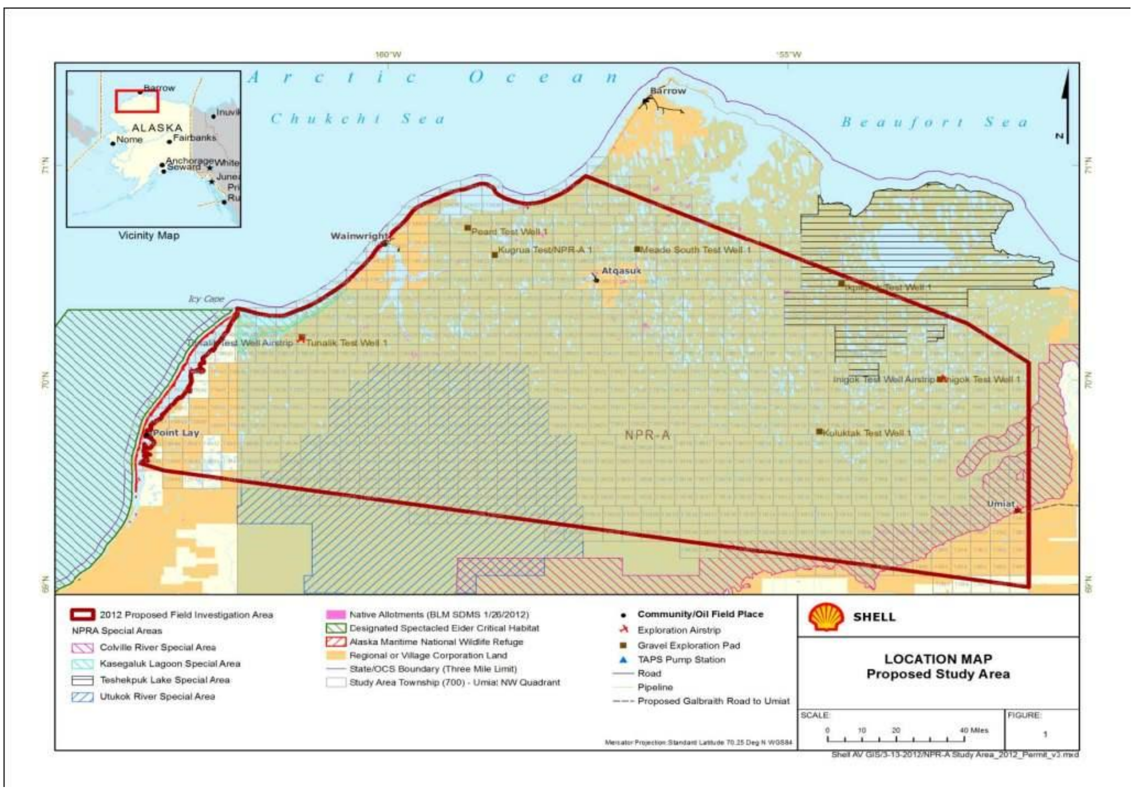

Figure 2.1. Action area for proposed 2012 environmental baseline research in nearshore waters near Wainwright, Alaska and onshore in undeveloped areas of the NPR-A.

Project actions

Hydrology Studies

Surface Hydrology

Between June and September, hydrologic data (stream width/depth ratios, stream slope cross sections, and stream bank stability) would be collected from up to 50 river and stream sites, and up to 50 lakes. These sites would be distributed throughout the study area. Crews would use helicopters, small inflatable boats with outboard motors, or remote controlled boats with acoustic Doppler profilers. Hydrology studies would include up to 418 total helicopter take-offs/landings (Table 2.1). Each site would be visited no more than once or twice, and data would be collected by two or three crews of 3-4 persons (including a bear guard).

Coastal Processes

In mid- to late June, 2–3 time-lapse and 1 light detection and ranging (LIDAR) cameras would be deployed along 70km of the Chukchi Sea coast at 2–3 stations. Access to survey stations would be via the *M/V Tukpuk* or similar vessel. Wainwright residents or project hydrologists may maintain instruments and retrieve data when necessary by overland utility vehicle (UTV) traveling along the Chukchi coast beaches and established connecting trails. While Shell does not anticipate accessing these sites by helicopter, transport by helicopter would be necessary if Wainwright residents cannot maintain these sites, or ice conditions do not allow safe use of the *M/V Tukpuk*. Cameras would be retrieved in late September or early October.

Ecological Surveys

Habitat Assessments

Between mid-July and mid-August, intensive habitat surveys would be conducted in undeveloped areas of NPR-A. Up to 150 survey transects would be accessed via helicopters based in Umiat and Atqasuk with up to 490 take-off/landings (Table 2.1). Transect locations would be distributed such that ecological variation within distinct physiographic districts (e.g. coastal plain, floodplains, thaw basins) could be sampled. Transects would be oriented perpendicular to topographic gradients to maximize the range of environmental gradients sampled. Field habitat assessments would be conducted using intensive sampling plots located along 1 km transects navigated on foot. Data collection would describe soils, hydrology, surface form, electrical conductivity, pH, depth to permafrost, vegetation composition, and surface geomorphology. Soil samples (250-300 g) would be collected at 3-4 plots per intensive transect for Near Infrared Analysis and wet laboratory analysis. In addition to the intensive transects, up to 30 rapid verification plots would also be sampled at 100 m intervals along 2 km transects. At each plot, a list of dominant species would be compiled, representative photographs taken and GPS coordinates saved.

Ground-truthing for remote sensing validation would complement the intensive habitat survey plots. Sampling protocols would be systematic and extensive to provide for direct comparisons with moderate resolution remote sensing data. Sampling would include measurements with a hand-held field spectrometer. Habitat sampling personnel would include six 3-person (2 scientists and a bear guard) crews assigned to two helicopters.

Fish Surveys

Coastal fish data would be collected using beam trawls (1-2 m beam width) and pelagic trawls (< 3 m^2 opening) in the nearshore marine environment and/or beach seines or fyke nets along the shoreline. Sampling would take place near Wainwright, AK between 10 nautical miles north and south of Kuk Lagoon (Figure 2.2). Beam trawls would be conducted from the *M/V Tukpuk* or similar vessel and beach seines would be conducted from skiffs or small inflatable boats operating close to shore. Timing of coastal fish surveys would occur during a 10-day sampling period in late June or early July and again over 10 days in mid- to late August. The crew would consist of 4-5 technicians and scientists.

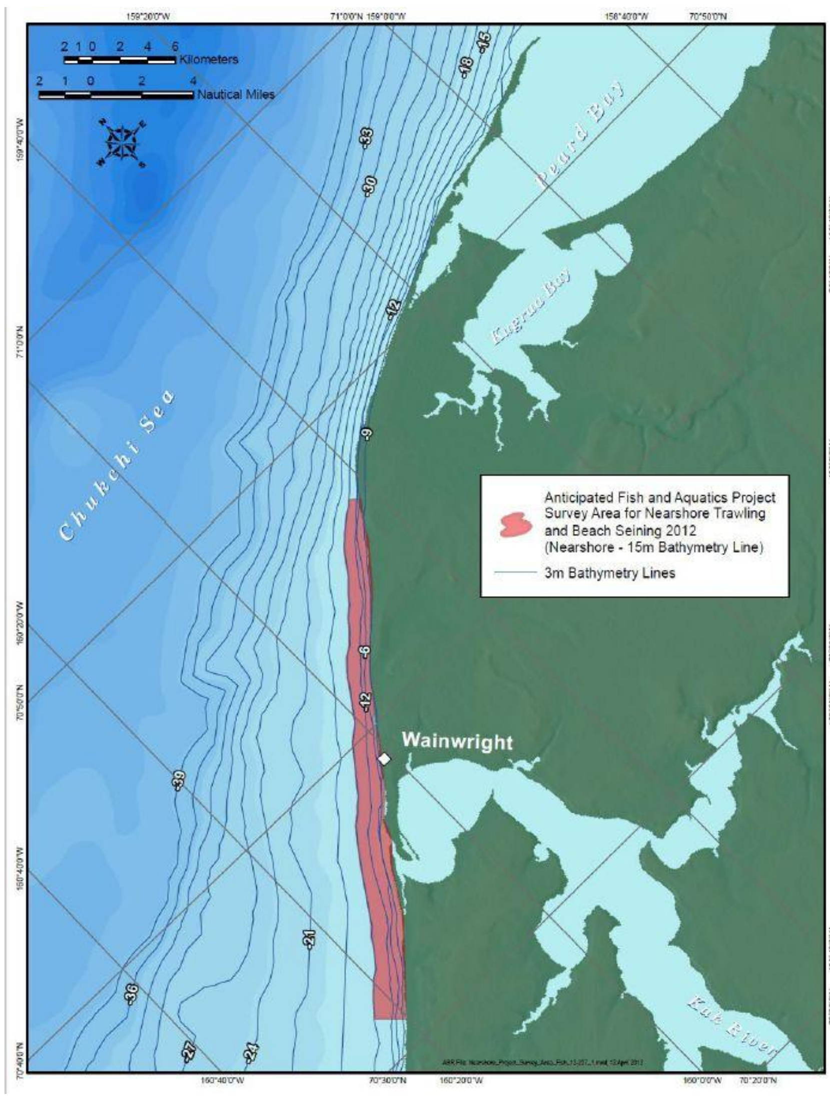

Figure 2.2. Location of fish survey area between 10 nautical miles north and south of Wainwright, Alaska.

Bird Surveys
Boat-based marine bird surveys would be conducted between Point Franklin and Icy Cape (Figure 2.3). Surveys would take place in late June, late July, and late August. Survey transects would be oriented in a sawtooth pattern between the nearshore boundary (6 m isobath) and secondary boundary (5 km [2.7 nm]) offshore. There would be 145 km of transects during each monthly survey. The transects surveyed would be modified as appropriate in consultation with the boat operator and village representatives to avoid for navigational hazards, subsistence activities, or other restrictions. Survey vessels would maintain a minimum distance of 800 m (0.5 mi) from marine mammal haul-out areas.

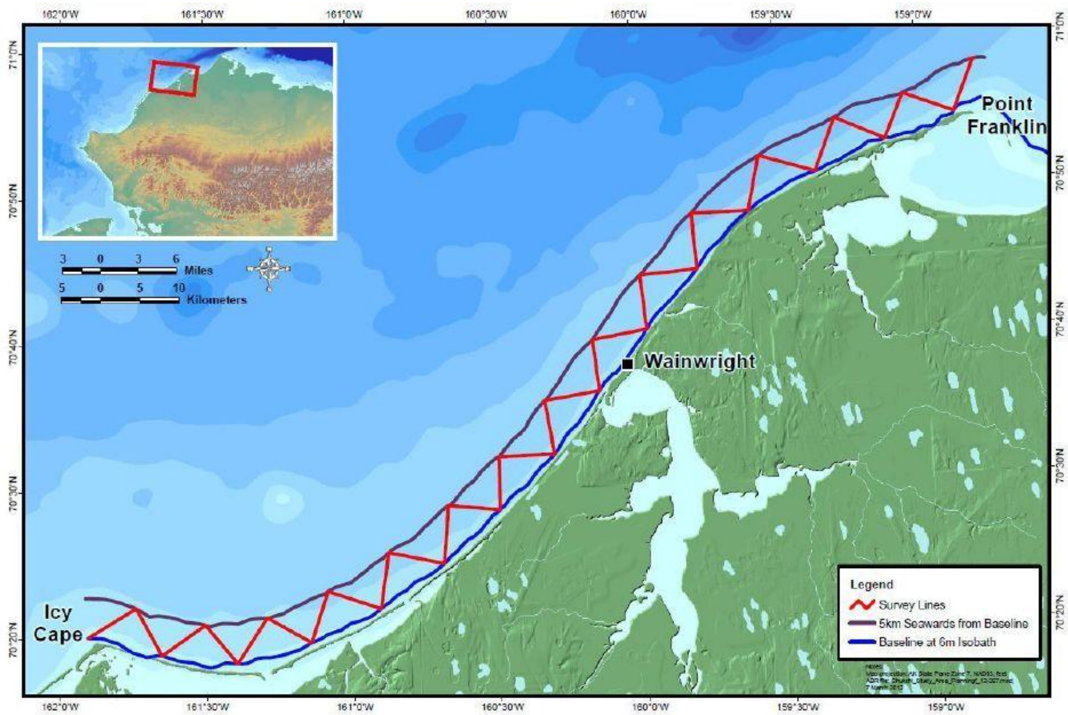

Figure 2.3. Locations of planned bird survey transects near Wainwright, Alaska for the summer of 2012.

During surveys, two observers would record bird species, count, distance, and behavior. Near-surface water temperature and salinity would also be recorded with a thermosalinograph. If weather and marine conditions permit, the survey vessel would land between 4 and 5 times per survey (for a total of 15 landings) on the seaward side of barrier islands north of Icy Cape and in the vicinity of Peard Bay. Researchers would walk across barriers islands and record bird densities within the shallow lagoon systems.

Cultural Resource Surveys
Between mid-July and early-August, cultural resource surveys would be conducted using a combination of low-level helicopter flights (200-300 ft of altitude) and on-the-ground inspection.

Table 2.1. Planned takeoffs and landings for proposed activities within the entire Action area for Shell's environmental baseline research during summer and fall 2012 in northern, Alaska. Takeoffs and landings from established airstrips (Atqasuk and Umiat) are not included.

Study	Assumption	Period	Total Field Survey Days	Estimated Flying Days	Base	Takeoff/ Day	Landing/ Day	Total Takeoffs	Total Landings
Hydrology Phase 1	2 stations/team/day	June 15 to July 10	25	23	Atqasuk	7	7	158	158
Hydrology Phase 2	2 stations/team/day	Aug. 16 to Sept. 18	33	30	Umiat	7	7	208	208
Habitat Team 1	1 habitat transect/team/day	July 12 to Aug. 14	34	31	Atqasuk	7	7	214	214
Habitat Team 2	1 habitat transect/team/day	July 12 to Aug. 14	34	31	Umiat	7	7	214	214
Cultural	2 on-the-ground inspection/day	Jun. 15 to Aug 5	28	25	Atqasuk and Umiat	2	2	50	50
Hydrology Phase 1	2 stations/team/day	June 15 to July 10	25	23	Atqasuk	7		7	158
						Program Total		844	844

Cultural resource surveys would primarily assess up to 76 sites (with 76 take-off/landings, Table 2.1) identified by the State of Alaska or North Slope Borough databases. Cultural sites will be recorded by GPS and no other sampling would be involved. This work would be conducted by a single project archaeologist and the helicopter would remain with the archaeologist at all times. In accordance with Shell's Bear Avoidance and Human Encounter/Interaction Plan field employees will be trained in bear awareness prior to conducting field work.

Mitigation Measures

Incidental take

MMM is proposing to issue letters of authorization (LOAs) for incidental take of polar bears and Pacific walrus during the Action proposed by Shell. These LOAs are issued under the MMPA and contain binding mitigation measures for polar bears and walrus. These measures are part of Shell's effort to comply with *Terms and Conditions* of the *Incidental Take Statement* associated with this BO. The LOAs would be valid from the date of issuance to November 30, 2012. This authorization is valid only for those activities identified in the request for a Letter of Authorization dated April 11, 2012 and other documents in Shell's application package. Shell Operations Managers, or designees, must be fully aware, understand, and be capable of implementing the conditions of these LOAs. These LOAs and the required conditions below include contractors of Shell performing Shell-approved work under the scope of operations to be conducted. The LOAs are subject to the following conditions:

- All provisions of the marine mammal interaction plan developed by Shell and approved by MMM must be complied with unless specifically noted otherwise in the LOA. A copy of the Polar Bear Interaction Plans must be available on site for all personnel.
- Polar bear monitoring, reporting, and survey activities must be conducted in accordance with 50 CFR Section 18.128. In addition, Shell must comply with the following monitoring, mitigation, and reporting requirements:
- Shell must cooperate with the Service and other designated Federal, State, or local agencies to monitor the impacts of oil and gas exploration activities on polar bears. At the discretion of the Service, Shell must allow the Service to have an observer on-site to monitor the impacts of the activity on polar bears.
- Shell must not conduct activities that operate nor pass within one mile (1.6 km.) of known polar bear dens, and all observed dens must be reported to the Service's Marine Mammals Management Office immediately. Should occupied dens be identified within one mile of activities, Shell must cease work in the immediate area and contact the Marine Mammals Management Office for guidance. The Marine Mammals Management Office will evaluate these instances on a case-by-case basis to determine the appropriate action. Potential actions may range from cessation or modification of work to conducting additional monitoring, and Shell must comply with any additional measures specified.
- If any changes develop in Shell's project during the 2012 field season, such as flight paths, activities or location, Shell must notify the Service prior to the planned operation.
- Shell must designate a qualified individual or individuals to observe, record, and report the effects of the activity on polar bears to the Service within 24 hours of visual observation. Every polar bear observed must be recorded on a Polar Bear Observation

Form. See the LOA for specific reporting requirements. Evidence of polar bears, such as tracks, carcass, or dens, must also be reported.

- Shell must submit a monitoring report to MMM as required under 18 CFR 18.128(f), which will be received within 90 days after completion of the project.

Intentional take

MMM is also proposing to issue an LOA for intentional take of polar bears and Pacific walrus during the activities described in this project. The LOA would be valid from the date of issuance to November 30, 2012. This LOA would be valid only for those activities identified in the request for a Letter of Authorization dated April 11, 2012 and other documents in Shell's application package. Deterrence and hazing techniques authorized by MMM as part of the intentional take LOA would include minimization measures. Hazing techniques must not cause the injury or death of a bear and types of hazing techniques may include, but are not limited to:

- Bear Monitors;
- Air horns;
- Electric fences;
- Chemical repellents;
- Acoustic recordings;
- Vehicles;
- Projectiles: cracker shells, bean bags, rubber bullets, and screamers.

Prior to conducting a harassment activity, operators must:

- Reduce/eliminate attractants;
- Secure site; notify supervisor; move personnel to safety;
- Ensure bear has escape route(s);
- Ensure communication with all personnel.

When conducting a harassment activity, operators must:

- Chose the method that will have the least effect on the bear and increase the intensity of the method or use additional methods only if necessary;
- Shout at the bear before using a projectile (avoidance conditioning);
- Move the bear in proper direction; continue with minimally necessary deterrents to receive the desired result.

After a harassment event has occurred, operators must:

- Monitor bear movement (to ensure no return);
- Notify supervisor and personnel to resume work;
- Fill out report to be sent to the Service as required under condition five, above (within 24 hours).

Additionally, Shell must adhere and be fully capable of implementing the following conditions:

- Follow their approved polar bear interaction plan and make the plan available to all personnel;
- Document and report all instances involving harassment activities as soon as possible and not later than 24 hours after the occurrence;

- Only assign **trained and qualified** personnel the task of harassing (deterring) polar bears. A list of trained personnel responsible for deterrence will be on file prior to initiation of activities with the Service Incidental Take Coordinator.

A final report of all encounters and hazing events must be submitted to the MMM Office within 60 days from the expiration date of this authorization.

Additionally, mitigation measures would include avoidance of concentrations or groups of walruses and polar bears hauled out on land or ice by all vessels, aircraft, and ground crews under the management of Shell. Operators of support vessels should, at all times, conduct their activities at the maximum distance possible from known or observed concentrations of animals and under no circumstances, other than an emergency, should vessels operate within 800 meters (0.5 mile) of walruses or polar bears observed on land or ice. Vessels must reduce speed when walruses or polar bears are observed in water and vessels capable of steering around these animals must do so. Vessels may not be operated in such a way as to separate members of a group of walruses or polar bears from other members of the group and vessels should avoid multiple changes in direction and speed when walruses or polar bears are present. Furthermore, aircraft must avoid polar bears and walrus haul-out concentrations by at least 0.5 mile horizontal distance and 1,500 feet mean sea level vertical distance unless human safety dictates otherwise. However, when aircraft are operated at altitudes below 1,500 feet mean sea level because of weather or other conditions, the operator must take all precautions possible to avoid known walrus haul-outs or polar bear use areas and avoid flying directly over or within 0.5 mile lateral distance of observed polar bears and walruses. Due to their importance as polar bear summer resting habitat, flight paths will be offset from the coastline of Beaufort Sea barrier islands (including the Jones Island group, Cross, Flaxman, and Tigvariak islands) by at least 0.5 mile and 1,500 feet above ground level.

3. ACTION AREA

The Action area includes the near-shore environment (within 10 nautical miles [nm]) of the Chukchi Sea coast from the Kukpowruk River (south of Point Lay) to the shoreline north of Peard Bay and encompasses on-shore areas inland of these points in a southeasterly direction to the eastern border of townships T8R1 and T5R1 of the northwest Umiat Quadrant (Figure 3.1).

4. EFFECT DETERMINATION FOR THE STELLER’S EIDER, YELLOW-BILLED LOON, PACIFIC WALRUS, POLAR BEAR CRITICAL HABITAT AND SPECTACLED EIDER CRITICAL HABITAT

Based on the description of the proposed Action and the best available species information, the Service expects effects of the Action on Steller’s eiders, yellow-billed loons, Pacific walrus, polar bear critical habitat, and spectacled eider critical habitat, would have at most only minor effects on these species and designated critical habitat. We briefly describe the effects of the proposed action on these species below. However, the proposed action could adversely affect spectacled eiders and polar bears; thus, effects for these species are described in more detail in later in this document.

Steller's Eider
On June 11, 1997, the Alaska-breeding population of Steller's eiders was listed as threatened based on a substantial decrease in this population's breeding range and the increased vulnerability of the remaining Alaska-breeding population to extirpation (62 FR 31748). In Alaska, Steller's eiders breed almost exclusively on the Arctic Coastal Plain (ACP), migrating to the breeding grounds in late spring and remaining in the region as late as mid-October. However, nesting is concentrated in tundra wetlands near Barrow, AK and Steller's eiders occur at very low densities elsewhere on the ACP (Larned et al. 2010). USFWS aerial surveys for breeding eiders conducted on the ACP from 1992–2010 detected only 5 Steller's eiders east of the Colville River, with the most recent observation in 1998 (USFWS Alaska Region Migratory Bird Management, unpublished data). There is a slight possibility coastal boat surveys could temporarily disturb or displace Steller's eiders as they feed in near-shore waters or migrate through the Action area. Because available data indicate Steller's eiders are unlikely to nest near the Action area and disturbances to feeding or migrating birds would be temporary and minor, we conclude that adverse effects to the species would be discountable and therefore, effects of the proposed action are *not likely to adversely affect* Steller's eiders.

Yellow-billed Loon
On March 25, 2009, the Service designated the yellow-billed loon a candidate for protection under the Act because of its small population size range-wide and concerns about levels of subsistence harvest and other potential impacts to the species (74 FR 12932). Although rare, yellow-billed loons may be present in the Action area from early June through September where they nest and rear broods in tundra ponds and lakes on Alaska's ACP. Temporal overlap is likely between the proposed habitat assessment and cultural resource surveys (see description of proposed action) and the presence of yellow-billed loons in the Action area. It is possible some nesting or brooding yellow-billed loons may be disturbed by the proposed activities. While aircraft landings and ground surveys may cause birds to flush, we expect this response to be insignificant as the disturbance will only cause minor behavioral changes in a few individuals for a short duration. There is also spatial overlap associated with the proposed surface hydrology study, which may occur in up to 50 lakes. This activity would likely cause adult birds to flush and/or broods to seek concealment. We expect this response to be insignificant and discountable as the disturbance will only cause minor behavioral changes in a few individuals for a short duration. There also is a slight possibility coastal boat surveys could temporarily disturb or displace yellow-billed loons as they feed in near-shore waters or migrate through the Action area Because available data indicate yellow-billed loons do not nest in high densities within the Action area, disturbances to nesting, feeding, or migrating birds would be temporary and minor, the Service concludes that adverse effects of the proposed activities and would <u>not</u> cause population-level declines. *Therefore, the proposed action is not likely to jeopardize the continued existence of yellow-billed by reducing appreciably the likelihood of survival and recovery of this species in the wild by reducing its reproduction, numbers, and distribution*

Pacific Walrus
The Service designated the Pacific walrus as a candidate for listing under the Endangered Species Act on February 10, 2011 (USFWS 2011). Pacific walruses may be present in the Action area in off-shore and near-shore waters as well as at coastal haul-outs. Since the mid-1990s reductions in summer sea-ice cover have coincided with increased use of coastal haul-outs

along the northwest coast of Alaska. Increased use of summer land haul-outs by adult females and young could result in increased energy expenditures from shore-based foraging trips and reduced access to preferred feeding grounds (Jay et al. 2011). In addition, disturbance events could cause walrus groups to abandon land haul-outs in a stampede and could potentially result in trampling injuries, mortalities, or cow-calf separations. Disturbance events have led to the trampling and death of hundreds of walruses in Alaska and thousands in Russia. The proposed Action includes use of helicopters which have the potential to cause these types of disturbance at haul-outs. However, given mitigation measures defined in the LOA, flight paths would be diverted away from walrus concentrations by a minimum straight-line distance of 0.5 mile and an altitude of 1,500 ft unless human safety would dictate otherwise. Furthermore, aerial activities associated with the proposed surveys would be limited to the terrestrial environment and established coastal airports. Therefore, we conclude that flights associated with the proposed surveys are not likely to adversely affect walrus.

The proposed action also includes use of boats and people on foot (fish and bird surveys), both of which could disturb walrus, if present. Responses of walruses to disturbance stimuli are variable, and depend on whether the animal is swimming versus hauled out, or if it is an individual animal or part of a group. In general, individual walruses that are hauled out are more sensitive to disturbance than swimming individuals. Swimming walruses may respond to disturbances by looking in the direction of the disturbance or by swimming away. Vessel traffic could temporarily interrupt the movement or foraging of walruses or displace some animals when vessels pass through an area, but this displacement would likely have a minor effect that would be of short duration.

Vessel landings and foot access to barrier islands during bird surveys has the potential to cause stampede abandonment of terrestrial haul-outs. However, because Shell has agreed to avoid marine mammal haul-outs by a minimum distance of 800 m, the likelihood of a disturbance from vessel traffic or foot access to barrier islands causing a stampede would be low. Because disturbance to swimming walruses would not persist and only cause temporary displacement, and because haul-out avoidance measures adopted by Shell would prevent stampede abandonment of terrestrial haul-outs, we conclude that adverse effects of the proposed action would be minor and *would not cause population-level declines. Therefore, the proposed action is not likely to jeopardize the continued existence of Pacific walrus by reducing appreciably the likelihood of survival and recovery of this species in the wild by reducing its reproduction, numbers, and distribution*.

Polar Bear Critical Habitat

The Service designated polar bear critical habitat on December 7, 2010 (USFWS 2010a). The Primary Constituent Elements (PCEs) of critical habitat for the polar bear are sea-ice habitat used for feeding, breeding, denning, and movement, terrestrial denning habitat, and barrier island habitat. Barrier island habitat includes all barrier islands along the Alaska coast, associated spits, within the range of the polar bear in the United States, and the water, ice, and terrestrial habitat within 1.6 km (1 mi) of these islands. Critical habitat does not include existing manmade structures (e.g., houses, gravel roads, generator plants, sewage treatment plants, hotels, docks, seawalls, pipelines) or the land on which they are located within the boundaries of designated critical habitat on the effective date of this rule.

Some projects would take place within polar bear critical habitat (e.g., foot surveys on barrier islands) and these activities may temporarily create disturbance or degrade the function of barrier island habitat as a refuge from human disturbance. For example, vessels may need to use barrier islands to weather out a storm, and this may interfere with a polar bear's ability to use barrier islands for the same purpose. However, these activities would either not alter physical features of critical habitat important to the conservation role of polar bears or alterations would be extremely limited in nature (e.g., tracks from researchers on beaches). Because disturbances in critical habitat would be minor in scale, would not persist, and would not affect critical habitat's intended conservation role for polar bears, we conclude that adverse effects of the proposed Action would be discountable and therefore, are *not likely to adversely affect* polar bear critical habitat.

Spectacled Eider Critical Habitat

Because of its importance to migrating and molting spectacled eiders, on February 6, 2001 the Service designated 13,960 km^2 (5,390.0 mi^2) of Ledyard Bay as the LBCHU (66 FR 9146). This designation includes the area within about 74 km (40 nm) of shore, excluding waters less than 1.85 km (1 nm) from shore (66 FR 9146). The primary constituent elements (PCEs) of this critical habitat unit are: marine waters > 5 m and ≤ 25 m deep, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. Although Figure 2.1 indicates a portion of LBCHU would be included in the study area, neither the proposed fish surveys (Figure 2.2) nor bird surveys (Figure 2.3) would enter spectacled eider critical habitat (transects for the latter survey cease at Icy Cape). No other surveys in the proposed Action would take place in the LBCHU. Furthermore, because the Action area is restricted to coastal waters within 10 nm of shore, and the LBCHU spectacled eider critical habitat extends from 1-40 nm off-shore, only a small proportion of LBCHU would be included in the Action area. Because we can identify no mechanism through which adjacent fish and avian surveys would affect PCEs or the ability of spectacled eiders to use Ledyard Bay, we conclude that adverse effects would be discountable and that the proposed action is *not likely to adversely affect* spectacled eider critical habitat.

5. STATUS OF THE SPECIES

This section presents biological and ecological information relevant to formation of the BO. Appropriate information on the species' life history, habitat and distribution, and other factors necessary for their survival is included for analysis in later sections.

Spectacled Eider

Spectacled eiders (Figure 5.1A) were listed as threatened throughout their range on May 10, 1993 (USFWS 1993) based on indications of steep declines in the two Alaska-breeding populations. There are three primary spectacled eider populations, each corresponding to breeding grounds on Alaska's North Slope, the Yukon–Kuskokwim Delta (Y-K Delta), and northern Russia. The Y-K Delta population declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, Alaska (R. Suydam, pers. comm. in USFWS

1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available. Spectacled eiders molt in several discrete areas (Figure 5.1B) during late summer and fall, with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). All three spectacled eider populations overwinter in openings in pack ice of the central Bering Sea, south and southwest of St. Lawrence Island (Petersen et al. 1999; Figure 5.2), where they remain until March–April (Lovvorn et al. 2003).

Life History

Breeding – In Alaska, spectacled eiders breed primarily on the Arctic Coastal Plain (ACP) of the North Slope and the Y-K Delta. On the ACP, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (15 miles) inland from its mouth. Breeding density varies across the ACP (Figure 5.2). Although spectacled eiders historically occurred throughout the coastal zone of the Y-K Delta, they currently breed primarily in the central coast zone within about 15 km (~9 miles) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996). However, a number of sightings on the Y-K Delta have also occurred both north and south of this area during the breeding season (R. Platte, USFWS, pers. comm. 1997).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). Spectacled eider clutch size near Barrow has averaged 3.2–4.1, with clutches of up to eight eggs reported (Quakenbush et al. 1995, Safine 2011). Incubation lasts 20–25 days (Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992).

Nest initiation on Kigigak Island on the Y-K Delta occurs from mid-May to mid-June (Lake 2007). Incubation lasts approximately 24 days (Dau 1974). Mean spectacled eider clutch size is higher on the Y-K Delta compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the Y-K Delta (1985–2011; Fischer et al. 2011), and 4.0–5.5 on Kigigak Island (1992–2011; Gabrielson and Graff 2011), with clutches of up to eight eggs reported (Lake 2007).

On the breeding grounds, spectacled eiders feed on mollusks, insect larvae (craneflies, caddisflies, and midges), small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Ducklings fledge approximately 50 days after hatch, and then females with broods move directly from freshwater to marine habitat to stage prior to fall migration.

Nest success is highly variable and thought to be influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. In arctic Russia, apparent nest success was calculated as <2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992, Anderson et al. 1998). On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06–0.92 from 1992–2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season. Bowman et al. (2002) also reported high variation in nesting success (20–95%) of spectacled eiders on the Y-K Delta, depending on the year and location.

Available data indicates egg hatchability is high for spectacled eiders nesting on the ACP, in arctic Russia, and at inland sites on the Y-K Delta, but considerably lower in the coastal region of the Y-K Delta. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Additionally, from 1969 to 1973 at an inland site on the Yukon Delta National Wildlife Refuge, only 0.8% of spectacled eider eggs were addled or infertile (Dau 1974). In contrast, 24% of all nests monitored in a coastal region of the Y-K Delta during the early to mid-1990s contained inviable eggs and ~10% of eggs in successful nests did not hatch due to either embryonic mortality or infertility (Grand and Flint 1997). This relatively high occurrence of inviable eggs near the coast of the Y-K Delta may have been related to exposure to contaminants (Grand and Flint 1997). It is unknown whether hatchability of eggs in this region has improved with decreased use of lead shot in the region and natural attenuation of existing lead pellets (Flint and Schamber 2010) in coastal Y-K Delta wetlands.

Recruitment rate (the percentage of young eiders that hatch, fledge, and survive to sexual-maturity) of spectacled eiders is poorly known (USFWS 1999) because there is limited data on juvenile survival. In a coastal region of the Y-K Delta, duckling survival to 30 days averaged 34%, with 74% of this mortality occurring in the first 10 days, while survival of adult females during the first 30 days post hatch was 93% (Flint and Grand 1997).

(A)

(B)

Figure 5.1. (A) Male and female spectacled eiders in breeding plumage. (B) Distribution of spectacled eiders. Molting areas (green) are used July –October. Wintering areas (yellow) are used October –April. The full extent of molting and wintering areas is not yet known and may extend beyond the boundaries shown.

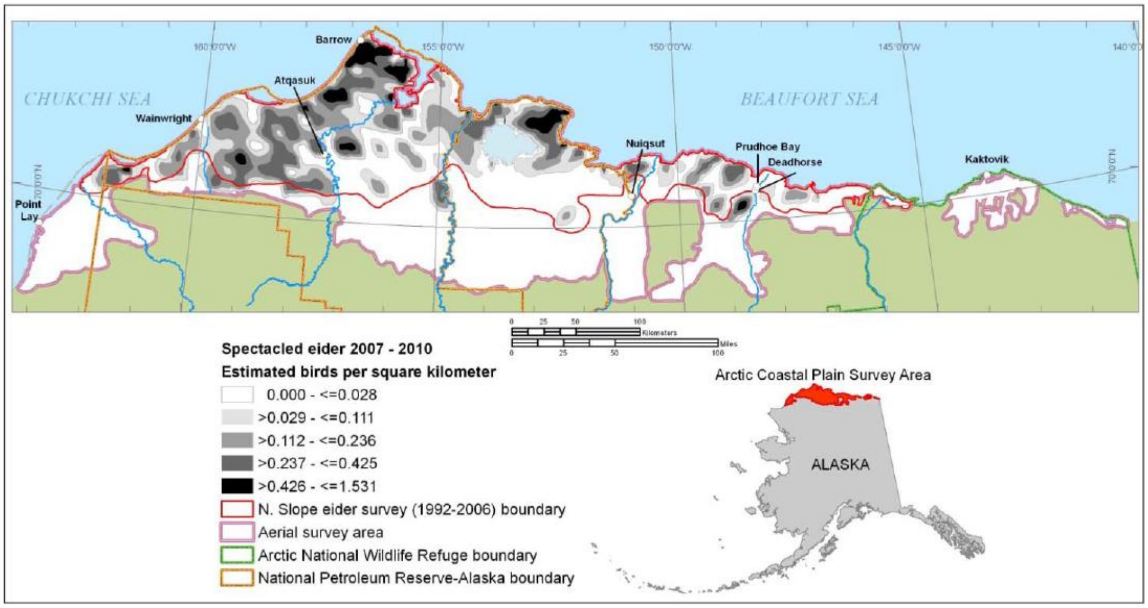

Figure 5.2. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007–2010 (Larned et al. 2011).

Fall migration and molting – As with many other sea ducks, spectacled eiders spend the 8–10 month non-breeding season at sea, but until recently much about the species' life in the marine environment was unknown. Satellite telemetry and aerial surveys led to the discovery of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995), Larned et al. (1995), and Petersen at al. (1999). Results of recent satellite telemetry research (2008–2011) are consistent with earlier studies (Matt Sexson, USGS, pers. comm.). Phenology spring migration and breeding, including arrival, nest initiation, hatch, and fledging, is 3–4 weeks earlier in western Alaska (Y-K Delta) compared to northern Alaska (ACP); however, phenology of fall migration is similar between areas. Individuals depart breeding areas July–September, depending on their breeding status and molt in September–October. (Matt Sexson, USGS, pers. comm.).

Males generally depart breeding areas on the North Slope (ACP) when females begin incubation in late June (Anderson and Cooper 1994, Bart and Earnst 2005). Use of the Beaufort Sea by departing males is variable. Some appear to move directly to the Chukchi Sea over land, while the majority move rapidly (average travel of 1.75 days) over near-shore waters from breeding grounds to the Chukchi Sea (TERA 2002). Of 14 males implanted with satellite transmitters, only four spent an extended period of time (11–30 days), in the Beaufort Sea (TERA 2002). Preferred areas for males appeared to be near large river deltas such as the Colville River where open water is more prevalent in early summer when much of the Beaufort Sea is still frozen. Most adult males marked in northern and western Alaska in a recent satellite telemetry study migrated to northern Russia to molt (USGS, unpublished data). Results from this study also suggest that male eiders likely follow coast lines but also migrate straight across the northern Bering and Chukchi seas in route to northern Russia (Matt Sexson, USGS, pers. comm.).

Females generally depart the breeding grounds later, when much more of the Beaufort Sea is ice-free, allowing for more extensive use of the area. Females spent an average of two weeks in the Beaufort Sea (range 6-30 days) with the western Beaufort Sea used most heavily (TERA 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than the males (Petersen et al. 1999). Greater use of the Beaufort Sea and offshore areas by females was attributed to the greater availability of open water when females depart the area (Petersen et al. 1999, TERA 2002). Recent telemetry data indicates that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid, 2 weeks, compared to 2–3 months spent in the Chukchi Sea (Matt Sexson, USGS, pers. comm.).

Spectacled eiders use specific molting areas from July to late October/early November. Larned et al. (1995) and Petersen et al. (1999) discussed spectacled eiders' apparently strong preference for specific molting locations, and concluded that all spectacled eiders molt in four discrete areas (Table 5.1). Females generally used molting areas nearest their breeding grounds. All marked females from the Y-K Delta molted in nearby Norton Sound, while females from the North Slope molted in Ledyard Bay, along the Russian coast, and near St. Lawrence Island. Males did not show strong molting site fidelity; males from all three breeding areas molted in Ledyard Bay, Mechigmenskiy Bay, and the Indigirka/Kolyma River Delta. Males reached molting areas first, beginning in late June, and remained through mid-October. Non-breeding females, and those that nested but failed, arrived at molting areas in late July, while successfully-breeding females and young of the year reached molting areas in late August through late September and remained through October. Fledged juveniles marked on the Colville River Delta usually staged in the Beaufort Sea near the delta for 2–3 weeks before migrating to the Chukchi Sea.

Avian molt is energetically demanding, especially for species such as spectacled eiders that complete molt in a few weeks. Molting birds must have ample food resources, and the rich benthic community of Ledyard Bay (Feder et al. 1989, 1994a, 1994b) likely provides these for spectacled eiders. Large concentrations of spectacled eiders molt in Ledyard Bay to use this food resource; aerial surveys on 4 days in different years counted 200 to 33,192 molting spectacled eiders in Ledyard Bay (Petersen et al. 1999; Larned et al. 1995).

Wintering – Spectacled eiders generally depart all molting sites in late October/early November (Matt Sexson, USGS, pers. comm.), migrating offshore in the Chukchi and Bering Seas to a single wintering area in openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 5.1B). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 70 m to eat bivalves, other mollusks, and crustaceans (Cottam 1939, Petersen et al. 1998, Lovvorn et al. 2003, Petersen and Douglas 2004).

Table 5.1 Important staging and molting areas for female and male spectacled eiders from each breeding population.

Population and Sex	**Known Staging/Molting Areas**
Arctic Russia Males	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
	Ledyard Bay
Arctic Russia Females	unknown
North Slope Males	Ledyard Bay
	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
North Slope Females	Ledyard Bay
	Mechigmenskiy Bay
	West of St. Lawrence Island
YKD Males	Mechigmenskiy Bay Northeastern Norton Sound
YKD Females	Northeastern Norton Sound

Spring migration – Recent information about spectacled and other eiders indicates they probably make extensive use of the eastern Chukchi spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring aerial observations in the eastern Chukchi have documented dozens to several hundred common eiders (*Somateria mollissima)* and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, University of Wyoming, pers. comm.). Woodby and Divoky (1982) documented large numbers of king eiders (*Somateria spectabilis*) and common eiders using the eastern Chukchi lead system, advancing in pulses during days of following winds, and concluded that an open lead is probably requisite for the spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure 5.3; USGS, unpublished data) suggest that spectacled eiders also use the lead system during spring migration.

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate their eggs while living primarily off body reserves (Korschgen 1977, Drent and Daan 1980, Parker and Holm 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Coulson 1984, Raveling 1979, Parker and Holm 1990). Body reserves must be maintained from winter or acquired during the 4-8 weeks (Lovvorn et al. 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during their spring migration through the Chukchi Sea (including Ledyard Bay). Common eider female body mass increased 20% during the 4-6 weeks prior to egg laying (Gorman and Milne 1971, Milne 1976, Korschgen 1977, Parker and Holm 1990). For spectacled eiders, average female body weight in late March in the Bering Sea was 1,550 ± 35 g (n = 12), and slightly (but not significantly) more upon arrival at breeding sites (1,623 ± 46 g, n = 11; Lovvorn et al. 2003), indicating that spectacled eiders must maintain or enhance their physiological condition during spring staging.

Abundance and trends

Aerial surveys of the population winter in the Bering Sea south of St. Lawrence Island were conducted in 1997 and 1998, and again in 2009. The surveys in 2009 and 2010 provided estimates of 305,260 and 369,122, respectively, which were comparable with 1997 and 1998 estimates of 363,030 and 374,792, respectively (Larned et al. 2012).

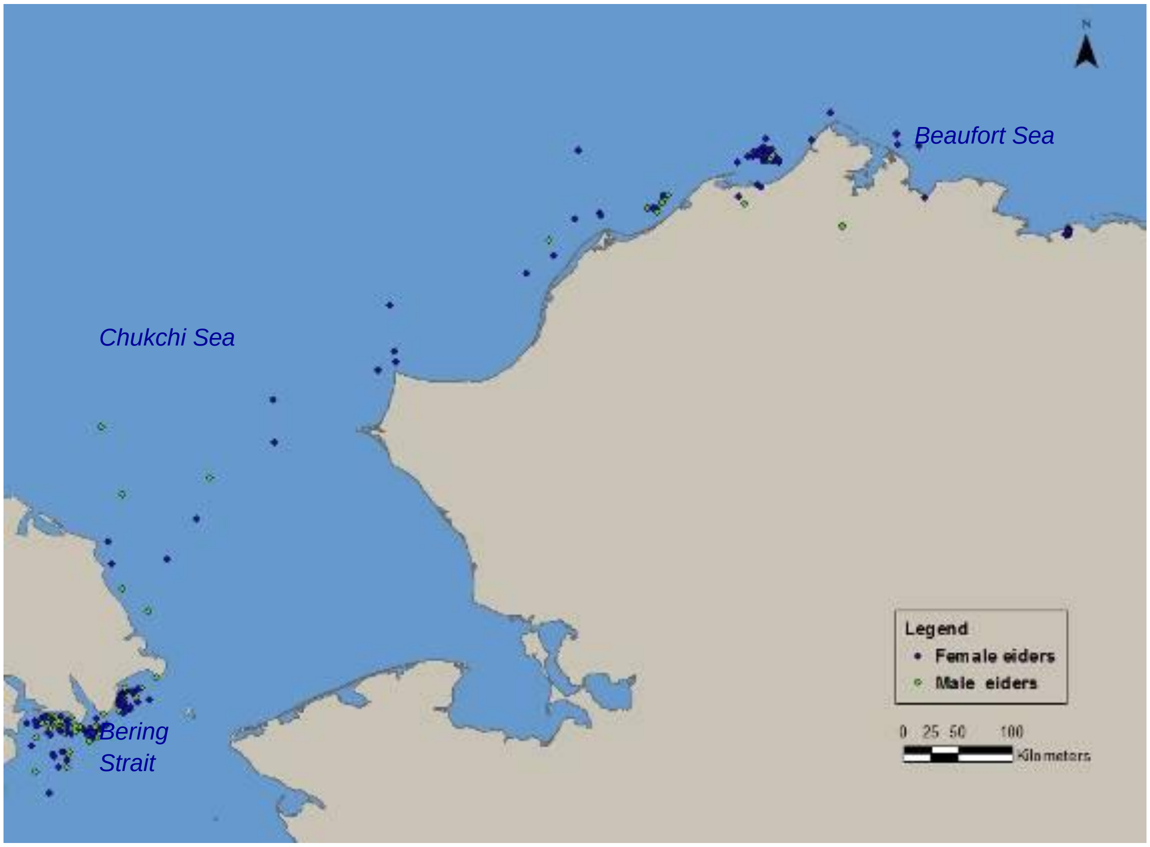

Figure 5.3. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished).

Population indices for North Slope-breeding spectacled eiders are unavailable prior to 1992. However, Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 to 1991 in the Prudhoe Bay area. Since 1992, the Service has conducted annual aerial surveys for breeding spectacled eiders on the ACP. The 2010 population index based on these aerial surveys was 6,286 birds (95% CI, 4,877–7,695; unadjusted for detection probability), which is 4% lower than the 18-year mean (Larned et al 2011). In 2010, the index growth rate was significantly negative for both the long-term (0.987; 95% CI, 0.974–0.999) and most recent 10 years (0.974; 95% CI, 0.950–0.999; Larned et al. 2011). Stehn et al. (2006) developed a North Slope-breeding population estimate of 12,916 based on the 2002–2006 ACP aerial index for spectacled eiders and relationships between ground and aerial surveys on the Y-K Delta. If the same methods are applied to the 2007–2010 ACP aerial index reported in Larned et al (2011), the resulting population estimate for North Slope-breeding spectacled eiders is 11,254 (8,338–14,167, 95% CI).

The Y-K Delta spectacled eider population was thought to be about 4% of historical levels in 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994). They documented a 79% decline in eider nesting between 1969 and 1992 for areas near the Kashunuk River. Aerial and ground survey data indicated that spectacled eiders were undergoing a decline of 9–14% per year from 1985–1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the Y-K Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977).

The decline in abundance evident on the Y-K Delta appears to have reversed I the early 1990s, with continued population recovery since that time (Platte and Stehn 2011, Fischer et al. 2011). Fischer et al. (2011) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the Y-K Delta in 2011 and evaluate long-term trends in the Y-K Delta breeding population from 1985 to 2011. The estimated total number of nests measures the minimum number of breeding pairs in the population in a given year and does not include potential breeders that did not establish nests that year or nests that were destroyed or abandoned at an early stage (Fischer et al. 2011). The total number of nests in 2011 was estimated at 3,608 (SE 448) spectacled eiders nests on the Y-K Delta, the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI = 0.994–1.105) in 2002–2011 and 1.003 (90% CI = 0.991–1.015) in 1985–2011 (Fischer et al. 2011). Log-linear regression based solely on the long-term Y-K Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI = 1.046–1.100) in 2001–2010 and 1.070 (90% CI = 1.058–1.081) in 1988–2010 (Platte and Stehn 2011).

Spectacled eider recovery criteria

The Spectacled Eider Recovery Plan (USFWS 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the Act is no longer required. Although the cause or causes of the spectacled eider population decline is not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al. 1995, Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

Polar Bear

The Service listed the polar bear as threatened throughout its range on May 15, 2008 (USFWS 2008). Polar bears are widely distributed throughout the Arctic where the sea is ice-covered for large portions of the year. Sea ice provides a platform for hunting and feeding, for seeking mates and breeding, for denning, for resting, and for long-distance movement. Polar bears primarily hunt ringed seals, which also depend on sea ice for their survival, but they also consume other marine mammals (USFWS 2008). Because the principal habitat of polar bears is sea ice, it is considered a marine mammal, and is therefore protected under the Marine Mammal Protection Act of 1972 (MMPA).

Distribution and status

Polar bears are distributed throughout regions of arctic and subarctic waters where the sea is ice-covered for large portions of the year. The total number of polar bears worldwide is estimated to be 20,000–25,000 bears (Schliebe et al. 2006). Although movements of individual polar bears overlap extensively, telemetry studies have demonstrated spatial segregation among groups or stocks of polar bears in different regions of their circumpolar range (Schweinsburg and Lee 1982, Amstrup 2000, Garner et al. 1990 and 1994, Messier et al. 1992, Amstrup and Gardner 1994, Ferguson et al. 1999, Carmack and Chapman 2003). Patterns in spatial segregation suggested by telemetry data, along with information from surveys, marking studies, and traditional knowledge, resulted in recognition of 19 partially discrete polar bear groups by the International Union for the Conservation of Nature (IUCN) Polar Bear Specialist Group (PBSG). These 19 groups have been described as management subpopulations (or stocks) in the scientific literature and regulatory actions (IUCN 2006).

Two stocks of polar bears occur in Alaska: the Chukchi/Bering seas (CBS) and Southern Beaufort Sea (SBS) stocks (Figure 5.4). Unlike polar bears in eastern Canada, the Alaskan stocks do not currently spend extended periods of time on land (Garner et al. 1990), with the exception of females that choose to den on land rather than pack ice.

Movement patterns

Telemetry studies indicate polar bear movements are not random, nor do they passively follow ocean currents on the ice as previously thought (Mauritzen et al. 2003) Movement data come almost exclusively from adult female polar bears because male anatomy (their neck is larger than their skull) will not accommodate radio collars. The movements of seven male polar bears surgically implanted with transmitters in 1996 and 1997 were compared to movements of 104 females between 1985 and 1995 (Amstrup et al. 2001). The data indicated males and females had similar activity areas on a monthly basis, but males traveled farther each month (Amstrup et al. 2000). Activity areas have not been determined for many populations, and available information reflects movement data collected prior to recent changes wrought by retreating ice conditions. In the Beaufort Sea, annual activity areas for individually monitored female bears averaged 149,000 km^2 (range 13,000–597,000 km^2, Amstrup et al. 2000). Total annual movements by female bears in the Beaufort Sea averaged 3,415 km and ranged up to 6,200 km, with a movement rate of > 4 km/ hr sometimes sustained for long periods, and movements of > 50 km/day observed (Amstrup et al. 2000). Mean activity area in the Chukchi Sea, which is characterized by highly dynamic ice conditions, was 244,463 km^2 (Garner et al. 1990). Average annual distance moved by CBS female bears was 5,542 km.

Radio-collared females indicate some individuals occupy home ranges (multi-annual activity areas), which they seldom leave (Amstrup 2003). The size of a polar bear's home range is determined, in part, by the annual pattern of freeze-up and break-up of sea ice, and therefore by the distance a bear must travel to access prey (Stirling 1988, Durner et al. 2004). A bear with consistent access to ice, leads, and seals may have a relatively small home range, while bears in areas such as the Barents, Greenland, Chukchi, Bering or Baffin seas may have to move many hundreds of kilometers each year to remain in contact with sea ice from which to hunt (Born et al. 1997, Mauritzen et al. 2001, Ferguson et al. 2001, Amstrup 2003, Wiig et al. 2003).

The CBS population is widely distributed on the pack ice of the northern Bering, Chukchi, and eastern portions of the Eastern Siberian seas (Garner et al. 1990, Garner et al. 1994, Garner et al. 1995). Polar bears are seasonally abundant in the Chukchi Sea and their distribution is influenced by the movement of seasonal pack ice. Polar bears in the Chukchi and Bering seas move south with advancing ice during fall and winter, and move north in advance of receding ice in late spring and early summer (Garner et al. 1990). Polar bears are dependent upon sea ice for foraging and the most productive areas are near ice edges, leads, or polynyas where ocean depth is minimal (Durner et al. 2004). Polar bears can be present along the Alaskan shoreline as they opportunistically scavenge on marine mammal carcasses.

The SBS population occurs between Icy Cape, Alaska on the western boundary and Pearce Point, Northwest Territories (NWT; Amstrup et al. 1986, Amstrup and DeMaster 1988, Stirling et al. 1988). It is thought that nearly all bears in the central coastal region of the Beaufort Sea are from the SBS population, and that proportional representation of SBS bears decreases to both the west and east. For example, only 50% of polar bears occurring in Barrow, Alaska and Tuktoyaktuk, NWT are SBS bears, with the remainder being from the CBS and Northern Beaufort Sea populations.

Feeding

Polar bears derive essentially all their sustenance from marine mammal prey and have evolved a strategy that utilizes the high fat content of marine mammals (Best 1985, Amstrup et al. 2007). Over half the caloric content of a seal carcass occurs in the layer of fat between the skin and underlying muscle (Stirling and McEwan 1975) and polar bears quickly remove the fat layer from beneath the skin after they catch a seal. High fat intake from specializing on marine mammal prey allows polar bears to thrive in the harsh Arctic environment (Stirling and Derocher 1990, Amstrup 2003).

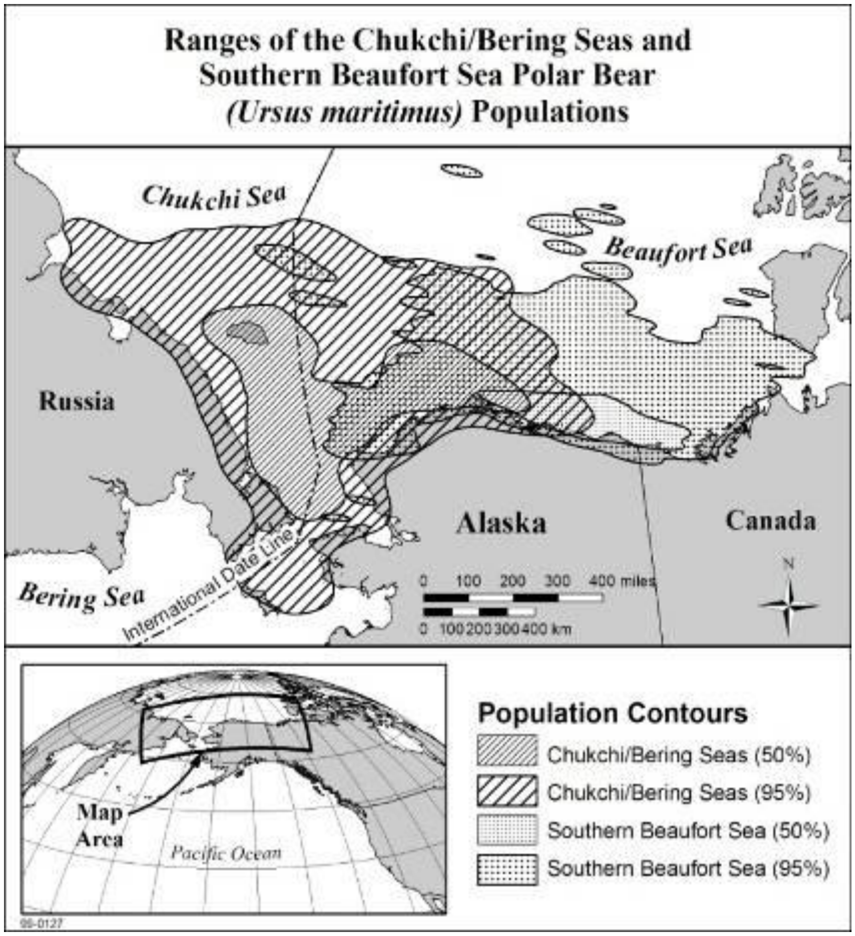

Figure 5.4. Ranges of polar bear stocks in Alaska (USFWS 2009).

Over much of their range, polar bears are dependent on one species of seal, the ringed seal (*Phoca hispida*) (Smith and Stirling 1975, Smith 1980). The relationship between ringed seals and polar bears is so close that the abundance of ringed seals in some areas appears to regulate the density of polar bears, while polar bear predation in turn regulates density and reproductive success of ringed seals (Hammill and Smith 1991, Stirling and Øritsland 1995). Polar bears also occasionally catch belugas (*Delphinapterus leucas*), narwhals (*Monodon monoceros*), walrus (*Odobenus rosmarus divirgens*), and harbor seals (*P. vitulina*) (Smith 1985, Calvert and Stirling 1990, Smith and Sjare 1990, Stirling and Øritsland 1995, Derocher et al. 2002). Where common, bearded seals (*Erignathus barbatus*) can be a large part of polar bear diets, and are probably the second most common prey item (Derocher et al. 2002). The walrus can also be seasonally important in some parts of the polar bear's range (Ovsyanikov 1996).

Polar bears rarely catch seals on land or in open water (Furnell and Oolooyuc 1980); rather they catch seals and other marine mammals at the air-ice-water interface, where aquatic mammals come to breathe (Amstrup et al. 2007). Although there are local exceptions (e.g. Bentzen et al. 2007, Schliebe et al. 2008), it appears that polar bears gain little overall benefit from alternate foods (Amstrup et al. 2007). Therefore, maintenance of polar bear populations is dependent upon marine prey, largely seals, and polar bears are tied to the surface of the ice for effective access to that prey (Amstrup et al. 2007).

Reproduction

Polar bears have an intrinsically low reproductive rate characterized by late age of sexual maturity, small litter sizes, and extended maternal investment in raising young. Female polar bears enter a prolonged estrus between March and June, when breeding occurs. Ovulation is thought to be induced by mating (Wimsatt 1963, Ramsay and Dunbrack 1986, Derocher and Stirling 1992). Implantation is delayed until autumn, and gestation is 195–265 days (Uspenski 1977), with active development of the fetus suspended for most of that time. The timing of implantation, and hence birth, is likely dependent upon body condition of the female, which in turn is dependent upon a variety of environmental factors (Schliebe et al. 2006).

Throughout their range, most pregnant female polar bears excavate dens in snow located on land during September–November after drifts large enough to excavate a snow cave have formed (Harington 1968, Lentfer and Hensel 1980, Ramsay and Stirling 1990, Amstrup and Gardner 1994). In the southern Beaufort Sea, a portion of the population dens in snow caves located on pack- and shore-fast ice. Successful denning by polar bears requires an accumulation of sufficient snow combined with winds to cause snow accumulation leeward of topographic features that create denning habitat (Harington 1968). The common characteristic of all denning habitat is topographic features that catch snow in the autumn and early winter (Durner et al. 2003). Polar bear denning habitat in Alaska includes areas of low relief topography characterized by tundra with riverine banks within approximately 50 km of the coast (Amstrup 1993; Amstrup and Gardner 1994; Durner et al. 2001, 2003), and offshore pack ice pressure ridge habitat. Although the northern Alaskan coast gets minimal snow fall, because the landscape is flat the snow is blown continuously throughout the winter creating drifts in areas of relief.

Fidelity to denning habitat was investigated by Amstrup and Gardner (1994), who located 27 females at up to four successive maternity dens. Bears that denned once on pack ice were more likely to den on pack-ice than on land in subsequent years. Similarly, bears were faithful to general geographic areas – those that denned once in the eastern half of the Alaska coast were more likely to den there than to the west in subsequent years. Annual variations in weather, ice conditions, prey availability, and the long-distance movements of polar bears (Amstrup et al. 1986, Garner et al. 1990) make recurrence of exact denning locations unlikely.

Satellite telemetry studies determined mean dates of den entry in the Beaufort Sea were 11 and 22 November for land (n = 20) and pack ice (n = 16), respectively; however, many pregnant females did not enter dens until late November or early December (Amstrup and Gardner 1994). Female bears foraged until den entry. Mean date of emergence was 26 March for pack-ice dens (n = 10) and 5 April for land dens (n = 18). Messier et al. (1994) reported mean date of den entry and exit varied among years depending upon sea-ice, snow and weather conditions. For bears denning on sea-ice or moving from sea-ice to land denning habitat, time of sea-ice consolidation can alter the onset of denning. Sea-ice dens must be in ice stable enough to stay intact for up to 164 days while possibly moving hundreds of kilometers by currents (Amstrup 2003, Wiig 1998).

Data suggests that an increasing number of SBS females are denning on land. Sixty percent of radio-collared females denned on land from 1996–2006, compared to forty percent in the previous 15 years (Fishbach et al. 2007). The geographic distribution of terrestrial dens also appears to have shifted to the west (USFWS 2006).

Insufficient data exist to accurately quantify polar bear denning locations along the Alaskan Chukchi Sea coast; however, dens in the area are less concentrated than for other areas in the Arctic. The majority of denning of Chukchi Sea polar bears occurs on Wrangel Island, Herald Island, and other locations on the northern Chukotka coast of Russia.

Polar bears give birth in dens during mid-winter (Harington 1968, Ramsay and Dunbrack 1986). Survival and growth of the cubs depends on the warmth and stable environment within the maternal den (Blix and Lentfer 1979). Family groups emerge from dens in March and April when cubs are about three months old and able to survive outside weather conditions (Blix and Lentfer 1979, Amstrup 1995).

Newborn polar bears are very small, weighing approximately 0.6 kg (Blix and Lentfer 1979), and nurse from their hibernating mothers. Cubs grow quickly and may weigh 10-12 kg by the time they emerge from the den about three months later. Young bears stay with their mothers until weaned, which occurs most commonly in early spring when the cubs are 2.3 years of age. Female polar bears are available to breed again after cubs are weaned. Therefore, in most areas, the minimum successful reproductive interval for polar bears is 3 years (Schliebe et al. 2006).

Age of maturation of mammals is often associated with a threshold body mass (Sadleir 1969), and in polar bear populations it appears to be largely dependent on numbers and productivity of ringed seals. In the Beaufort Sea, ringed seal densities are lower in some areas of the Canadian High Arctic and Hudson Bay. As a possible consequence, female polar bears in the Beaufort Sea usually do not breed for the first time until they are 5 years of age (Lentfer and Hensel 1980), giving birth for the first time at 6 years of age.

Litter size and reproduction rates vary by geographic area and may change in response to hunting pressure, environmental factors, and other population perturbations. Litters of two cubs are common (Schliebe et al. 2006), with litters of three cubs occurring sporadically across the Arctic and most commonly reported in the Hudson Bay region (Stirling et al. 1977, Ramsay and Stirling 1988, Derocher and Stirling 1992). Average litter size across the species' range varied from 1.4 to 1.8 cubs (Schliebe et al. 2006), and several studies have linked reproduction to availability of seal prey, especially in the northern portion of their range. Body weights of mother polar bears and their cubs decreased markedly in the mid-1970s in the Beaufort Sea following a decline in ringed and bearded seal pup production (Stirling et al. 1976, 1977, Kingsley 1979, DeMaster et al. 1980, Stirling et al. 1982, Amstrup et al. 1986). Declines in reproductive parameters varied by region and year with ice conditions and the corresponding reduction in numbers and productivity of seals (Amstrup et al. 1986). In the Beaufort Sea, female polar bears produce a litter of cubs at an annual rate of 0.25 litters per adult female (Amstrup 1995).

Polar bear reproduction lends itself to early termination without extensive energetic investment by the female (Ramsay and Dunbrack 1986, Derocher and Stirling 1992). Female polar bears may defer reproduction in favor of survival when foraging conditions are difficult (Derocher et al. 1992). Repeated deferral of reproduction could cause a decline in populations with an intrinsically low rate of growth (Schliebe et al. 2006).

Life span and survivorship

Polar bears are long-lived animals; the oldest known female polar bear in the wild was 32 years and the oldest known male was 28, although few bears in the wild live beyond 20 years (Stirling 1990). Taylor and colleagues (unpublished data) described survival rates that generally increased by age class up to approximately 20 years of age (cubs-of-the-year, 35–75%; subadults 1–4 years, 63–98%; adults 5–20 years, 95–99%; and adults > 20 years 72–99%).

Survival of cubs is dependent upon their weight when they exit maternity dens (Derocher and Stirling 1992), and most cub mortality occurred early in the period immediately following emergence from the den (Amstrup and Durner 1995, Derocher and Stirling 1996), with early mortality generally associated with starvation (Derocher and Stirling 1996). Survival of cubs to the weaning stage (generally 27–28 months) is estimated to range from 15% to 56% of births (Schliebe et al. 2006). Subadult survival rates are poorly understood because telemetry collars cannot be used on rapidly growing individuals. Population age structure indicates subadults 2–5 years survive at lower rates than adults (Amstrup 1995), probably because their hunting and survival skills are not fully developed (Stirling and Latour 1978).

Eberhardt (1985) hypothesized adult survival rates must be in the upper 90% range to sustain polar bear populations. Studies using telemetry monitoring of individual animals (Amstrup and Durner 1995) estimated adult female survival in prime age groups may exceed 96%, and survival estimates are a reflection of the characteristics and qualities of an ecosystem to maintain the health of individual bears (Schliebe et al. 2006).

Abundance and Trends – Alaska Stocks

A reliable population estimate for the CBS stock currently does not exist (USFWS 2010b); however, the best available information at this time suggests a minimum population estimate of 2,000 (USFWS 2010b), based on extrapolation from multiple years of denning data for Wrangel Island in Russia and an assumed population denning rate (IUCN 2006 in USFWS 2010a). Reliable estimates of population size based upon mark and recapture studies are not available for this region. The combined Alaska–Chukotka polar bear harvest is currently believed to exceed sustainable levels, and the status of the CBS polar bear population is considered uncertain or declining (Schliebe et al. 2006).

Estimates of the population size of the SBS were 1,778 from 1972 to 1983 (Amstrup et al. 1986), 1,480 in 1992 (Amstrup 1995), and 2,272 in 2001 (Amstrup, USGS unpublished data). Most recently, Regehr et al. (2006) estimated the SBS to be 1,526 (95% CI = 1,211–1,841), the most current and valid estimate of the SBS population (USFWS 2010c). Declining survival, recruitment, and body size (Regehr et al. 2006, 2007), low growth rates during years of reduced summer and fall sea ice (2004 and 2005), and an overall declining growth rate of 3% per year from 2001–2005 (Hunter et al. 2007), indicate the SBS stock population is declining (USFWS 2010c).

Declines in sea ice have occurred in optimal polar bear habitat in the southern Beaufort and Chukchi seas between 1985 to 1995 and 1996 to 2006, and the greatest declines in 21st century optimal polar bear habitat are predicted to occur in these areas (Durner et al. 2009). These stocks are vulnerable to large-scale dramatic seasonal fluctuations in ice movements which result in decreased abundance and access to prey, and increased energetic costs of hunting. The CBS and the SBS stocks are currently experiencing the initial effects of changes in sea ice conditions (Rode et al. 2010, Regehr et al. 2010, and Hunter et al. 2007). Regehr et al. (2010) found that the vital rates of polar bear survival, breeding rates, and cub survival declined with an increasing number of ice-free days/year over the continental shelf, and suggested that declining sea ice affects these vital rates via increased nutritional stress.

6. ENVIRONMENTAL BASELINE

The environmental baseline provides an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat, and ecosystem in the Action area. The environmental baseline is a “snapshot” of a species’ health at a specified point in time. It does not include the effects of the proposed Action under review in this consultation.

Spectacled Eiders

The North Slope-breeding population of spectacled eiders (approximately 12,916 breeding birds) occupies terrestrial and marine parts of the Action area for significant portions of their life history. Spectacled eiders have undergone significant, unexplained declines in their Alaska-breeding populations, however they breed, molt, and migrate within the Action area, and nest throughout much of the NPR-A.

Specific information about spring migration routes for this species is limited, but it is believed spectacled eiders advance northward similarly to other species of eiders as spring leads develop in the eastern Chukchi Sea ice. Spectacled eiders occupy Ledyard Bay seasonally during their north and south migrations, although the duration of use is not documented in detail. In spring they presumably move through Ledyard Bay as leads open, and in summer and autumn they return utilizing the open waters of Ledyard Bay to molt. Large numbers of molting spectacled eiders are present in Ledyard Bay from late June until late October (Larned et al. 1995, Petersen et al. 1999). Spectacled eiders would not be present in the Action area from approximately November 15 to April 15.

Polar Bears

Polar bears can occur in the Action area. Polar bears generally do not occur inland during the summer, but a slight possibility exists that field crews may encounter transient polar bears when working within a few miles of the coast. In summer and fall, polar bears can be found with a frequently on barrier islands and along the mainland coast. There is also a slight possibility that swimming polar bears could be encountered in near-shore waters.

7. EFFECTS OF THE ACTION ON LISTED SPECIES

This section of the BO provides an analysis of effects of the action on listed species and critical habitat. Both direct effects (i.e., those immediately attributable to the action) and indirect effects (i.e., those caused by the action but which will occur later in time) are considered, as well as interrelated and interdependent effects of the Action.

Spectacled Eiders

The proposed activities may result in disturbance of nesting females and young broods. The severity of disturbance and displacement effects depends upon duration, frequency, and timing of the disturbing activity. Disturbance that results in agitated behavior, flushing, or other movements in response to a stimulus can increase energy costs, especially for birds that are already energetically stressed from cold, lack of food, or physiologically demanding life cycle stages such as reproduction. Birds may be displaced from preferred habitats to areas where resources are less abundant or are of lower quality. Furthermore, eggs exposed by flushed hens or ducklings separated from their brood become more vulnerable to predation. For the proposed Action, we expect the majority of disturbance events would be attributed to aircraft landings and on-tundra activities.

Aircraft landings and on-tundra activities

It is difficult to assess the area within which listed eiders would be flushed by an aircraft landing, however we use the best available data to calculate disturbance. We anticipate a gradient of effect centered on the landing site. A landing close to a nest would likely flush a female and prevent her from returning for as long as the aircraft, and the associated human activity, remains near the nest. The likelihood of a hen flushing and her reluctance to return to the nest likely decreases as distance from the landing site increases. For the purposes of calculating incidental take we assumed that all hens within a 600 m radius of a landing site would be flushed, and hence their nests would be at risk from abandonment or depredation.

After landing, field crews would conduct work over an unspecified area. Some of the proposed studies involve searching a plot, and it would be likely some nesting eiders on the plot would be disturbed. Other work would be conducted along transects, potentially disturbing birds over a narrower linear area. Based on activity descriptions provided by Shell, we do not anticipate these on-tundra activities would disturb birds in an area significantly larger than that impacted by the landing. Therefore, disturbance from landings and on-tundra activities at study locations have been combined for the purposes of estimating incidental take.

Shell estimates that aircraft landings and on-tundra activities would occur at 844 sites during the eider nesting season (between June 5 and August 15) in 2012. The number of aircraft landings at each site would vary from one to several throughout the season, and duration of activities at each site varies from < 1 hour to 8-10 hours.

The estimated average density of spectacled eiders within the combined North Slope Eider Strata of the ACP Survey in 2010 was 0.1157 spectacled eiders/km^2, and hence we assume 0.058 nests/km^2 (Larned et al. 2011). This average density was used to estimate incidental take, as described below.

The number of hens that may be flushed in a radius 600 m from a landing site was calculated multiplying the area (1.13 km^2) by the number of estimated landing sites in 2012, and the average nest density for each species, resulting in an estimate of 55.3 spectacled eider flush events as follows:

844 landing sites x 1.13 km^2 = 953.72 km^2 affected

0.058 spectacled eider nests/km^2 x 953.72 km^2 = 55.32 spectacled eider flush events

Not all flushes would result in a nest being abandoned or depredated. The likelihood of nest abandonment or depredation resulting from aircraft landings and on-tundra activities probably varies among sites based on the number of aircraft landings during the nesting season and the intensity and duration of activities at each site. For example, a site visit that includes one helicopter landing of 15 minutes may result in a lower likelihood of nest abandonment than a site visit requiring several landings and 8-10 hours of on-tundra activity; however, the difference is difficult to quantify. Data from the Y-K Delta indicates that nest disturbance from human activity decreases spectacled eider nest survival rate by 4% (Bowman and Stehn 2003)**,** and 14% (Grand and Flint 1997). For the purposes of estimating effects, we estimate that on average 9% (mean of 4 and 14%) of flushes would result in a nest loss. Hence, the estimated 55.32 flush events would result in the loss of **5 spectacled eider nests** (55.32 x 0.09 = 4.98).

Loss of nests would result in loss of eggs. Loss of eggs is of much lower significance for survival and recovery of the species than the death of an adult bird. For example, spectacled eider nest success recorded on the Y-K Delta ranged from 18-73% (Grand and Flint 1997). From the nests that survived to hatch, spectacled eider duckling survival to 30-days on the Y-K Delta ranged from 25-47% (Flint et al. 2000). Over-winter survival of one-year old spectacled eiders was estimated at 25% (Flint pers. comm.), and annual survival of 2-year old birds (which may enter the breeding population) 80% (Grand et al. 1998). Using these data we estimate for every 100 spectacled eider eggs laid on the Y-K Delta, at most between 1 and 7 may survive to enter the breeding population. Similarly, we expect that only a small proportion of spectacled eider eggs or ducklings on the North Slope would eventually survive to maturity.

Using methods and logic explained above and an average clutch size of 3.9 eggs for spectacled eiders, we estimate loss of production of up to 2 adult spectacled eiders from egg loss due to nest abandonment.

3.9 eggs x 5 nests = 19.5 eggs lost

19.5 eggs lost x 0.09 survival = 1.76 adults lost

Although the loss of 5 nests containing **approximately 20 eggs** may adversely affect spectacled eiders, the Service expects this level of incidental take, and the estimated loss of two adults, would not cause population-level declines.

Polar bears

Because the Service consulted on the effects of authorizing incidental take on polar bears in the Chukchi and Beaufort Sea ITRs BOs, no further consultation on issuing LOAs for incidental take of polar bears is necessary. Therefore, the effects analysis below analyzes effects of issuing LOAs for the intentional take of polar bears

Polar bears may need to be intentionally hazed if they approach terrestrial survey areas. In a separate consultation, the Service concluded that acoustical and vehicular deterrence methods (starting a vehicle or revving an engine) that anyone can perform are not likely to adversely affect polar bears (75 FR 61631), and these methods would not require authorization via LOAs. Intentional take LOAs would allow trained individuals to use mechanisms (e.g., chemical repellants, electric fences, and projectiles such as bean bags projected from a shotgun) to intentionally harass or deter polar bears away from personnel, and would allow the Service to require mitigation measures and ensure minimum standardized training in the use of deterrence methods. Polar bears could experience temporary disturbance and stress from some deterrence activities (e.g., from acoustic devices, or aircraft) and may walk, run or swim away. For healthy bears, any stress they experience from this activity would likely be short term; bears that have walked or swam long distances may experience longer periods of stress and may have to rest elsewhere prior to resuming normal activities such as feeding. Bears that are deterred using more aggressive methods (e.g., projectiles such as bean bags and rubber bullets), would likely experience stress, short-term pain, and could be bruised. In extremely rare circumstances if performed incorrectly, a polar bear may be severely injured or die.

Polar bears occasionally use coastal margins of the Action area in summer and fall, and aircraft, vessels and ground crews associated with the proposed Action may encounter transient bears. These but encounters would likely be infrequent and affect few individuals, particularly for activities occurring inland. If field crews in transit via aircraft encounter polar bears, aircraft noise may cause minor behavioral changes in bears (e.g., may run a short distance). However, as stipulated in the LOA for incidental take, in order to minimize effects if field crews detect a polar bear (per the human – polar bear guidelines) they will divert their flight path to a minimum of 1,500 feet above ground level or ½ mile horizontal distance away from the observed bear(s) unless, in the rare event, human safety dictates otherwise. Furthermore, any disturbance by humans on the ground would likely be minor and temporary, especially because field crews would follow a human-polar bear interaction plan. Additionally, given the low density of polar bears in the Action area, we expect that only a few polar bear interactions would result in intentional take.

Although Shell would have authorization to use projectiles to deter bears away from ground crews, we expect the majority of deterrence events would not involve contact with the bear, and most of these events would cause only minor, temporary, behavioral changes (e.g., a bear runs or swims away). Very few deterrence events would likely use techniques that would contact an individual bear, such as projectiles. For example, from 2006 through 2010, the oil and gas industry reported sightings of 1,414 polar bears, of which 209 (15%) were intentionally harassed, or deterred (C. Perham, pers. communication, email, July 12, 2011). During those previous events 0-5 polar bears were deterred via bean bags and between 0-1were deterred via rubber bullets annually. Therefore, we expect instances of intentional take involving projectiles during the proposed Action would be very rare and although a few individual bears may experience pain, bruising, or stress, we would not expect bears to die. Because the chance of encountering a polar bear in the Action area is low, instances of intentional take would be very rare, and those instances are unlikely to result in the death of a bear, we conclude adverse effects of the proposed action are not likely to cause worldwide population declines in polar bears.

8. CUMULATIVE EFFECTS

Under the ESA, cumulative effects are the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the Action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered because they require separate consultation under the ESA.

The possibility exists that some private citizens may disturb listed species as they travel in the area while hunting, camping, etc. Most of the Action area is remote, and these effects would be insignificant.

9. CONCLUSIONS

After reviewing the current status of spectacled eiders, Alaska-breeding Steller's eiders, yellow-billed loons, polar bears, Pacific Walrus, designated critical habitat, the environmental baseline, effects of the proposed activities, and cumulative effects, it is the Service's biological opinion that the activities to be conducted by Shell from June through October, 2012 described in this BO are not likely to jeopardize the continued existence of listed species. In evaluating the impacts of the proposed project to Steller's eiders, yellow-billed loons, Pacific walrus, polar bear critical habitat and spectacled eider critical habitat, the Service concludes that impacts to these species are discountable and that the proposed action is *not likely to adversely affect* Steller's eiders, yellow-billed loons, or Pacific walrus and is *not likely to adversely affect* designated polar bear critical habitat or spectacled eider critical habitat.

However, in evaluating the impacts of the proposed action to spectacled eiders and polar bears, the Service concludes that the proposed Action could adversely affect these species through disturbance of nesting females and intentional take by deterrence respectively.

The population of spectacled eiders is large (over 360,000 individuals); hence, the estimated loss of 24 eggs is not expected to have significant population-level effects, especially considering the North Slope-breeding spectacled eiders is estimated at 12,916 (10,942-14,890 95% CI; Stehn et al. 2006). The Service expects this level of incidental take would not affect the likelihood of survival and recovery of spectacled eiders. Therefore, the Service concludes the effects of the proposed action, considered together with the status of the species, environmental baseline, and cumulative effects, *are <u>not</u> reasonably likely to jeopardize the continued existence of listed spectacled eiders by reducing appreciably the likelihood of survival and recovery of this species in the wild by reducing their reproduction, numbers, and distribution*.

Given the sparse distribution of polar bears in the Action area, we anticipate that while adverse effects to polar bears may occur from deterrence activities, most effected bears would experience pain, bruising, and temporary stress, but mortalities would be exceptionally rare. This level of impact is not likely to cause population-level declines. Therefore, the Service concludes the effects the proposed action considered together with the status of the species, environmental baseline, and cumulative effects, *are not reasonably likely to jeopardize the continued existence of polar bears by reducing appreciably the likelihood of survival and recovery of these species in the wild by reducing their reproduction, numbers, and distribution*.

10. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, but not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

As described in Section 8 - Effects of the Action, the activities described and assessed in this BO may adversely affect spectacled eiders through disturbance from aircraft landings and people working on the tundra. We anticipate the following take for **spectacled eiders**:

- 55 flush events
- Loss of 20 eggs from 5 abandoned nests

The measures described below are non-discretionary, and must be undertaken by Shell so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. Shell has a continuing duty to regulate activities covered by this incidental take statement. If Shell (1) fails to assume and implement the terms and conditions, or (2) fails to require any applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse.

11. REASONABLE AND PRUDENT MEASURES

These reasonable and prudent measures (RPMs) and their implementing terms and conditions aim to minimize the incidental take anticipated from activities described in this BO. As described in *Section 10 – Incidental Take Statement*, activities conducted by Shell and their agents are anticipated to lead to incidental take of spectacled eiders through disturbance of nesting or brood rearing females. Additional RPMs address incidental take of polar bears and walrus as well as reporting requirements to monitor the effectiveness of RPMs and terms and conditions.

RPM 1 – Work jointly with the Service to minimize impacts of disturbance from aircraft, ground crews, and vessels on listed bird species.

RPM 2 – To minimize effects on polar bears and walrus, Shell must ensure its agents comply with the MMPA and any stipulations required by MMPA take authorizations.

RPM 3 – To monitor implementation of this BO and evaluate its effectiveness both in terms of protecting the species and improving administrative efficiency, the BLM will monitor effects on spectacled eiders.

12. TERMS AND CONDITIONS

To be exempt from the prohibitions of Section 9 of the ESA, BLM and MMM as authorizing agencies, must comply with the following terms and conditions (T&C), which implement the RPMs described above. These terms and conditions are non-discretionary.

RPM 1 – Work jointly with the Service to minimize impacts of disturbance from aircraft, vessels, and ground crews on listed bird species.

> **T&C 1a**. Vessels that encounter flocks along their path will maintain a steady speed (typically 3-8 knots) and divert around these flocks to avoid unnecessary disturbance.
>
> **T&C 1b** . Ground crews that flush hens during on-tundra activities or encounter nests following aircraft landings will not disturb nests or handle eggs and will vacate the area as soon as possible.

RPM 2 – To minimize effects on polar bears and walrus, Shell must ensure its agents comply with the MMPA and any stipulations required by MMPA take authorizations.

> **T&C 2**. Shell will comply with specific conditions and requirements in the incidental and intentional take LOAs.

RPM 3 – To monitor implementation of this BO and evaluate its effectiveness both in terms of protecting the species and improving administrative efficiency, the BLM will monitor effects on spectacled eiders and other listed species.

> **T&C 3a**. To monitor implementation of this BO and evaluate its effectiveness both in terms of protecting the species and improving administrative efficiency, BLM is required to report the location (latitude and longitude), time, and date of all authorized aircraft landings conducted by Shell in undeveloped areas of NPR-A. Data should be provided in decimal degree form, in Microsoft Excel™ spreadsheets, with the latitude and longitude in separate columns. These data should be provided to the Service by December 31, 2012, where it will be used to:

- Assist in determining if the consultation adequately assessed effects (e.g., if activities are concentrated in specific areas, a more region specific density estimate may have been appropriate); and

- Determine if the number and types of activities that actually occurred were accurately estimated.

T&C 3b. Shell will provide the Service and BLM with a report summarizing the results of the coastal bird surveys, including all confirmed sightings of spectacled eiders, Steller's eiders, and yellow-billed loons.

T&C 3c. Shell will provide the Service with a report summarizing all spectacled eider flush events that occur as a result of aircraft landings or on-tundra activities. The report should include the location (latitude and longitude), time, date, and circumstances of each flush event.

The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed Action. The Service believes that no more than **64 flush events (hens flushed from nests) will occur and no more than 24 spectacled eider eggs will be incidentally taken**. If, during the course of the action, this level of incidental take is exceeded, Shell must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs. Additionally, re-initiation of consultation will be required.

13. CONSERVATION RECOMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Shell is encouraged to:

- Schedule compliance inspections, surveys, and other work to avoid the nesting period, especially in areas of NPR-A known to support high densities of listed eiders;
- Communicate with researchers and representatives, and request they consider planning future work such that high use areas and/or the nesting period are avoided;
- Continue to support research that may provide information to strengthen our understanding of Steller's and spectacled eiders, the reasons for their decline, and assist in focusing and conducting recovery efforts; and
- Facilitate coordination of field efforts to reduce duplication of trips and efforts in the same areas.

In order for the Service to be kept informed of actions affecting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

14. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in Shell's letter requesting consultation and supplemental materials pertaining to aircraft landings, near-shore activities near Wainwright, Alaska, and on-tundra activities in remote undeveloped portions of NPR-A from June to October, 2012.

As provided in 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

1) The amount or extent of incidental take is exceeded;
2) New information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3) The agency action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or
4) A new species is listed or critical habitat is designated that may be affected by the action.

Thank you for your cooperation in the development of this biological opinion. If you have any comments or require additional information, please contact Neesha Stellrecht, Acting Endangered Species Branch Chief, Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Fairbanks, Alaska, 99701.

15. LITERAURE CITED

Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. Arctic 46:246–250.

Amstrup, S. C. 1995. Movements, distribution, and population dynamics of polar bears in the Beaufort Sea. Ph.D. Dissertation, University of Alaska Fairbanks, Fairbanks.

Amstrup, S.C., and D.P. DeMaster. 1988. Polar bear, Ursus maritimus. Pages 39-45 in J.W. Lentfer, ed., Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Marine Mammal Commission, Washington, D.C.

Amstrup, S. C., and G. M. Durner. 1995. Survival rates of radio-collared female polar bears and their dependent young. Canadian Journal of Zoology 73:1312–22.

Amstrup, S.C., and C. Gardner. 1994. Polar bear maternity denning in the Beaufort Sea. Journal of Wildlife Management 58(1):1–10.

Amstrup, S.C. 2000. Polar bear. pp. 133–157 *in* J.J. Truett and S.R. Johnson, *eds.* The natural history of an Arctic oilfield: development and the biota. Academic Press, Inc. New York.

Amstrup, S.C., G.M. Durner, I. Stirling, N.J. Lunn, and F. Messier. 2000. Movements and distribution of polar bears in the Beaufort Sea. Canadian Journal of Zoology 78:948–66.

Amstrup, S.C., B.G. Marcot, and D.C. Douglas. 2007. Forecasting the range-wide status of polar bears at selected times in the 21st century. U.S. Geological Survey Administrative Report, Reston, Virginia. 126 pp.

Amstrup, S.C. T.L. McDonald, and I. Stirling. 2001. Polar bears in the Beaufort Sea: a 30-year mark–recapture case history. Journal of Agricultural, Biological, and Environmental Statistics 6(2):221–234.

Amstrup, S.C. 2003. Polar Bear (*Ursus maritimus*). Pages 587–610 *in* Feldhamer, B.C. Thompson, and J.A. Chapman, *eds.* Wild Mammals of North America – Biology, Management, and Conservation. John Hopkins University Press. Baltimore, Maryland

Amstrup, S. C., I. Stirling, and J.W. Lentfer. 1986. Past and present status of polar bears in Alaska. Wildlife Society Bulletin 14: 241–254.

Anderson, B. and B. Cooper. 1994. Distribution and abundance of spectacled eiders in the Kuparuk and Milne Point oilfields, Alaska, 1993. Unpublished report prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska by ABR, Inc., Fairbanks, Alaska, and BBN Systems and Technologies Corp., Canoga Park, CA. 71 pp.

Anderson B., A.A. Stickney, R.J. Ritchie, and B.A. Cooper. 1995. Avian studies in the Kuparuk Oilfield, Alaska, 1994. Unpublished report for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska.

Anderson, B., R. Ritchie, A. Stickney, and A. Wildman. 1998. Avian studies in the Kuparuk oilfield, Alaska, 1998. Unpublished report for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska. 28 pp.

Bart, J. and S.L. Earnst. 2005. Breeding ecology of spectacled eiders *Somateria fischeri* in Northern Alaska. Wildfowl 55:85–100.

Bentzen, T. W., E. H. Follman, S. C. Ampstrup, G. S. York, M. J. Wooller, and T. M. O'Hara. 2007. Variation in winter diet of southern Beaufort Sea polar bears inferred from stable isotope analysis. Canadian Journal of Zoology 85: 596-608.

Best, R.C. 1985. Digestibility of ringed seals by the polar bear. Canadian Journal of Zoology 63:1033–1036.

Blix, A. S., J. K. Lentfer. 1979. Modes of thermal protection in polar bear cubs – at birth and on emergence from the den. American Journal of Physiology 236: R67-R74.

Born, E.W., Ø. Wiig, and J. Thomassen. 1997. Seasonal and annual movements of radio collared polar bears (*Ursus maritimus*) in NE Greenland. Journal of Marine Systems 10:67–77.

Bowman, T., J. Fischer. R. Stehn, and G. Walters. 2002. Population size and production of geese and eiders nesting on the Yukon-Kuskokwim Delta, Alaska in 2002. Field Report. U.S. Fish and Wildlife Service, Waterfowl Management Branch, Anchorage, Alaska. 22 pp.

Bowman, T.D. and R. A. Stehn. 2003. Impact of Investigator Disturbance on Spectacled Eiders and Cackling Canada Geese nesting on the Yukon-Kuskokwim Delta. Unpub. Rept. U.S. Fish and Wildlife Service, Anchorage Alaska 22p.

Calvert, W., and I. Stirling. 1990. Interactions between polar bears and overwintering walruses in the central Canadian High Arctic. International Conference on Bear Research and Management. 8:351-356.

Carmack, E., and D.C. Chapman. 2003. Wind driven shelf/basin exchange on an Arctic shelf: the joint roles of ice cover extent and shelf-break bathymetry. Geophysical Research Letters 30:1778.

Cottam, C. 1939. Food habits of North American diving ducks. USDA Technical Bulletin 643, Washington, D.C.

Coulson, J.C. 1984. The population dynamics of the Eider Duck *Somateria mollissima* and evidence of extensive non-breeding by adult ducks. Ibis 126:525–543.

Dau, C.P. 1974. Nesting biology of the spectacled eider, *Somateria fischeri* (Brandt), on the Yukon–Kuskokwim Delta, Alaska. University of Alaska, Fairbanks, Alaska. M.S. thesis. 72 pp.

Dau, C.P., and S.A. Kistchinski. 1977. Seasonal movements and distribution of the spectacled eider. Wildfowl. 28:65–75.

DeMaster, D. P., M. C. S. Kingsley, and I. Stirling. 1980. A multiple mark and recapture estimate applied to polar bears. Canadian Journal of Zoology. 58(4):633-638.

Derocher, A.E. and Stirling, I. 1992. The population dynamics of polar bears in western Hudson Bay. – In: McCullough, D. R. and Barrett, R. H. (eds.), Wildlife 2001: populations. Elsevier Science Publishers, pp. 1150 – 1159.

Derocher, A. E., I. Stirling, and D. Andriashek. 1992. Pregnancy rates and serum progesterone levels of polar bears in western Hudson Bay. Canadian Journal of Zoology 70: 561-566.

Derocher, A. E., and I. Stirling. 1996. Aspects of survival injuvenile polar bears. Canadian Journal of Zoology 74:1246–1252.

Derocher, A. E., Ø. Wiig, and M. Andersen. 2002. Diet composition of polar bears in Svalbard and the western Barents Sea. Polar Biology. 25(6):448-452.

Drent, R. and S. Daan. 1980. The prudent parent: energetic adjustments in breeding biology. Ardea 68:225–252.

Durner, G. M., S. C. Amstrup, and K. J. Ambrosius. 2001. Remote identification of polar bear maternal den habitat in northern Alaska. Arctic 54:115–21.

Durner, G. M., S. C. Amstrup, and A. S. Fischbach. 2003. Habitat characteristics of polar bear terrestrial maternal den sites in Northern Alaska. Arctic 56:55–62.

Durner, G.M., S.C. Amstrup, R. Nielson, T. McDonald. 2004. Using discrete choice modeling to generate resource selection functions for female polar bears in the Beaufort Sea. Pages 107–120 in S. Huzurbazar (*Ed.*). Resource Selection Methods and Applications: Proceedings of the 1st International Conference on Resource Selection, 13–15 January 2003, Laramie, Wyoming.

Durner G.M, D. C. Douglas, R. M. Nielson, S. C. Ampstrup, T. L. McDonald, I Stirling, M. Mauritzen, E.W. Born, Ø. Wiig, E. DeWeaver, M. C. Serreze, S. E. Belikov, M. M. Holland, J. Maslanik, J. Aars, D. A. Bailey, and A. E. Derocher. 2009. Predicting 21st century polar bear habitat distribution from global climate models. Ecological Monographs 79:25–58.

Ely, C.R., C.P. Dau, and C.A. Babcock. 1994. Decline in population of Spectacled Eiders nesting on the Yukon–Kuskokwim Delta, Alaska. Northwestern Naturalist 75:81–87.

Eberhardt, L. L. 1985. Assessing the dynamics of wild populations. Journal of Wildlife Management 49: 997-1012.

Esler D., J.M. Pearce, J. Hodges, and M.R. Petersen. 1995. Distribution, abundance and nesting ecology of spectacled eiders on the Indigirka River Delta, Russia. Unpublished progress report. National Biological Survey, Alaska Science Center. 12 pp.

Feder, H.M., A.S. Naidu, J.M. Hameedi, S.C. Jewett, and W.R. Johnson. 1989. The Chukchi Sea Continental Shelf: Benthos–Environmental Interactions. Final Report. NOAA–Ocean Assessment Division, Anchorage, Alaska. 294 pp.

Feder, H.M., N.R. Foster, S.C. Jewett, T.J. Weingartner, and R. Baxter. 1994a. Mollusks in the Northeastern Chukchi Sea. Arctic 47(2): 145–163.

Feder, H.M., A.S. Naidu, S.C. Jewett, J.M. Hameedi, W.R. Johnson, and T.E. Whitledge. 1994b. The northeastern Chukchi Sea: benthos–environmental interactions. Marine Ecology Progress Series 111:171–190.

Ferguson, S.H., M.K. Taylor, E.W. Born, A. Rosing-Asvid, and F. Messier. 1999. Determinants of home range size for polar bears (*Ursus maritimus*). Ecology Letters 2:311–18.

Ferguson, S.H., M.K. Taylor, E.W. Born, A. Rosing-Asvid, and F. Messier. 2001. Activity and movement patterns of polar bears inhabiting consolidated versus active pack ice. Arctic 54:49–54.

Fischbach, A.S., S.C. Amstrup, D.C. Douglas. 2007. Landward and eastward shift of Alaskan polar bear denning associated with recent sea ice changes. Polar Biology 30:1395–1405.

Fischer, J.B., R.A. Stehn, and G. Walters. 2011. Nest population size and potential production of geese and spectacled eiders on the Yukon–Kuskokwim Delta, Alaska, 1985–2011. Unpublished Report. U.S. Fish and Wildlife. Service, Anchorage, Alaska. 43 pp.

Flint, P.L and J. B. Grand. 1997. Survival of spectacled eider adult females and ducklings during brood rearing. Journal of Wildlife Management 61:217–221.

Flint, P. L., J. B. Grand, J. A. Morse, and T. F. Fondell. 2000. Late summer survival of adult female and juvenile Spectacled Eiders on the Yukon-Kuskokwim Delta, Alaska. Waterbirds 23:292-297.

Flint, P.L and J. L. Schamber. 2010. Long-term persistence of spent lead shot in tundra wetlands. Journal of Wildlife Management 74:148–151.

Franson, J., M.R. Petersen, C. Meteyer, and M. Smith. 1995. Lead poisoning of spectacled eiders (*Somateria fischeri*) and of a common eider (*Somateria mollissima*) in Alaska. Journal of Wildlife Diseases 31:268–271.

Furnell, D. J., and D. Oolooyuk. 1980. Polar bear predation on ringed seals in ice-free water. Canadian Field-Naturalist. 94(1):88-89.

Gabrielson, M. and N. Graff. 2011 Monitoring of Nesting Spectacled Eiders on Kigigak Island, Yukon Delta NWR, 2011. Unpublished report. U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska 99559. 16 pp.

Garner, G.W., S.T. Knick, and D.C. Douglas. 1990. Seasonal movements of adult female polar bears in the Bering and Chukchi Seas. International Conference on Bear Research and Management 8:219–26.

Garner, G.W., S.C. Amstrup, I. Stirling, and S.E. Belikov. 1994. Habitat considerations for polar bears in the North Pacific Rim. Transactions of the North American Wildlife and Natural Resources Conference 59:111–20.

Garner, G.W., S.E. Belikov, M.S. Stishov, and S.M. Arthur. 1995. Research on polar bears in western Alaska and eastern Russia 1988–92. Pages 155–164 *in* Wiig, O., E.W. Born, and G.W. Garner, *eds*. Polar bears: proceedings of the eleventh working meeting of the IUCN/SSC Polar Bear Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Gorman, M.L. and H. Milne. 1971. Seasonal changes in adrenal steroid tissue of the common eider *Somateria mollissima* and its relation to organic metabolism in normal and oil polluted birds. Ibis 133:218–228.

Grand, J.B. and P.L. Flint. 1997. Productivity of nesting spectacled eiders on the Lower Kashunuk River, Alaska. The Condor 99:926–932.

Grand, J.B., P.L. Flint, and M.R. Petersen. 1998. Effect of lead poisoning on spectacled eiders survival rates. Journal of Wildlife Management 62:1103–1109.

Hammill, M. O., and T. G. Smith. 1991. The role of predation in the ecology of the ringed seal in Barrow Strait, Northwest Territories, Canada. Marine Mammal Science. 7:123-135.

Harington, C. R. 1968. Denning habits of the polar bear (*Ursus maritimus* Phipps). Canadian Wildlife Service Report Ser. 5. 30pp.

Harwood, C. and T. Moran. 1993. Productivity, brood survival, and mortality factors for spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1992. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska. 11pp + Appendix.

Hunter, C.M., H. Caswell, M.C. Runge, E.V. Regehr, S.C. Amstrup, and I. Stirling. 2007. Polar bears in the southern Beaufort Sea II: demographic and population growth in relation to sea ice conditions. U.S. Dept. of the Interior, U.S. Geological Survey Administrative Report. 46 pp.

IUCN. 2006. Status of the polar bear. Pages 33–56 in J. Aars, N.J. Lunn, and A.E. Derocher (Eds.), Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Seattle, United States. IUCN, Gland, Switzerland and Cambridge, UK.

Jay, C. V., B. G. Marcot, D. C. Douglas, 2011: Projected status of the Pacific walrus (*Odobenus rosmarus divergens*) in the twenty-first century. Polar Biol., doi:10.1007/s00300-011-0967-4.

Kingsley, M. C. S. 1979. Fitting the von Bertalanffy growth equation to polar bear age-weight data. Canadian Journal of Zoology 57**:** 1020-1025.

Kondratev, A. and L. Zadorina. 1992. Comparative ecology of the king eider *Somateria spectabilis* and spectacled eider *Somateria fischeri* on the Chaun tundra. Zool. Zhur. 71:99–108. (in Russian; translation by J. Pearce, National Biological Survey, Anchorage, Alaska).

Korschgen, C.E. 1977. Breeding stress of female eiders in Maine. Journal of Wildlife Management 41:360–373.

Lake, B. C. 2007. Nesting Ecology of Spectacled and Common Eiders on Kigigak Island, Yukon Delta NWR, Alaska, 2007. Unpublished report. U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska 99559. 18 pp.

Larned, W., G.R. Balogh, and M.R. Petersen. 1995. Distribution and abundance of spectacled eiders (*Somateria fischeri*) in Ledyard Bay, Alaska, September 1995. Unpublished progress report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 11 pp.

Larned, W.W., R. Platte and R. Stehn. 2009. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2008. Unpublished report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 42 pp.

Larned, W., R. Stehn, and R. Platte. 2010. Waterfowl breeding population survey Arctic Coastal Plain, Alaska 2009. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, AK. 42 pp.

Larned, W., R. Stehn, and R. Platte. 2011. Waterfowl breeding population survey Arctic Coastal Plain, Alaska 2010. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, AK. 52 pp.

Larned, W., K. Bollinger, and R.Stehn. 2012. Late winter population and distribution of Spectacled Eiders (*Somateria fischeri*) in the Bering Sea 2009 and 2010. U.S. Fish and Wildlife Service, Anchorage, AK 23 pp.

Lentfer, J. W., and R. J. Hensel. 1980. Alaskan polar bear denning. International Conference on Bear Research and Management 4:101-108.

Lovvorn, J.R., S.E. Richman, J.M. Grebmeier, and L.W. Cooper. 2003. Diet and body condition of spectacled eiders wintering in the pack ice of the Bering Sea. Polar Biology 26:259–267.

Mauritzen, M., A.E. Derocher, and Ø Wiig. 2001. Space-use strategies of female polar bears in a dynamic sea ice habitat. Canadian Journal of Zoology 79:1704–1713.

Mauritzen, M., A.E. Derocher, O. Pavlova., and Ø. Wiig. 2003. Female polar bears, *Ursus maritimus*, on the Barents Sea drift ice: walking the treadmill. Animal Behavior 66: 107–113.

Messier, F., M.K. Taylor, and M.A. Ramsay. 1992. Seasonal activity patterns of female polar bears (*Ursus maritimus*) in the Canadian Arctic as revealed by satellite telemetry. Journal of Zoology (London) 226:219–29.

Messier, F., M. K. Taylor, and M. A. Ramsay. 1994. Denning ecology of polar bears in the Canadian Arctic Archipelago. Journal of Mammalogy 75:420–30.

Milne, H. 1976. Body weights and carcass composition of the common eider. Wildfowl 27:115–122.

Moran, T. and C. Harwood. 1994. Nesting ecology, brood survival, and movements of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1993. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska. 33 pp + appendix.

Moran, T. 1995. Nesting ecology of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1994. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska. 8pp + appendix.

Ovsyanikov, N. 1996. Polar Bears. Living with the White Bear. Voyager Press, Stillwater, Minnesota. 144 pp.

Parker, H. and H. Holm. 1990. Pattern of nutrient and energy expenditure in female Common eiders nesting in the high arctic. Auk 107:660–668.

Pearce, J.M., D. Esler and A.G. Degtyarev. 1998. Birds of the Indigirka River Delta, Russia: historical and biogeographic comparisons. Arctic 51:361–370.

Petersen, M.R. and D. Douglas. 2004. Winter ecology of spectacled eiders: environmental characteristics and population change. Condor 106:79–94

Petersen, M.R. and P.L. Flint. 2002. Population structure of pacific common eiders breeding in Alaska. Condor 104:780–787.

Petersen, M., D. Douglas, and D. Mulcahy. 1995. Use of implanted satellite transmitters to locate spectacled eiders at sea. Condor 97: 276–278.

Petersen, M.R., J.F. Piatt, and K.A. Trust. 1998. Foods of Spectacled Eiders *Somateria fischeri* in the Bering Sea, Alaska. Wildfowl 49:124–128.

Petersen, M.R., W.W. Larned, and D.C. Douglas. 1999. At-sea distribution of spectacled eiders: a 120-year-old mystery resolved. The Auk 116(4):1009–1020.

Platte, R.M. and R.A. Stehn. 2011. Abundance and trend of waterbirds on Alaska's Yukon–Kuskokwim Delta coast based on 1988 to 2010 aerial surveys. Unpublished report, U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. April 29, 2011. 43 pp.

Quakenbush, L.T., R.S. Suydam, K.M. Fluetsch, & C.L. Donaldson. 1995. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1991–1994. Ecological Services Fairbanks, AK, U.S. Fish & Wildlife Service, Technical Report NAES-TR-95-03. 53 pp.

Ramsay, M. A., R. L. Dunbrack. 1986. Physiological constraints on life-history phenomena: the example of small polar bear cubs at birth. American Naturalist 127: 735-743.

Ramsay, M. A., and I. Stirling. 1988. Reproductive biology of female polar bears (Ursus maritimus). Journal of Zoology (London) 214: 601-634.

Ramsay, M. A., and I. Stirling. 1990. Fidelity of female polar bears to winter-den sites. Journal of Mammalogy 71:233–36.

Raveling, D.G. 1979. The annual cycle of body composition of Canada Geese with special reference to control of reproduction. Auk 96:234–252.

Regehr, E.V., S.C. Amstrup and I. Stirling. 2006. Polar bear population status in the Southern Beaufort Sea. Report Series 2006-1337, U.S. Department of the Interior, U.S. Geological Survey, Anchorage, Alaska. 20pp.

Regehr, E. V., N. J. Lunn, S. C. Amstrup, and I. Stirling. 2007. Effects of earlier sea ice breakup on survival and population size of polar bears in western Hudson Bay. Journal of Wildlife Management 71:2673–2683.

Regehr, E.V., C.M. Hunter, H. Caswell, S.C. Amstrup, and I. Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. Journal of Animal Ecology 79: 117-127. doi: 10.1111/j.1365-2656.2009.01603.x

Rode, K. D., S. C. Amstrup, E. V. Regehr. 2010. Reduced body size and cub recruitment in polar bears associated with sea ice decline. Ecological Applications 20: 768-782.

Sadleir, R. M. F. S. 1969. The ecology of reproduction in wild and domestic mammals. Methuen, London.

Safine, D.E. 2011. Breeding ecology of Steller's and spectacled eiders nesting near Barrow, Alaska, 2008–2010. U. S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 66 pp.

Schliebe, S., T.J. Evans, K. Johnson, M. Roy, S. Miller, C. Hamilton, R. Meehan, and S. Jahrsdoerfer. 2006. Status assessment in response to a petition to list polar bears as a threatened species under the U.S. Endangered Species Act. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, Alaska. 262pp.

Schliebe, S. L., K. D. Rode, J. S. Gleason, J. Wilder, K. Proffitt, T. J. Evans, and S. Miller. 2008. Effects of sea ice extent and food availability on spatial and temporal distribution of polar bears during the fall open-water period in the southern Beaufort Sea. Polar Biology 31:999–1010.

Schweinsburg, R.E. and L.J. Lee. 1982. Movement of four satellite-monitored polar bears in Lancaster Sound, Northwest Territories. Arctic 35:504–11.

Smith, T. G. 1980. Polar bear predation of ringed and bearded seals in the land-fast sea ice habitat. Canadian Journal of Zoology. 58:2201-2209.

Smith, T. G. 1985. Polar bears, *Ursus maritimus*, as predators of belugas, *Delphinapterus leucas*. Canadian Field-Naturalist. 99:71-75.

Smith, L., L. Byrne, C. Johnson, and A. Stickney. 1994. Wildlife studies on the Colville River Delta, Alaska, 1993. Unpublished report prepared for ARCO Alaska, Inc., Anchorage, Alaska. 58 pp.

Smith, T. G., and B. Sjare. 1990. Predation of belugas and narwals by polar bears in nearshore areas of the Canadian High Arctic. Arctic. 43(2):99-102.

Smith, T. G. and I. Stirling. 1975. The breeding habitat of the ringed seal (Phoca hispida). The birth lair and associ-ated structures. Can. J. Zool. 53:1297- 1305.

Stehn, R., C. Dau, B. Conant, and W. Butler. 1993. Decline of spectacled eiders nesting in western Alaska. Arctic 46: 264–277.

Stehn, R., W. Larned, R. Platte, J. Fischer, and T. Bowman. 2006. Spectacled eider status and trend in Alaska. U.S. Fish and Wildlife Service, Anchorage, Alaska. Unpublished Report. 17 pp.

Stirling, I. 1988. Polar bears. University of Michigan Press, Ann Arbor, Michigan, USA. 220 pp.

Stirling, I. 1990. Polar bears and oil: ecological perspectives. Pages 223–34 *in* Geraci, J.R. and D.J. St. Aubin, *eds*. Sea Mammals and Oil: Confronting the Risks. Academic Press, Inc. New York, New York.

Stirling, I., and A.E. Derocher. 1990. Factors affecting the evolution and behavioral ecology of the modern bears. International Conference on Bear Research and Management 8:189–204.

Stirling, I., C. Jonkel, P. Smith, R. Robertson, and D. Cross. 1977. The ecology of the polar bear (*Ursus maritimus*) along the western coast of Hudson Bay. Occasional Paper No. 33. Canadian Wildlife Service, Edmonton, Alberta. 64 pp.

Stirling, I., M. Kingsley, and W. Calvert. 1982. The distribution and abundance of seals in the eastern Beaufort Sea, 1974–79 (Occasional Paper No. 47). Canadian Wildlife Service, Ottawa.

Stirling, I., and P. B. Latour. 1978. Comparative hunting abilities of polar bear cubs of different ages. Canadian Journal of Zoology 56:1768–1772.

Stirling, I. and M. McEwan. 1975. The caloric value of whole ringed seals (*Phoca hispida*) in relation to polar bear (*Ursus maritimus*) ecology and hunting behavior. Canadian Journal of Zoology 53:1021–1027.

Stirling, I., A. M. Pearson, and F. L. Bunnell. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Transactions of the North American Wildlife and Natural Resources Conference 41:421–30.

Stirling, I., and N. A. Øritsland. 1995. Relationships between estimates of ringed seal (*Phoca hispida*) and polar bear (*Ursus maritimus*) populations in the Canadian Arctic. Canadian Journal of Fisheries and Aquatic Sciences. 52:2594-2612.

TERA (Troy Ecological Research Associates). 2002. Spectacled eider movements in the Beaufort Sea: Distribution and timing of use. Report for BP Alaska Inc., Anchorage, Alaska and Bureau of Land Management, Fairbanks, Alaska. 17 pp.

Uspenski, S. M. 1977. Polar Bear and its protection in the Soviet Arctic. Moscow (in Russian)

USFWS. 1993. Final rule to list the Spectacled Eider as threatened. Published 10 May 1993 by the U.S. Fish and Wildlife Service. Federal Register 58(88):27474–27480.

USFWS. 1996. Spectacled Eider Recovery Plan.. Prepared for Region 7, U.S. Fish and Wildlife Service, Anchorage, Alaska. 100 pp + Appendices.

USFWS. 1999. Population status and trends of sea ducks in Alaska. Migratory Bird Management, Anchorage, Alaska.

USFWS. 2006. Marine mammals; incidental take during specified activities. Final rule [to authorize the nonlethal, incidental, unintentional take of small numbers of polar bears and Pacific walruses during year-round oil and gas industry exploration, development, and production and operations in the Beaufort Sea and adjacent northern coast of Alaska]. U.S. Fish and Wildlife Service, Anchorage, Alaska. Federal Register 71:43926–43953.

USFWS. 2008. Determination of threatened status for the polar bear (*Ursus maritimus*) throughout its range; final rule. U.S. Fish and Wildlife Service. Federal Register 73:28212–28303

USFWS. 2009. Designation of critical habitat for the polar bear (*Ursus maritimus*) in the United States. Proposed rule. U.S. Fish and Wildlife Service. Federal Register 74:56058–56086.

USFWS. 2010a. Designation of critical habitat for the polar bear (*Ursus maritimus*) in the United States. Final rule. U.S. Fish and Wildlife Service. Federal Register 75:76086–76137.

USFWS. 2010b. Polar bear (*Ursus maritimus*): Chukchi/Bering Seas stock. Stock Assessment Report. U. S. Fish and Wildlife Service, Anchorage, Alaska. 9 pp.

USFWS. 2010c. Polar bear (*Ursus maritimus*): southern Beaufort Sea stock. Stock Assessment Report. U. S. Fish and Wildlife Service, Anchorage, Alaska. 9 pp

USFWS. 2011. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the Pacific walrus as endangered or threatened; proposed rule. Published 10 February 2011 by the U.S. Fish and Wildlife Service. Federal Register 76:7634–7679.

Warnock, N. and D. Troy. 1992. Distribution and abundance of spectacled eiders at Prudhoe Bay, Alaska: 1991. Unpublished report prepared for BP Exploration (Alaska) Inc., Environmental and Regulatory Affairs Department, Anchorage, Alaska, by Troy Ecological Research Associates (TERA), Anchorage, Alaska. 20 pp.

Wiig Ø., E.W. Born, and L.T. Pedersen. 2003. Movements of female polar bears (*Ursus maritimus*)in the East Greenland pack ice. Polar Biology 26:509–516.

Wimsatt, W. A. 1963. Delayed implantation in the Ur-sidae, with particular reference to the black bear (Ursus americanus Pallas). Pages 49-76 in A. C. Enders, ed. Delayed implantation. Univ. Chicago Press, Chicago.

Woodby, D.A. and G.J. Divoky. 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35: 403–410.