March 13, 2003

In reply, refer to:
AFWFO

Mr. Al Ewing
Denali Commission
510 L Street, Suite 410
Peterson Tower
Anchorage, Alaska 99501

Subject: Biological Opinion regarding upgrading and expanding a bulk fuel facility in Nelson Lagoon, Alaska, on the Threatened Steller's Eider (*Polysticta stelleri*) (consultation number 2002-0127).

Dear Mr. Ewing,

Enclosed is the Fish and Wildlife Service's Biological Opinion based on our review of the proposed upgrades to and expansion of the bulk fuel storage facility Nelson Lagoon, Alaska, and its effects on the Steller's eider (*Polysticta stelleri*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). This letter provides only a summary of the findings included in the Biological Opinion where a complete discussion of the effects analyses is provided. Because of their shared responsibilities in this project, a similar letter and the same Biological Opinion have been sent to Kristin Holzinger, Bureau of Indian Affairs (BIA).

This Biological Opinion is based on information provided in the Conceptual Design Report (CE2 Engineering, Inc 2002), distribution and abundance survey data, and other information available in our files and from experts within and outside federal government agencies. The complete administrative record for this consultation is on file at the Anchorage Fish and Wildlife Field Office.

Following is a summary of the consultation history for this project:

- On September 21, 2001, we received a list of Denali Commission funded bulk fuel upgrade projects scheduled for construction in 2002 at various locations in Alaska from Alaska Energy Authority (AEA).
- On February 1, 2002, we provided your office with a letter outlining our preliminary determinations of "no species present" and "not likely to adversely affect", and identified projects requiring further review. Nelson Lagoon bulk fuel upgrades were among those requiring additional review.
- On April 1, 2002, Anne Hershleb, CE2 Engineering, Inc., in a telephone conversation with Charla Sterne, discussed the contents of the Environmental Assessment (EA), the analysis area, and information needs.
- On April 24, 2002, Bryan Carey, Alaska Energy Authority (AEA) requested initiation of formal consultation.
- On April 25, 2002, the Service received the EA for the Nelson Lagoon bulk fuel upgrades.
- On June 18, 2002, a letter requesting more information on the Nelson Lagoon bulk fuel project was sent to Al Ewing.
- On July 16, 2002, the Service received the requested information, and formal consultation was initiated.
- On October 29, 2002, Ellen Lance toured pipe supply warehouses with CE2 Engineers, Inc. to better understand the materials used in the upgrades. Additionally, possible design modifications for the bulk fuel upgrades were discussed.
- On October 29, 2002, the Service received a request from Kristin Holzinger, BIA, to include the BIA action of the sale of Native allotment AA-007094 to the Nelson Lagoon Village Council, which is the site identified for the upgraded bulk fuel facility.
- On October 30, 2002, Ellen Lance, Anne Herschleb, and Bryan Carey met to discuss the proposed project, the action area, concerns of the Service, possible design modifications, and potential terms and conditions.
- On November 3 and 4, 2002, Ellen Lance and Anne Herschleb conducted a site visit to Nelson Lagoon and met with Butch Gundersen, Nelson Lagoon Enterprises, to discuss possible modifications to the bulk fuel facility design and possible terms and conditions.
- On November 27, 2002, the Draft Biological Opinion was submitted to the DC and BIA.
- On December 6, 2002, Ellen Lance and Kristin Holzinger discussed the content of the Draft Biological Opinion and the Terms and Conditions.
- On December 12, 2002, Ellen Lance, Greg Balogh, Ann Rappoport, Lenny Corin, and Kim Trust (Service) met with Kristin Holzinger (BIA; teleconference), Al Ewing and Kathy Prentke (DC), Bryan Carey and Chris Mello (AEA), Butch Gundersen (Nelson Lagoon Village Council), Anne Herschleb (CE2 Engineering), and Abraham Snyder (Alaska Realty Consortium) to discuss the Terms and Conditions of the Draft Biological Opinion. At that time, BIA indicated they would be willing to fund the development of the GRS (T&C 1.3), and the Service indicated they would be willing to cover the cost of supplying funding for transporting dead bird carcasses to Anchorage (T&C 2.1) and for the purchase of fuel collars (Conservation Recommendation).

- On January 9, 2003, Ellen Lance, Anne Herschleb, and Butch Gundersen met to discuss progress in meeting the Terms and Conditions. At that time Ellen Lance discussed moving the T&C requiring funding and execution of a blue muscle monitoring study to Conservation Recommendations. This modification from the Draft Biological Opinion would allow for the Nelson Lagoon Village Council to partner with the Service on competitive grants to fund the monitoring study, while allowing the project to move forward.
- On February 21, 2003, Kristin Holzinger (BIA) submitted a letter of intent to Nelson Lagoon Village Council for the funding of the GRS. Affirmative response by the Nelson Lagoon Village Council was requested from BIA for the issuance of the Final Biological Opinion.
- On March 10, 2003, a copy of a letter from Butch Gundersen to Kristin Holzinger was received by the Service. This letter acknowledges receipt of the February 21 letter of intent to fund the GRS, and states the intent of the Nelson Lagoon Tribal Council to apply for the grant funds.

Evaluation of direct and indirect effects of the upgrade and expansion of the bulk fuel facility in Nelson Lagoon indicates that the upgrade of the facility, using modern designs and meeting regulatory responsibilities, will reduce the risk of catastrophic oil spills into Nelson Lagoon. However, expansion of the bulk fuel facility by 50% to allow for community growth, which will include a seafood processing facility, will likely result in adverse effects to Steller's eiders and their habitat. The adverse effects are likely to be realized through increased chronic fuel spills and increased probability of boat/bird strikes, due to a projected increase in fishing vessel activity in Nelson Lagoon. Furthermore, although there is a likelihood of fuel spills related to the transfer of fuel from the fuel barge to the distribution lines of the bulk fuel facility, it is difficult to predict.

After reviewing all available information on the location, timing of construction, and facility operation, along with the anticipated effects of the proposed action and the best available information on the status, distribution, and life history of the Steller's eider, it is the Service's Biological Opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species or cause adverse modification to designated critical habitat.

This Biological Opinion includes Reasonable and Prudent Measures and Terms and Conditions that the Service believes will minimize the impacts of incidental take of Steller's eiders resulting from the proposed project. In order to be exempt from the prohibitions of section 9 of the ESA, the local project sponsors must comply with the terms and conditions, which implement the reasonable and prudent measures.

Recognizing the complexity of this issue, the high numbers of Steller's eiders that use Nelson Lagoon for wintering, molting, and staging (up to 75,000), and the length of time in which this use occurs (July through May), the consultation process has taken extra time. We thank you for your cooperation in meeting our joint responsibilities under section 7 of the Endangered Species Act. Please call me at (907) 271-2787, or Endangered Species Biologist Ellen Lance at (907) 271-1467 if you have any questions or concerns.

Sincerely,

Ann G. Rappoport
Field Supervisor

Enclosure

cc: Bryan Carey, Alaska Energy Authority
Anne Herschleb, CE2 Engineering, Inc.
Paul (Butch) Gundersen, Nelson Lagoon Tribal Council

BIOLOGICAL OPINION

The Effects of Upgrading and Expanding a Bulk Fuel Facility in Nelson Lagoon, Alaska, on the Threatened Steller's Eider (*Polysticta stelleri*).

DESCRIPTION OF PROPOSED ACTION

The Denali Commission (DC) and Bureau of Indian Affairs/Alaska Regional Office (BIA), together with the Alaska Energy Authority/Rural Energy Group (AEA) and Nelson Lagoon Enterprises (a subsidiary of the Nelson Lagoon Village Council), propose the upgrade and expansion of the bulk fuel storage facility in the Village of Nelson Lagoon, Alaska. This is the only bulk fuel storage facility in Nelson Lagoon.

The threatened Steller's eider (*Polysticta stelleri*) stages, molts, and winters in high numbers in the waters of and adjacent to Nelson Lagoon. Because the proposed project occurs within designated critical habitat, the U.S. Fish and Wildlife Service (Service) has undertaken formal consultation with the proponents of the bulk fuel project.

The proposed bulk fuel facility will provide a 50% increase in fuel storage capacity to accommodate an anticipated 2.5% annual growth in the population of Nelson Lagoon over the next 10 years, and includes the construction and operation of a new seafood processing facility, the construction and operation of a new water treatment facility, and the construction and operation of a new community building and clinic (CE2 Engineers 2002). Additionally, the proposed bulk fuel facility will follow modern fuel system designs, and incorporate safety features that assure compliance with State and Federal regulations and codes that govern design and operation of fuel storage facilities.

The existing fuel storage facility in Nelson Lagoon is located between Airport Road and the city dock (within 150 feet of shoreline), and consists of seven, 20,000-gallon horizontal, domed end, double wall, skid mounted, welded stainless steel tanks with a total shell capacity of 140,000 gallons. The existing facility in Nelson Lagoon was identified, during an evaluation by AEA of rural bulk fuel facilities, as the facility with the highest need for upgrade due to its deficiencies. The list of deficiencies includes:

1. Improper storage tank construction (wall thickness of the stainless steel tanks fails to meet required minimum thickness).
2. No dikes (diking is required for double wall tanks greater than 12,000 gallons).
3. Inadequate fencing.
4. No warning or identification signs. Tanks not properly labeled.
5. No fire extinguishers.
6. Inadequate separation distance between dispensing tanks and the dispensers (minimum separation of 50 feet is required).
7. No anti-siphon device or solenoid valve on the dispensing tanks.
8. Dispensers located in a confined enclosure.
9. No emergency venting on the secondary tanks.
10. Improper bronze valves on 1-inch distribution lines.

11. No flexible connectors in the manifold piping.
12. Valves are not locked.
13. No fill drip pan (an 84 gallon drip pan is required beneath each hose connection point).
14. No pressure relief valves.
15. No Spill Control and Countermeasures Plan (SPCC) or Facility Response Plan as required by the Environmental Protection Agency (EPA).
16. No Oil Spill Response Plan or Facility Operations Manual as required by the U.S. Coast Guard (CG).

The Nelson Lagoon bulk fuel facility upgrade and expansion project is funded by the DC, with the Nelson Lagoon Village Council the Grantee. The AEA assigned CE2 Engineers, a professional construction management firm, to assist the Nelson Lagoon Village Council with project design and construction. The Nelson Lagoon Corporation will own the completed facility, with Nelson Lagoon Enterprises operating the facility.

The proposed facility will be relocated to a 2-acre parcel of land, on the north side of Airport Road, approximately 1000 feet from the city dock at the southeast corner (Figure 1). The land is currently undeveloped, dominated by beach grass on gently rolling, sandy substrate. The elevation of the parcel averages 16 feet above MLLW, above potential flood zones, and has road access. The 2-acre parcel is Native allotment (AA-007094), owned by the Gundersen family of Nelson Lagoon. The Alaska Realty Consortium, contracted by BIA, will administer the preparation of the land sale transaction. Final approval of the land sale is under the authority of the BIA. The scope of this section 7 consultation includes the sale of Native allotment AA-007094 to the Nelson Lagoon Village Council, and the upgrade and expansion of the bulk fuel facility.

Figure 1. Location of the proposed bulk fuel facility in the village of Nelson Lagoon, Alaska.

Construction of the proposed bulk fuel facility is scheduled to begin in July of 2003, and continue through fall of 2004. The proposed bulk fuel facility will receive five types of fuel by barge delivery, including propane, which will be delivered in 100-lb and 420-lb bottles. Diesel fuels (#1 and #2), unleaded gasoline, and aviation gas will be delivered from a fuel barge through three separate 3-inch cargo lines installed in parallel in a pipe rack on the east side of the dock. Check valves, isolation valves, and drip pans with a capacity greater than 84 gallons each will be installed at the fuel barge connection points. The cargo lines will be buried underneath Airport Road within a 20-foot easement for approximately 500 feet, and continue underground along the southeast boundary of the site to the diked containment area. Within the diked containment area, six new 25,000-gallon storage tanks for diesel storage and four new 15,000-gallon storage tanks for gasoline will be housed. Additionally, the diked area will contain three 4,000-gallon, single-walled dispensing tanks for heating oil, unleaded gasoline, and aviation gas, and two single-walled “BIA” style tanks (9,000- and 9,800-gallon) to be used as spill recovery tanks. A fourth, 3-inch schedule 80 distribution line will supply #2 diesel to the power plant.

Adjacent to the diked area will be a truck loading rack to fill the utility fuel truck for home delivery of heating fuel. The truck fill area will be contained by a curbed concrete basin, with a floor drain. Water collected by the drain will flow to an oil water separator. Three single product dispensers will be located nearby for sale of heating oil, unleaded gasoline, and aviation gas. Dispensers will be controlled with a remote access panel, located in the sales office. An employee of Nelson Lagoon Enterprises will dispense fuels. No marine fueling facilities are planned for this project, however, this may be considered in the future.

An 8-foot x 10-foot electrical control building and a 36-foot by 24-foot service building, containing an office with a retail sales counter, shop, and garage for the fuel delivery vehicle will also be located adjacent to the diked area. Moreover, adjacent to the new buildings, a roofed and fenced storage area will be constructed to house full 100 lb and 420-lb propane bottles. An additional 40-foot x 20-foot fenced area will be constructed for the storage of empty propane cylinders.

Site preparation for the new facility will include removal of the root mat and organic topsoil, which will be moved and stockpiled for later revegetation. The construction footprint will be graded, and surplus material will be temporarily stockpiled on-site. Secondary containment, required to be of sufficient volume to hold the contents of the largest tank plus freeboard to contain accumulated precipitation (12 inches for Nelson Lagoon), will be constructed with a composite metal section of sloping corrugated metal sidewall, supported by a steel frame, and founded on timbers. The dike will be lined with a membrane compatible with diesel and gasoline, a non-woven geotextile fabric installed above and below the liner, and a 4-inch deep layer of rounded 1-inch minus, beach gravel over the liner.

Tanks, pipes, valves, and fittings in the proposed facility will be new materials, except for two spill containment tanks. Six new 25,000-gallon single-walled, horizontal cylindrical tanks for diesel, and four new 15,000-gallon single-walled, horizontal cylindrical tanks for unleaded and aviation gasoline will be shop built, lain on skid foundations, and appropriately labeled (Table 1). All tanks will be equipped with manholes, flanged valve connections, water draw valves, pressure/vacuum whistle vents, emergency vents, and level gages. Above grade, 3-inch piping will be schedule 40 black steel, and 2-inch piping and smaller will be schedule 80 black steel. Below ground piping will be schedule 80 steel with a high-density polyethylene coating and cathodic protection. Piping joints will be welded or flanged, except for connections to pumps, which may be threaded. All connections to pumps and tanks will be made with stainless steel flexible connectors. Transfer and dispensing pumps will be submersible style and equipped with anti-siphon valves.

Table 1. Number, size, and capacity of fuel tanks for the proposed bulk fuel facility upgrade at Nelson Lagoon, Alaska.

Fuel Type	Design Gross Shell Volume (Gallons)	Proposed Tank Shell Size (Gallons)	Proposed Number of Tanks	Proposed Gross Shell Volume (Gallons)
#1 Diesel Fuel	63,556	25,000	3	75,000
#2 Diesel Fuel	73,333	25,000	3	75,000
Unleaded Gasoline	25,666	15,000	2	30,000
Aviation Gasoline	30,555	15,000	2	30,000

A 6-foot high chain link fence with three-strand barbed wire top will enclose the diked area, propane storage and sale area, and control building. Outside of the fenced area, all valves will have lockable handles to prevent theft and vandalism. Security lighting will be installed at the retail dispensers, bulk transfer station, and diked storage area. Lighting will be yellow or white, and shielded downward.

STATUS OF THE SPECIES

Species Description

The Steller's eider was listed as a threatened species on June 11, 1997 (62 FR 31748). Critical habitat was designated for the Steller's eider on February 6, 2001 (65 FR 13262). The Steller's eider is the smallest of the eiders. The average weight of adult male and female Steller's eiders is 1.94 pounds (Bellrose 1980). Adult male Steller's eiders in breeding plumage have a black back, white shoulders, and a chestnut brown breast and belly. The males have a white head with black eye patches; they also have a black chin patch and a small greenish patch on the back of the head. Females and juveniles are mottled dark brown.

Life History

Longevity

Steller's eiders are long lived, with individuals known to have lived at least as long as 21 years and 4 months in the wild (band number 647-66747). Other ages recorded for this species in the wild are 20 years, 4 months (band numbers 647-66757 and 1077-13265), 19 years, 3 months (band number 647-64547), and 16 years (band numbers 1157-01787 and 1157-01876)(Chris Dau, Sevice, pers. comm.).

Energetics

Goudie and Ankney (1986) suggest that small-bodied sea ducks such as harlequin (*Histrionicus histrionicus*) and long-tailed ducks (*Clangula hyemalis*) that winter at northern latitudes do so near the limits of their energetic threshold. These species have little flexibility in regards to caloric consumption or in their opportunity to rely on caloric reserves. Under this life history strategy, such species are vulnerable to perturbations within their winter habitat. Because the Steller's eider is relatively small-bodied, being intermediate in size to the harlequin and long-tailed ducks (Bellrose 1980), and because it overlaps with harlequins and long-tailed ducks in its choice of foraging areas and prey items, the species may, like the harlequin and long-tailed ducks, exist near its energetic limits. Unlike other larger eiders, Steller's eiders must continue to feed upon reaching their nesting areas, to build up enough energy reserves to breed (D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.). In addition, female Steller's eiders must continue to feed during incubation. Spectacled eiders, a larger bodied sea duck, apparently do not exist so close to their energetic threshold; they arrive on the nesting grounds fit enough to fast through egg laying and incubation.

Age to Maturity

Sexual maturity is believed to be deferred to the second year (Bellrose 1980).

Reproductive Strategy

Johnsgard (1994) indicated that pair formation for most sea ducks occurs in fall and spring. Metzner (1993) hypothesized that Steller's eiders at Izembek Lagoon and Cold Bay paired in the spring because they were apparently too preoccupied with feeding during the fall and winter to form pair bonds. The length of time that Steller's eiders remain paired is unknown. However, long-term pair bonds have been documented in other ducks (Bengtson 1972, Savard 1985).

Pairs of Steller's eiders arrive at Point Barrow as early as June 5 (Bent 1987). While nesting, Steller's eiders often occupy shallow coastal wetlands in association with tundra (Bent 1987, Quakenbush et al. 1995, Solovieva 1997), although we have records of aerial observations of Steller's eider pairs well inland on the Arctic Coastal Plain. This species establishes nests near shallow ponds or lakes, usually close to water.

Clutch size has been reported to range from two to ten eggs (Bent 1987, Bellrose 1980, Quakenbush et al. 1995). The average clutch size of successful nests near Barrow is reported as 4.6 (n = 8). Solovieva (1997) found that clutch size for Steller's eiders on the Lena Delta varied between five and eight eggs with an average of 6.1 (n = 32). Nesting success near Barrow (percent of nests where eggs hatch) is variable (Quakenbush et al. 1995). In 1991, five of six nests hatched while in 1993, only four of 20 nests hatched. During some years, the species apparently does not even attempt to nest near Barrow (Quakenbush et al. 1995).

Recruitment

Steller's eider recruitment rate (the percentage of fledged birds that reach sexual maturity) is unknown. However, there is limited information regarding Steller's eider fledging rate. Near Barrow, 83.3 percent (five of six) of Steller's eiders nests with eggs hatched in 1991, 20.0 percent (four of 20) hatched in 1993 (Quakenbush et al. 1995), and 15 percent (three of 20) hatched in 2000 (Philip Martin, Service, pers. comm.). In other years, Steller's eiders do not even attempt to breed near Barrow (Philip Martin, Service, pers. comm., Quakenbush et al. 1995). We conclude that the annual recruitment rate for this species is likely variable.

Seasonal Distribution Patterns

Banded and Satellite-Tagged Alaskan Breeding Birds: Little is known of the distribution of Alaska breeding Steller's eiders outside of the breeding season. A few band recoveries indicate that birds that breed near Barrow undergo molt in Izembek Lagoon. A satellite telemetry study was initiated in 2000 to investigate the molting and wintering locations of the Alaskan population of Steller's eiders. Satellite transmitters were placed on four Steller's eiders captured in Barrow. Two Steller's eiders (one male and one female) spent the molting season on the Kuskokwim Shoals, while a third (a male) molted near the Seal Islands (Philip Martin, Service, pers. comm.). Both birds that molted at Kuskokwim Shoals moved on to the Hook Bay portion of Bechevin Bay in November. The male remained in Hook Bay at least until late December when his transmitter stopped working. The female remained at Hook Bay until early February, at which time she returned to Izembeck Lagoon and remained there into spring. The bird that molted near the Seal Islands moved west to Nelson Lagoon in October. After spending approximately 3 weeks at Nelson Lagoon, this bird moved west to Sanak Island at the end of November. The bird remained at Sanak Island for 3 months. During this time his use area was small, only a few square kilometers. By March 4, he had moved back to Izembek Lagoon in the vicinity of his November locations (Philip Martin, Service, pers. comm.).

Breeding Distribution: The exact historical breeding range of the Alaska-breeding population of Steller's eiders is not clear. The historical breeding range may have extended discontinuously from the eastern Aleutian Islands to the western and northern Alaska coasts, possibly as far east as the Canadian border. In more recent times, breeding occurred in two general areas, the Arctic Coastal Plain, and western Alaska, primarily on the Y-K Delta. Currently, Steller's eiders breed on the western Arctic Coastal Plain in northern Alaska, from approximately Point Lay east to Prudhoe Bay, and in extremely low numbers on the Y-K Delta.

On the Arctic Coastal Plain, anecdotal historical records indicate that the species occurred from Wainwright east, nearly to the Alaska-Canada border (Anderson 1913; Brooks 1915). There are very few nesting records from the eastern Arctic Coastal Plain, however, so it is unknown if the species commonly nested there or not. Currently, the species predominantly breeds on the western Arctic Coastal Plain, in the northern half of the National Petroleum Reserve - Alaska (NPR-A). The majority of sightings in the last decade have occurred east of the mouth of the Utukok River, west of the Colville River, and within 90 km (56 mi) of the coast. Within this extensive area, Steller's eiders generally breed at very low densities.

The Steller's eider was considered a locally "common" breeder in the intertidal, central Y-K Delta by naturalists early in the 1900s (Murie 1924; Conover 1926; Gillham 1941;

Brandt 1943), but the bird was reported to breed in only a few locations. By the 1960s or 70s, the species had become extremely rare on the Y-K Delta, and only six nests have been found in the 1990s (Flint and Herzog 1999). One to two nests continue to be found each year during the course of extensive ground-based waterfowl research and surveys. Given the paucity of early-recorded observations, only subjective estimates can be made of the Steller's eider's historical abundance or distribution on the Y-K Delta.

A few Steller's eiders were reportedly found nesting in other locations in western Alaska, including the Aleutian Islands in the 1870s and 80s (Gabrielson and Lincoln 1959), Alaska Peninsula in the 1880s or 90s (Murie and Scheffer 1959), Seward Peninsula in the 1870s (Portenko 1972), and on Saint Lawrence Island as recently as the 1950s (Fay and Cade 1959). It is unknown how regularly these areas were used or whether the species ever nested in intervening areas.

<u>Post-Breeding Distribution and Fall Migration</u>: Following breeding, males and some females with failed nests depart their Russian nesting area and return to marine waters (Solovieva 1997). We know little of Steller's eiders use of marine waters adjacent to Alaska's Arctic Coastal Plain and along the west and southwest coast of Alaska during late summer and fall migration. Historical observations made by Murdoch (1885 as in Bent 1987) indicate that birds that have bred near Point Barrow begin to return to the coast from the first to the middle of July. In addition, he indicated that they disappear from the Barrow area from the first to the middle of August. Steller's eiders arrived at St. Michael around 21 September (Bent 1987). Late date of departure was as follows: Point Barrow, September 17; St. Michael, October 5; and Ugashik, November 28 (Bent 1987).

Over 15,000 Steller's eiders were observed on September 27, 1996, in Kuskokwim Bay (Larned and Tiplady 1996). Most (nearly 14,000) were located along the mainland side of barrier islands while about 1,100 were detected further offshore. Despite this species' apparent preference for near-shore habitats, several groups were detected over 10 kilometers (km) from shore and two groups were over 30 km from shore.

In late summer and fall, large numbers of Steller's eiders molt in a few lagoons located on the north side of the Alaska Peninsula (i.e., Izembek and Nelson Lagoon/Port Moller Complex, Seal Islands) (Petersen 1980, 1981). Recent observations of over 15,000 Steller's eiders in Kuskokwim Bay, and the observation of two out of three satellite-tagged birds from Barrow molting there suggests that Kuskokwim Bay may also be a notable molting area for this species and for the listed entity (Larned and Tiplady 1996; Philip Martin, Service, pers. comm.). Following the molt, large numbers of Steller's eiders are known to over winter in near-shore marine waters of the Alaska Peninsula, Aleutian Islands, Kodiak Archipelago, and the Kenai Peninsula (e.g., within Kachemak Bay).

<u>Molt Distribution</u>: After breeding, Steller's eiders move to marine waters where they undergo a flightless molt for about 3 weeks. The majority is thought to molt in four areas along the Alaska Peninsula: Izembek Lagoon (Metzner 1993; Dau 1991; Laubhan and Metzner 1999), Nelson Lagoon, Herendeen Bay, and Port Moller (Gill et al. 1981;

Petersen 1981). Additionally, smaller numbers are known or thought to molt in a number of other locations along the western Alaska coast, around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (Swarth 1934; Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991).

Winter Distribution: Following the molt many, but not all, Steller's eiders disperse from major molting areas to other portions of the Alaska Peninsula and Aleutian Islands. Winter ice formation often temporarily forces birds out of shallow protected areas such as Izembek and Nelson Lagoons. During the winter, this species congregates in select near-shore waters throughout the Alaska Peninsula and the Aleutian Islands, around Nunivak Island, the Pribilof Islands, the Kodiak Archipelago, and in Kachemak Bay (Larned 2000a, Bent 1987, Agler et al. 1994, Larned and Zwiefelhofer 1995).

Larned (2000b) did not see Steller's eiders along most of the Alaska Peninsula coastline he surveyed during winter. Most of the birds were concentrated within relatively small portions of the coastal waters. Much of the population, detected during spring migration, was not detected on this winter survey. We believe this was because many Steller's eiders winter farther west in the Aleutian Islands and/or along the south side of the Alaska Peninsula.

Spring Migration: In the spring, Steller's eiders form large flocks along the north side of the Alaska Peninsula and move east and north (Larned et al. 1993, Larned 1998, Larned 2000b). Spring migration usually includes movement along the coast, although birds may take shortcuts across water bodies such as Bristol Bay (William Larned, Service, pers. comm.). Interestingly, despite many daytime aerial surveys, Steller's eiders have never been observed during migratory flights (William Larned, Service, pers. comm.). Larned (1998) concluded that Steller's eiders show strong site fidelity to "favored" habitats during migration, where they congregate in large numbers to feed before continuing their northward migration.

The number of Steller's eiders observed in each site during migration surveys should be considered a minimum estimate of the number of eiders that actually use these sites during migration. These data represent eider use during a snapshot in time, when in reality, a stream of eiders likely flows into and out of these sites throughout the migration season. The spring migration survey was not intended to document the intensity of use of any particular site by Steller's eiders, but was designed to monitor the entire population of Steller's eiders and other sea ducks during the spring migration.

Because the spring Steller's eider aerial survey was not intended to quantify use of any particular area by Steller's eiders during spring migration, care must be taken in interpreting the results with this purpose in mind. For example, Steller's eider use of habitat near Ugashik and Egegik Bays was documented in 1992, 1993, 1997, and 1998 (Larned et al. 1993, Larned 1998). However, in 2000, no Steller's eiders were observed there (Larned 2000b). In fact, no Steller's eiders were observed from the Cinder River Sanctuary to Cape Constantine; an expanse of approximately 110 miles of coastline which encompasses these bays and which has had several thousand Steller's eiders documented in previous years (Larned et al. 1993, Larned 1998). However, 15,000 Steller's eiders were observed south of this area and were distributed between Port Heiden and Port Moller (Larned 2000b). Three days later, about 43,000 Steller's eiders were observed south of Port Moller (Larned 2000b). The birds were, in essence, stacking up behind Port Moller, or were otherwise phenologically late in their migration relative to the previous few years. Regardless, survey results from that year suggested low use of habitats north of Port Moller, even though the birds that were counted south of Port Moller presumably used those more northerly habitats following the conclusion of the spring aerial survey.

Several areas receive consistent use by Steller's eiders during spring migration, including Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port Heiden, Cinder River State Critical Habitat Area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island (Larned et al. 1993, Larned 1998, and Larned 2000b).

<u>Summer Distribution in Southern Alaska</u>: A small number of Steller's eiders are known to remain along the Alaska Peninsula and Kachemak Bay during the summer; approximately 100 have been observed in Kachemak Bay, while a few may spend the summer at Izembek Lagoon (Chris Dau, Service, pers. comm.).

Site Fidelity

Steller's eiders appear to show site fidelity at different spatial scales during different times of the year. There is good evidence of fidelity to molting sites in this species. About 95 percent of recaptured molting Steller's eiders are recaptured at the same site at which they were banded (Flint et al. 2000). Flocks of Steller's eiders make repeated use of certain areas between years (Larned 1998), although it is unknown to what extent individuals display repeated use of these areas.

Female philopatry to breeding grounds in waterfowl species is high. Female waterfowl tend to return to the area where they hatched for their first nesting effort, and subsequently tend to return to the same area to breed in the following years (Anderson et al. 1992). Despite having had only a few opportunities to observe Steller's eiders breeding on the Y-K Delta, we have observed philopatry displayed by a female Steller's eider there; one individual chose nest sites in two consecutive years that were about 124 m apart (Paul Flint, U. S. Geological Service (USGS), Biological Resources Division, pers. comm.). Banding data from the Barrow area suggests some level of site fidelity for Steller's eiders breeding there as well (Quakenbush et al. 1995; Phillip Martin, Service, pers. comm.). Interestingly, natal philopatry has not been observed in Steller's eiders nesting in Russia (D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.).

Further evidence of breeding site fidelity is found in other sea ducks. Female spectacled eiders did not move between general nesting areas (coastal versus interior) between years (Scribner et al. 2000). In addition, mitochondrial DNA analysis indicates that female spectacled eiders tend to return to their natal breeding area once they are recruited to the breeding population (Scribner et al. 2000). Natal, breeding, and winter philopatry in other sea ducks has also been documented (Dow and Fredga 1983, Savard and Eadie 1989, Robertson 1997, Robertson et al. 1999).

Preliminary data from radio transmitters placed on 23 Steller's eiders captured in Captain's Bay and around Amaknak Island (near Dutch Harbor) in spring 2001 also reveal that eiders show site fidelity to general wintering areas (USGS 2001). Steller's eiders remained in the general vicinity from which they were initially captured from mid-February to mid-March 2001 when the radio transmitters stopped working (Paul Flint, USGS, pers. comm.). The birds marked in Captain's Bay were never detected outside of the area that the flock was observed using. Birds marked around Amaknak Island remained in the general area, but appeared to use a larger home range. Satellite telemetry data indicated that two tagged Steller's eiders used an area of only a few square kilometers from November through Feburary (Philip Martin, Service, pers.comm.). Although further investigation is needed, preliminary studies suggest that Steller's eiders show high site fidelity at over wintering sites, at least within one winter season. Whether Steller's eiders show fidelity to over wintering sites between years remains unknown.

We note that site fidelity has been observed in wintering harlequin ducks; they showed strong site fidelity for short stretches (5 km) of coastline (Cooke et al. 2000). Robertson et al. (1999) concluded that strong site tenacity suggests that local knowledge of an area is valuable and may help ensure high survival of individuals remaining in a familiar site. They suggest that site fidelity would be expected of long-lived species that are sensitive to adult mortality and depend, at least in part, upon habitat stability for survival.

Population Structure

Genetic analysis of vertebrate populations suggests that there are often genetic gradients or differences that correspond to the geographic distribution of the species (Lande and Barrowclough 1987). The Alaska breeding population of Steller's eiders may contain unique geographic sub-populations because of: (1) the distance between breeding populations on the Yukon-Kuskokwim (Y-K) Delta and the Arctic Coastal Plain [about 804 kilometers (500 miles)], and (2) the anticipated site fidelity of nesting adult females (Anderson et al.1992). The similarly distributed North Slope and Y-K Delta populations of spectacled eiders possess distinct mitochondrial DNA markers, implying limited maternal gene flow between these two areas for that species (Scribner et al. 2000).

Food Habits

Steller's eiders employ a variety of foraging strategies that include diving to a maximum depth of at least 9 meters (30 feet), bill dipping, body tipping, and gleaning from the surface of water, plants, and mud. During the fall and winter, Steller's eiders forage on a variety of invertebrates that are found in near-shore marine waters (Metzner 1993, Petersen 1981, Bustnes et al. 2000). Esophageal contents from 152 Steller's eiders collected at Izembek Lagoon, Kinzarof Lagoon, and Cold Bay, Alaska, indicate Steller's eiders forage on a wide variety of invertebrates (Metzner 1993). According to Metzner (1993), marine invertebrates accounted for the majority of the Steller's eider diet (92%, aggregate dry weight). In addition, occurrence of shell-free prey (e.g., Crustacea, Polychaeta) predominated, compared to that of food items with shells (Metzner 1993). Metzner (1993) concluded that Steller's eiders were opportunistic generalists, foraging primarily on fauna associated with eelgrass beds in Izembek Lagoon and Kinzarof Lagoon, and infauna, epibenthos, and highly mobile fauna. During molt, Steller's eiders were found to have consumed blue mussel (*Mytilus edulis*), other bivalves (e.g. *Macoma balthca*), and amphipods (a small crustacean). They were also found to have consumed more blue mussels while growing wing-feathers (Petersen 1981).

In northern Norway, 31 species were identified as Steller's eider winter food items; 13 species of gastropods (68.4% of total number of items), four species of bivalves (18.5%); 12 species of crustaceans (13%); and two species of echinoderms (0.1%) (Bustnes et al. 2000). Juveniles sampled in this study fed more on crustaceans (x = 61% aggregate wet weight) than did adults (x = 26% aggregate wet weight). Examination of female Steller's eiders found dead near Barrow showed they had consumed mostly Chironomid larvae, which are the predominant macrobenthic invertebrate in arctic tundra ponds (Quakenbush et al. 1995).

Predators

Predators of Steller's eiders include snowy owls (*Nyctea scandiaca*), short-eared owls (*Asio flammeus*), peregrine falcons (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*), pomarine jaegers (*Stercorarius pomarinus*), rough-legged hawks (*Buteo lagopus*), common raven (*Corvus corax*), glaucous gulls (*Larus hyperboreus*), arctic fox (*Alopex lagopus*), and red fox (*Vulpes vulpes*). Quackenbush et al. (1995) reported five adult male and three adult female Steller's eiders taken by avian predators in 4 years near Barrow. Predators included peregrine falcons, gyrfalcons, and snowy owls. In addition, pomarine jaegers preyed on Steller's eider eggs. On the Y-K Delta, Steller's eider nests have been destroyed by gulls (Paul Flint, USGS, pers. comm.). In fall, winter, and spring predation can be attributed primarily to avian predators, such as bald eagles (*Haliaeetus leucocephalus*) and gyrfalcons (Christian Dau, Service, pers. comm.).

Population Dynamics

Population Size

Yukon-Kuskokwim Delta: Estimating the size of the Steller's eider breeding population in Alaska has proved difficult. The large sampling errors associated with systematic aerial surveys preclude generation of an accurate/precise statistical estimate. Aerial surveys that included the Y-K Delta but did not include the Arctic Coastal Plain indicate that the population sizes of eiders (*P. stelleri* and *Somateria* spp.) had declined by

90% since 1957 (Hodges et al. 1996). For the 1950s and early 1960s, the upper limit of the population, excluding the North Slope, had been estimated to be approximately 3,500 pairs (Kertell 1991). Kertell noted, however, that the population might have been smaller due to the potential restriction of nesting Steller's eiders to specific habitats. Kertell (1991) concluded that the Steller's eider had been extirpated from the Y-K Delta prior to 1990.

Since publication of Kertell (1991), a few pairs of Steller's eiders have nested on the Y-K Delta (Paul Flint, USGS, pers. comm.). In no single year have biologists found more than three nests there, despite extensive ground-based nest search efforts in good spectacled eider breeding habitat (Table 2).

Table 2. Recent sightings of Steller's eiders on the Y-K Delta (Paul Flint, USGS, pers. comm.)

Year	General Location	Number of Pair	Nest Detected	Number of Eggs	Fate of Nest
1994	Kashunuk River near Hock Slough	1	1	7	Destroyed by Gulls
1996	Tutakoke River	1	1	6	Unknown
1997	Tutakoke River	2	0	NA	NA
1997	Kashunuk River	1	1	6	Hatched
1998	Tutakoke River; Kashunuk River	2;1	2; 1	Unk.; 7	Destroyed; Hatched

NA-Not Applicable
Unk.-Unknown

<u>Arctic Coastal Plain/North Slope</u>: Two separate aerial breeding pair surveys have been conducted on the Arctic Coastal Plain of Alaska at two different times during the Steller's eider nesting process. Those surveys are the Arctic Coastal Plain Breeding Pair Surveys (ACPBPS) and the North-Slope Eider Surveys (NSES). Mallek and King (2000) and Brackney and King (1995) reported on surveys designed for optimal population estimates for the greatest number of breeding waterfowl species on the Arctic Coastal Plain (ACPBPS; Table 3). Larned and Balogh (1996) reported on annual aerial surveys designed to provide optimal population estimates for spectacled eiders (NSES; Table 4).

Quakenbush et al. (1995) reported on ground surveys conducted specifically for Steller's eiders around Barrow from 1991-1994. Laing (1995) conducted helicopter based brood surveys around Barrow and south of Barrow. ABR (1999) conducted intensive aerial surveys within the "Barrow Triangle" area; surveys that, when compared to concurrent ground surveys, may be used to help derive an aerial survey visibility correction factor. However, Martin and Obritschkewitsch (2002) conducted such concurrent ground surveys during three different years (1999, 2000, and 2001), and concluded that there was not a strong correlation between aerial survey sightings and nest locations. That is, many of the Steller's eiders seen during the aerial breeding population surveys are transient birds.

Table 3. Aerial population estimates for Steller's eiders, from aerial breeding pair surveys on the Arctic Coastal Plain (ACPBPS; Mallek and King 2000; Dau and Mallek 2000, 2001).

Year	Population Estimate
1989	2,002
1990	534
1991	1,118
1992	954
1993	1,313
1994	2,524
1995	931
1996	2,543
1997	1,295
1998	281
1999	1,250
2000	0
2001	433

Table 4. Aerial population estimates for Steller's eiders, from the North Slope (NSES; 1992-2000).

Year	Number Seen	Population Estimate	95% Confidence Interval	Researcher(s)
1992	0	0	NA	Larned and Balogh (1996)
1993	11	263	11-713	Larned and Balogh (1996)
1994	4	91	4-215	Larned and Balogh (1996)
1995	14	322	14-725	Larned and Balogh (1996)
1996	0	0	NA	Larned and Balogh (1996)
1997	8	189	8-432	Larned et al. (1999)
1998	0	NA	NA	Larned et al. (1999)
1999	31	NI	NI	William Larned, Service, pers. comm.
2000	0	NA	NA	William Larned, Service, pers. comm.

NA-Not Applicable
NI-Not Indicated

Despite attacking the problem of Steller's eider population estimation from many different angles, our collective efforts have shed little light on which method results in the best estimate or what the best population point estimate actually is. The problem of population estimation lies largely with the fact that the species is spread across a huge landscape at very low densities. In addition, we acknowledge that the number of Steller's eiders present on the Arctic Coastal Plain may fluctuate dramatically from year to year for reasons that are unclear. However, it is the opinion of the biologists most familiar with the species on its Arctic Coastal Plain nesting grounds that the breeding population there is best described as numbering in the hundreds, or perhaps in the very low thousands.

Population Variability

Variability in the abundance of the Alaska breeding population of Steller's eiders is not well understood. The sampling errors around our population estimates are large enough to obscure large annual population fluctuations. However, ground-based efforts in the Barrow area suggest that the local breeding populations there fluctuate dramatically (Quakenbush et al. 1995). Indeed, during some years, as in 2000 and 2002, Steller's eiders completely forego nesting in this area (Philip Martin, Service, pers. comm.).

Population Stability

The Steller's eider is a relatively long-lived species. Such species do not typically display highly variable populations. That Steller's eiders completely forego nesting in some years near Barrow is consistent with the reproductive strategy for a long-lived species (Begon and Mortimer 1986). However, mortality factors may be undermining this species' ability to maintain a stable population.

The population of Steller's eiders molting and wintering along the Alaska Peninsula appears to be declining (Flint et al. 2000, Larned 2000b). In addition, comparison of banding data from 1975 -1981 to 1991-1997 indicates a reduction in Steller's eider survival over time (Flint et al, 2000). Population models for other waterfowl applied to this species indicate that the observed reduction in annual survival over time would have a substantial negative effect on populations (Schmutz et al. 1997, Flint et al. 2000). If this decline is caused by something in the marine environment, it is reasonable to conclude that the Alaska breeding population and Asia breeding population are being affected similarly.

Status and Distribution

Reasons for Listing

The Alaska breeding population of Steller's eiders was listed as a threatened species on June 11, 1997 (USFWS 1997). It was listed due to (1) its recognition as a distinct vertebrate population segment, (2) a substantial decrease in the species' nesting range in Alaska, (3) a reduction in the number of Steller's eiders nesting in Alaska, and (4) the vulnerability of the remaining breeding population to extirpation (USFWS 1997).

<u>Habitat Loss</u>: The direct and indirect effects of future gas/oil development within the National Petroleum Reserve-Alaska, and future village expansion (e.g., at Barrow), were cited as potential threats to the Steller's eider (USFWS 1997). Within the marine distribution of Steller's eiders, perceived threats include marine transport, commercial fishing, and environmental pollutants (USFWS 1997).

<u>Hunting</u>: Although not cited as a cause in the decline of Steller's eiders, the take of this species by subsistence hunters was cited as a threat to the population of Steller's eiders near Barrow in the final rule (USFWS 1997). However, the gathering of subsistence

harvest information similar to that collected from Native residents of the Y-K Delta has met with resistance from Native organizations on the Arctic Coastal Plain.

Predation: Increased predation by arctic foxes resulting from the concurrent crash of goose populations is cited as a possible contributing factor to the decline of the Steller's eider on the Y-K Delta (USFWS 1997). The potential for increased predation near villages resulting from the villages' associated gull and raven populations was also cited as a potential threat to this species (USFWS 1997).

Lead Poisoning: The presence of lead shot in the nesting environment on the Y-K Delta was cited as a continuing potential threat to the Steller's eider. The Service is progressing in its efforts to enforce a nationwide ban on lead shot on the Arctic Coastal Plain (USFWS 1997).

Ecosystem Change: Direct and indirect changes in the marine ecosystem caused by increasing populations of Pacific walrus (*Odobenus rosmarus*), gray whale (*Eschrichtius robustus*), and sea otter (*Enhydras lutris*), were cited as potential causes of the decline of Steller's eiders. Subsequent declines in sea otter populations (65 FR 67343) and continuing declines in Steller's eider populations suggest that otters were not responsible for a decline in eider numbers.

In addition, changes in the commercial fishing industry were also cited as perhaps causing a change in the marine ecosystem with possible effects upon eiders (USFWS 1997). However, we are unaware of any link between changes in the marine environment and contraction of the eider's breeding range in Alaska (USFWS 1997).

Range-wide Trend

Populations of Steller's eiders molting and wintering along the Alaska Peninsula have declined since the 1960s (Kertell 1991), and appear to be in continued decline (Flint et al. 2000, Larned 2000b). Indeed, long term survey data suggests a 7.6% annual decline in migrating Steller's eiders ($R^2 = 0.86$; Larned 2002). The imprecision of our breeding ground estimates precludes us from detecting any but the most obvious population trends for the listed entity. However, if a marine-based threat is causing a decline in the world population of Steller's eiders, then it seems reasonable to conclude that the Alaska breeding population may also be affected by such a threat.

New Threats

Chronic Petroleum Spills: The chronic release of petroleum products near large concentrations of Steller's eiders is not a new threat as much as it is a newly realized threat. The gregarious behavior of Steller's eiders during a spill event may result in acute and/or chronic toxicity in large numbers of birds. Indeed, Larned (2000b), expressed concern for the survival and reproductive success of the large number of Steller's eiders observed in harbors.

A life-history strategy of long life and low annual reproductive effort would be expected to evolve under conditions of predictable and stable non-breeding environments (Sterns 1992). The life history strategy of the Steller's eider seems to fit this model. That is, the Steller's eider is long-lived, has low annual recruitment, and winters in apparently productive and reasonably stable near-shore marine environments. Because the Steller's eider is relatively small bodied and winters at northern latitudes, it may do so near the limits of its energetic threshold. Harlequin ducks and long-tailed ducks exist near their energetic limit in such climates (Goudie and Ankney 1986), and the Steller's eider is intermediate in size to these two species. Therefore, environmental perturbations that reduce prey availability or increase the species energetic needs may result in harm. Fuels and oils are toxic to Steller's eiders (Holmes et al. 1978, Holmes et al. 1979, McEwan and Whitehead 1980, Leighton et al. 1983, Holmes 1984, Leighton 1993, Rocke et al. 1984, Yamato et al. 1996, Glegg et al. 1999, Trust et al. 2000, Esler et al. 2000) and their prey (e.g., amphipods and snails; Newey and Seed 1995 as in Glegg et al. 1999, Finley et al. 1999). Therefore, we believe that spilled petroleum is likely to adversely affect Steller's eiders.

<u>Increased Risk of Lead Poisoning</u>: Because this species continues feeding near the nesting site before and during incubation (D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.), it may be subjected to an increased risk of exposure to lead shot over other waterfowl species that largely forego feeding at this time. Spectacled eiders do not seem to engage in feeding activities as much as Steller's eiders once breeding has commenced, however, spectacled eiders have been observed to have higher rates of exposure to lead than any species sampled on the Y-K Delta (Flint et al. 1997). The proportion of spectacled eiders on the Y-K Delta's lower Kashunuk River drainage that contained lead shot in their gizzards was high (11.6%, n = 112) compared to other waterfowl in the lower 48 states from 1938-1954 (8.7%, n = 5,088) and from 1977-1979 (8.0%, n = 12,880). Blood analyses of spectacled eiders indicated elevated levels of lead in 13% of pre-nesting females, 25.3% of females during hatch, and 35.8% of females during brood rearing. Nine of 43 spectacled eider broods (20.9%) contained one or more ducklings exposed to lead by 30 days after hatch (Flint et al. 1997). Thus, if spectacled eiders have experienced population level effects on the Y-K Delta due to lead poisoning, then Steller's eiders may have experienced similar, or even greater lead-induced effects.

<u>Collisions with Manmade Structures</u>: Steller's eiders have been documented to collide with wires, communication towers, boats, and other structures. During a 4-year period near Barrow, at least one adult Steller's eider female died from striking a wire and another adult Steller's eider was suspected to have died from striking a radio tower (Quakenbush et al. 1995). In addition, large numbers of Steller's eiders are known to have collided with communication towers in the wintering area along the Alaska Peninsula.

"Bird storms" are a well-documented occurrence within the commercial crab fishery fleet, a result of their use of bright lights during inclement nighttime weather. In December 1980 or 1981, "at least 150" dead eiders (species unknown) were reported to be on the deck of the M/V *Northern Endeavor* the morning after the vessel, with crab lights illuminated, anchored on the Bering Sea side of False Pass (Day 2001). Based on the time of year and location, we assume these to be Steller's eiders. Two Steller's eiders died after striking the crab lights of the P/V *Wolstad* on February 15, 1994; no additional information was provided with this report. One male Steller's eider landed on the deck of the *Elizabeth F* on February 14, 1997, at 11:36 pm; another male Steller's eider struck the vessel and died the following day at 5:00 pm. Three spectacled eiders died after striking a Coast Guard cutter conducting sampling in the Bering Sea in March 2001.

Between September 26, 2001, and October 29, 2001, the Northstar facility on the North Slope of Alaska experienced 18 sea duck mortalities and one sea duck injury due to collisions with facility infrastructure. Sixteen dead eiders of unknown species were found on October 28, 2001, on the Endicott spur-drilling island. The actual number of birds injured and killed through collisions with manmade structures is likely higher; many injured and killed birds are believed to go undetected, unreported, or become scavenged before humans detect them.

Stochastic Events: The small population size of the Steller's eiders on the Y-K Delta and the Arctic Coastal Plain may put them at risk of the deleterious effects of demographic and environmental stochasticity. Demographic stochasticity refers to random events that affect the survival and reproduction of individuals (e.g., shifts in sex ratios, striking wires, being shot, oil/fuel spills; Goodman 1987). Environmental stochasticity is due to random, or at least unpredictable, changes in factors such as weather, food supply, and populations of predators (Shaffer 1987). As discussed by Gilpen (1987), small populations will have difficulty surviving the combined effects of demographic and environmental stochasticity. The risk of local extirpation is probably highest for Steller's eiders nesting on the Y-K Delta due to the low number of birds that breed there.

The world population of Steller's eiders is probably not at high risk of extinction due to environmental stochasticity alone. Local groups of wintering birds, however, may be vulnerable to starvation due to stochastic events (e.g., unusually heavy ice cover in their feeding habitats).

Allee Effect: "Allee effect" refers to the destabilizing tendency associated with inverse density-dependence as it relates to population size and birth rate. One form of this occurs when the ability to find a mate is diminished (Begon and Mortimer 1986). For example, if the sex ratio of a population significantly shifts from a normal condition for a species, the ability of adults to produce young may diminish. For the Steller's eider, the higher mortality rate of males (Flint et al. 2000) may result in a lower number of pairs returning to nest (i.e., adult females unable to find a mate are effectively removed from the breeding population).

The annual survival rate for Steller's eiders molting and wintering in Alaska is estimated to be 0.899 ± 0.032 for females and 0.765 ± 0.044 for males (Flint et al. 2000). At this estimated annual survival rate, about 39 percent of the females of a cohort will reach 10 years of age, while only about 7% of the males will survive for 10 years.

The observed difference in annual survival between sexes may be manifested in a skewed sex ratio. Female Steller's eiders notably out-numbered male eiders on winter surveys of three areas during January, February, and March (LGL 2000; Lanctot and King 2000). In waters off Unalaska and False Pass, female Steller's eiders comprised 63 and 69 percent, respectively, of Steller's eiders observed (N = 2,053 and 114 respectively) (John Burns, U.S. Corp of Engineers, pers. comm.; Lanctot and King 2000). At Akutan Harbor, the combined female to male sex ratio for all surveys was approximately 3 to 1 (n = 590) (Lanctot and King 2000). Band recoveries reported by Dau et al. (2000) also suggest a shift in Steller's eider sex ratios through time (Table 5), however, in photographs taken of over 13,000 Steller's eiders at Izembek Lagoon in January, 2002, 61% were classified as males (Chris Dau, Service, pers. comm.). Furthermore, females represented only 38% and 21% of Steller's eiders captured at Nelson Lagoon over a 3-year period (Flint et al. 2000). This suggests that spatial segregation among sexes, during winter, may lead to assumptions of skewed sex ratio depending on areas surveyed.

Table 5. Shifting sex ratio of Steller's eiders at sample area No. 1 in Izembek Lagoon (Dau et al. 2000).

Years	Female	Male	Sample Size	Percent Male
1961-1966	271	566	837	68%
1968	60	85	145	59%
1974-1981	3576	2197	5773	38%
1991-1997	5971	708	6679	11%

Observations of the sex ratio skewed toward females are in stark contrast to that which is typical for many other Anatinae, where an excess of males is the norm (Johnsgard 1994). If an excess of females does exists throughout the species range (as opposed to just at some locations) then the biased sex ratio may have implications regarding reproductive potential. Although our limited observations and Dau et al.'s (2000) banding data suggest that a biased sex ratio exists for this species, we do not know if this biased sex ratio exists range wide, nor do we know what may be causing it.

Analysis of the species likely to be affected

The Steller's eider was listed as a threatened species on June 11, 1997 (62 FR 31748). The Nelson Lagoon critical habitat designation was established on January 12, 2001 (50 CFR part 17). Because of the risk of spills during the delivery of fuel to the bulk fuel facility, and the expected increase in boat traffic as a result of population increases and the proposed seafood processing plant, construction and operation of an expanded bulk fuel facility in Nelson Lagoon is likely to adversely affect Steller's eiders and their critical habitat. Adverse effects are likely to occur to Steller's eiders and their habitat due to the increased risk of petroleum releases associated with vessels delivering fuel to the facility and in route to and from the seafood processor.

ENVIRONMENTAL BASELINE

When preparing a biological opinion, under 50 CFR 402.14, the Service is responsible for evaluating the "effects of the action" (i.e., direct and indirect effects together with effects of activities that are interrelated or interdependent) on federally listed species. These effects become additive to the environmental baseline.

The "environmental baseline" section of Service biological opinions summarize the effects of past and present human and natural phenomena on the current status of threatened and endangered species and their habitat in an action area. The "environmental baseline" section establishes the base condition for natural resources, human usage, and species usage in an action area, which would be used as a point of comparison for evaluating the effects of an action.

Assumptions Used in Analysis of Past, Present and Future Effects

In order to systematically assess the past, present, and future effects of this proposed project on Steller's eiders, we developed several assumptions. The assumptions, and the rational behind each one follow:

Proportion of Wintering Birds from Listed Population

We are assuming that 4.2 percent of all Steller's eiders observed on the wintering grounds in Alaska are from the listed Alaska breeding population. This estimate derives from an average of the three most recent spring migration surveys for a total population estimate of 60,459 birds (Larned 2000b, 2001, 2002), and the highest point estimate of nesting Alaskan birds (2,543 birds; Table 2). Both are conservative estimates and, thus, are negatively biased to an unknown degree.

Proportion of Listed Population using Nelson Lagoon

Based on recent data collected with satellite technology, we are assuming that 54% of the Alaska breeding population of Steller's eiders stage, molt, and winter in the near-shore waters of the Nelson Lagoon-Port Moller complex (Philip Martin, Service, pers. comm.). Satellite data from 7 of 13 birds, captured on their breeding grounds near Barrow, spent some portion of the staging, molting, wintering period in Nelson Lagoon or Port Moller. Furthermore, we assume the 1996 breeding population estimate from the arctic coastal plain (2,543 birds) represents the Alaskan Steller's eiders population (Mallek and King 2000). Therefore, we assume that 1373 Alaskan Steller's eiders use Nelson Lagoon.

Rate of Decline for Steller's Eider Populations Wintering in Alaska

We are assuming that Stellers eider populations are and will continue to decline annually at a rate of 7.6%. This assumption is based on long-term survey data of migrating Steller's eiders (R^2 = 0.86; Larned 2002).

Affect of Chronic Oiling on Steller's Eiders

For modeling effects, we are assuming that survivorship is reduced annually by 5.7% as a result of chronic petroleum exposure resulting from small, but consistent oil spills, that are reasonably certain to occur. This assumption is based on results from a study comparing harlequin ducks inhabiting oiled verses unoiled bays, more than 6 years after a large oil spill (Esler et al. 2000). Due to the physiological and ecological similarities with harlequin ducks, Steller's eiders are assumed to respond to chronic oiling in a similar way. Moreover, periodic releases of hydrocarbons from oiled beaches in Prince William Sound are assumed to be similar, in effect, to periodic releases of hydrocarbons from fishing vessels and refueling spills. Based on data from Day and Pritchard (2000), diesel and gasoline spills are likely to occur where refueling operations take place over water. It is assumed that the reduced survivorship due to chronic oiling is additive to of the annual rate of decline of Steller's eiders wintering in Alaska due to unknown reasons (i.e., 7.6% as described above). For modeling purposes, population growth rates (represented elsewhere by lambda) are assumed equally sensitive to changes in the survival rates of juveniles and adults (Morrison and Pollock 2000, Morrison et al. 1998).

Boundaries of Action Area

In a 15-knot wind and water temperatures of 40 degrees Fahrenheit, less than 35% of spilled fuel will evaporate in 4 hours, the duration of tidal movement between high and low tide. Sixty-five percent of the spilled fuel will remain through the entire cycle, and perhaps much longer. We assume that maximum potential drift of oil from the contamination source, that occurs over one tidal cycle, defines the action area.

Life of the Project

The fuel tanks are designed to last 40 years. Therefore, the life of this project is assumed to be 40 years.

Determination of Action Area

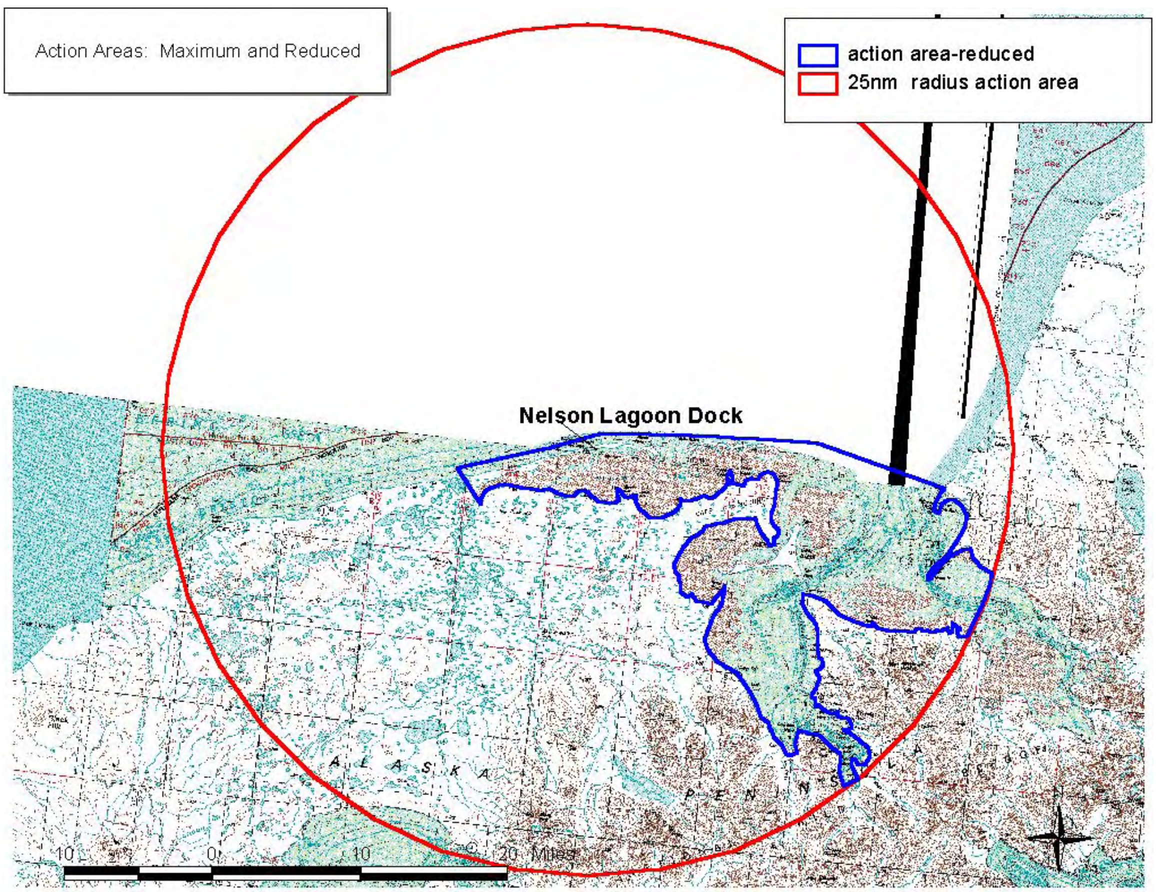
To define the action area for this project, the distance an oil spill may travel from the Nelson Lagoon dock was estimated using the following calculation (John Whitney, NOAA, pers. comm.):

$$D_{nm} = (t_h(C_{nm/h} \pm (W_{nm/h} * 0.03))$$

Where D_{nm}, the linear distance of the spill trajectory (in nautical miles), equals t_h, the duration of oil movement (assumed to be 4 hours) multiplied by the velocity of the oil (the velocity of the current ($C_{nm/h}$) plus/minus the velocity of the wind ($W_{nm/h}$) pushing the oil at the surface (assumed to be 3% of the wind speed)).

The tidal current in Nelson Lagoon is very strong, particularly during an ebb tide, when the influence of the river current joins forces with the waters of Nelson Lagoon, which covers approximately 5 square miles, and empties out through a 2800-foot wide channel at Lagoon Point. An average current within the lagoon at mid-ebb tide is 6 knots (Butch Gunderson, Nelson Lagoon Enterprises, pers. comm.; Paul Flint, USGS, pers. comm.). The average wind speed for Nelson Lagoon is 15 knots (nautical miles/hour). Therefore, the linear distance oil may move in one tide cycle, when wind, blowing from the southwest has an additive influence on the velocity, is 25 nm (Figure 2). Using 25 nm as a radius to define the action area results in an action area encompassing 240 square miles. Within an action area this vast, it would be impossible to establish an effects model with any degree of certainty. Therefore, the action area was reduced to a discrete polygon restricted to protected waters of Nelson Lagoon, Mud Bay, Herendeen Bay, and Port Moller, and the band of critical habitat on the Bering Sea side of Nelson Lagoon. The area of the reduced action area is 28.0 square miles. The action area encompasses the entire Nelson Lagoon-Port Moller Critical Habitat Unit as designated for Steller's eiders in 2001 (USFWS 2001a).

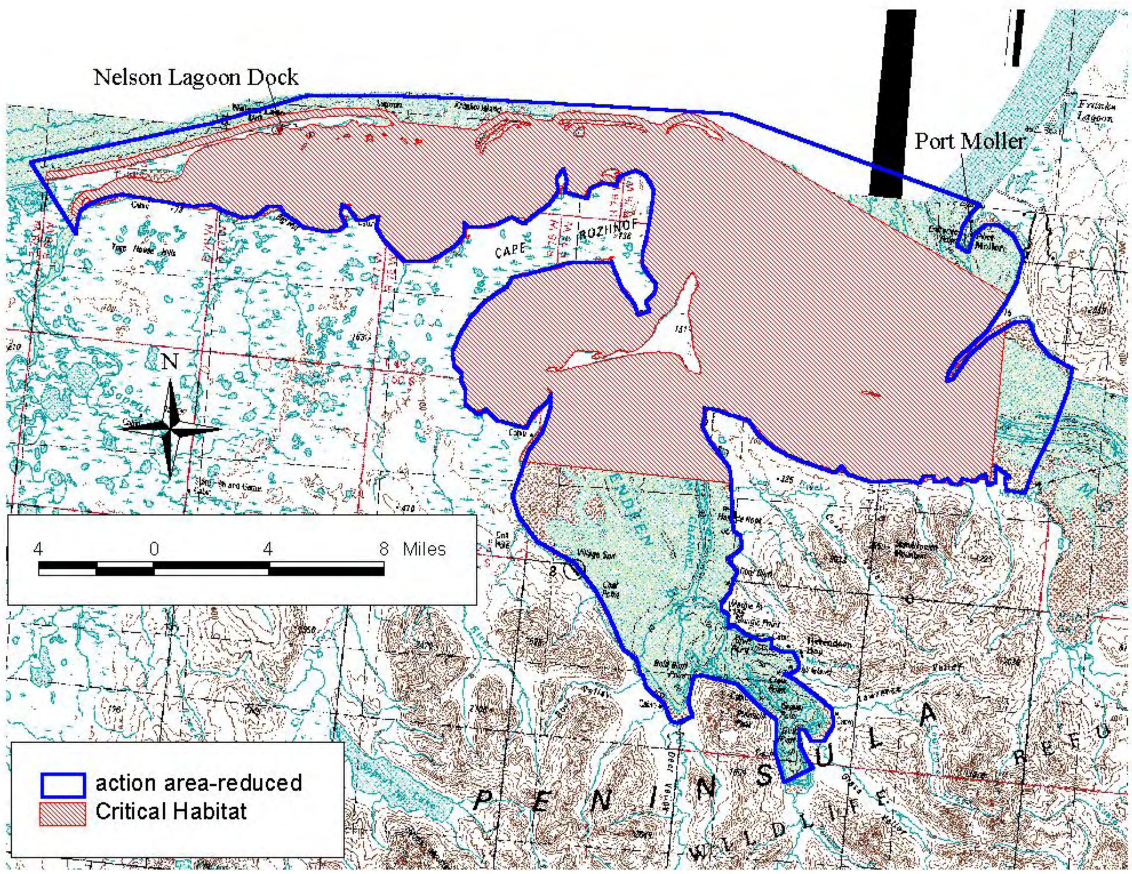
Figure 2. Action area for Nelson Lagoon Bulk Fuel Facility Upgrade Project.



Status of the Species Within the Action Area

The Nelson Lagoon – Port Moller complex, on the northcentral Alaska Peninsula, is characterized by a regular coastline of sand beaches, low terraces, and alluvial fan deposits (Gill et al. 1981). This complex is the largest single estuary and represents 44% of all such habitat along the Alaska Peninsula. Nelson Lagoon is designated critical habitat (Figure 3; Service 2001a), and is considered one of the most important staging, molting and wintering areas for Steller's eiders. Aerial survey data indicate that on average 4% of all the Steller's eiders migrating and staging along the Alaska Peninsula use Nelson Lagoon in spring, and 51% in fall (Dau and Mallek 2000, 2001, 2002; Mallek and Dau 2000, 2001, 2002; Larned 2000, 2001, 2002).

Figure 3. Steller's eider critical habitat boundary for the Nelson Lagoon-Port Moller unit.



Steller's eiders, from both the federally listed-Alaskan breeding population and the Russian population, arrive in the Nelson Lagoon area in late July to early August, when they either stay to molt or move on to another molting ground (Dau et al. 2000, Peterson 1981, Philip Martin, Service, pers. comm.). Steller's eiders exhibit very high fidelity to specific molting areas (Flint et al. 2000). Research in the early 1980s concluded that Nelson Lagoon was a very important molting ground for male and subadult Steller's eiders (Peterson 1981), but less so for females, and banding information from the early 1990's corroborated those findings (Flint 2000). New information, however, suggests that near-shore habitat in Nelson Lagoon - Port Moller (within the action area) complex may be equally as important for molting-female Steller's eiders from the listed population (Philip Martin, Service, pers. comm.).

When flightless, Steller's eiders prefer shallow, protected estuaries, and tend to concentrate in channels at low tide (Dau et al. 2000, Flint et al. 2000). Molt begins in late July with subadults becoming flightless, followed by the adult birds (Peterson 1980). Most birds are flightless by early August and regain the ability to fly by mid to late September, with females molting last (Peterson 1980; Metzner 1993). During this energetically demanding time-period, Steller's eiders concentrate in channels in a flightless state, and they are particularly vulnerable to anthropogenic perturbations, such as disturbance from vessels and oil spills (Peterson 1981).

During the molt, Steller's eiders must compensate for the higher energy needs by either increasing the amount of time feeding or by eating highly nutritious food (Peterson 1981). Within the Nelson Lagoon-Port Moller complex, Steller's eiders primarily occupy near-shore and inshore waters (Gill et al. 1981). Most foraging occurs within 2 hours on either side of low tide (Peterson 1981). Blue mussels, a high-energy food source for Steller's eiders in Nelson Lagoon, are the primary forage, especially during molting (Peterson 1981). Other high value food sources include clams (*Macoma balthica*), and sand-hoppers (*Anisogammarus pugettensis*) (Peterson 1980, 1981).

Winter concentrations of Steller's eiders in Nelson Lagoon fluctuate, and are most dependent on the ice conditions in the lagoon; the largest numbers occur during milder winters (Gill et al. 1981). Fifty to 60 thousand Steller's eiders can be observed in Nelson Lagoon in January (Chris Dau, Service, pers. comm.) Steller's eiders can be seen foraging and resting in large concentrations in various locations around the lagoon.

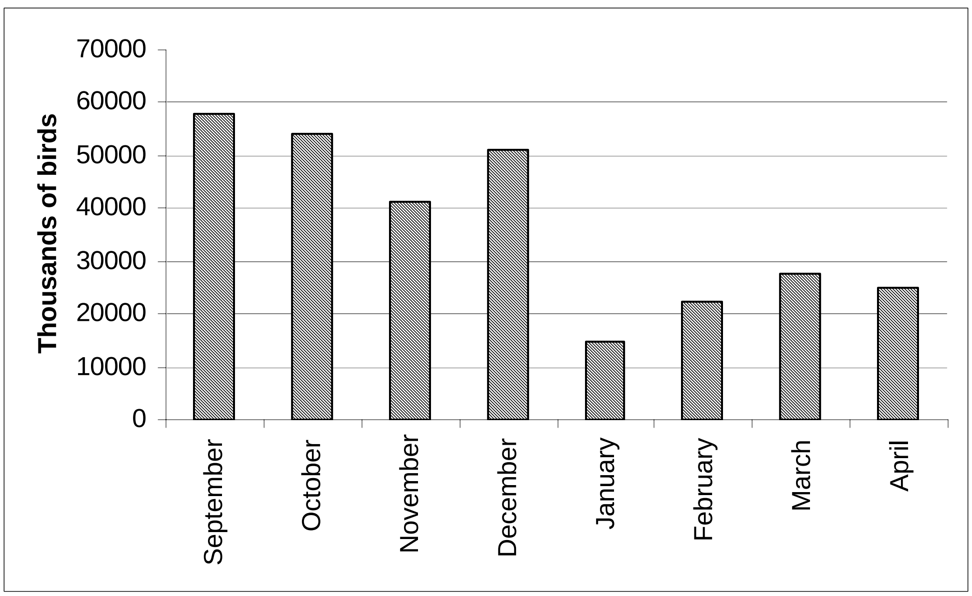
In spring, Steller's eiders concentrate in Nelson Lagoon, staging for their migration to the breeding grounds. During April through mid-May, three classes of Steller's eiders migrate through the Nelson Lagoon area: migrating pairs (assumed because >90% of flocks are near equal sex ratio), subadult males and females (comprise <10% of total migrants and they migrate at a later time), and adult males. Migrating Steller's eiders leave the Nelson Lagoon area by early May (Chris Dau, Service, pers. comm.; Peterson 1980).

Monthly aerial surveys conducted at Nelson Lagoon between 1991 and 1997 indicate that variability is high across years (Table 6), but use patterns can be inferred (Figure 4). Steller eider numbers are highest in the Nelson Lagoon area during molt and into the winter period. Even though there is high variability among surveys, it is clear that the Nelson Lagoon-Port Moller complex is a high use and highly important area for Steller's eiders. As noted previously, recent satellite telemetry data indicate that 54% of Alaska breeding Steller's eiders use Nelson Lagoon to stage, molt, or winter (Philip Martin, Service, pers. comm.)

Table 6. Summarized survey data from 1991-1997 for Steller's eider at Nelson Lagoon (Chris Dau, Service, pers. comm.)

Month	No. Surveys	Peak Total	Mean±1SD	Total in Segments Around Nelson Lagoon (Mean±1SD)	Range in Segments
January	4	14,786	11,950±2143	2,114±561	1600-2848
February	3	22,283	15,391±5969	1,813±740	995-2435
March	6	27,500	17,241±5738	1,948±868	619-2885
April	5	25,017	16,737±5174	2,856±762	1892-3938
September	11	57,988	36,572±12648	3,929±5442	0-17825
October	4	54,169	37,843±13203	5,758±1942	3655-8354
November	2	41,065	39,383±2379	4,759±1171	3931-5587
December	2	51,050	33,789±15188	8,815±10811	1795-21264

Figure 4. Steller's eider abundance at Nelson Lagoon, by month (1991-1997).



Annual survivorship, between Steller's eiders Izembek Lagoon and Steller's eiders at Nelson Lagoon, did not significantly differ (Flint et al. 2000). Both Izembek Lagoon and Nelson Lagoon support a commercial fishery, and so both are at risk of chronic oiling from fishing vessels. The salmon fisheries are somewhat different, however, because Izembek Lagoon's fishery involves fewer than five seine boats (diesel fuel engines) and Nelson Lagoon's fishery involves 30 vessels, both set netters (unleaded fuel engines) and drift/gill netters (diesel fuel engines; Bob Murphy, Alaska Department of Fish and Game (ADF&G, pers. comm.). Survivorship between two time-periods (late 1970's and early 1990's) was compared for Steller's eiders banded at Izembek Lagoon, and a decline of approximately 9% was reported, although the QAIC value suggested the evidence was weak (Flint 2000). Additionally, there was a difference in survivorship between sexes (male survivorship was lower than females; Figure 5). It is noteworthy to mention that the proportion of females captured in Nelson Lagoon (0.384±0.004 and 0.215±0.003) appears quite different to that of Izembek Lagoon (0.791±0.003, 0.404±0.004, and 0.977±0.005).

Figure 5. Survivorship of Steller's eiders at Izembek Lagoon compared across two time periods (Flint et al. 2000).

Factors affecting species' environment within the action area

Current Bulk Fuel Facility

The existing bulk fuel facility receives fuel deliveries at a frequency of two times per year. One delivery occurs in May, when Steller's eiders are departing for breeding grounds, and can number in the tens of thousands. The second delivery occurs in October, when Steller's eider numbers can exceed 50,000 in Nelson Lagoon. The fuel barge has the capacity to carry 315,000 gallons of fuel and, based on current annual fuel consumption, may deliver 40,000 gallons of diesel fuel at each delivery (Jim Dwight, Crowley Marine Services, pers. comm.).

The current facility fails to comply with state and federal requirements in at least 16 different areas. Among those deficiencies is inadequate secondary containment, no drip pans under hose connection points at the marine headers, and no oil spill contingency plan. This existing facility poses considerable risk, not only to the Steller's eiders staging, molting and wintering in Nelson Lagoon, but also to the critical habitat designated in and around Nelson Lagoon. The proposed action will upgrade the onshore bulk fuel facility, and with proper management, decrease the threat of fuel spills into Nelson Lagoon.

Petroleum Spills

Fuel Barges: There were 171 fuel spills from fuel barges, caused by various reasons, in Alaska from August 1994, to November 2002 (Table 7; Alaska Department of Environmental Conservation (ADEC) 2002). Among the common causes of spills was overfilling tanks. This could be included in the human error category, because tanks should be monitored during refueling operations.

Table 7. Some causes of fuel spills by fuel barges operating in Alaska, 1994 to present (ADEC 2002).

Cause Of Spill	Percent of Total Spills
Overfill	17.0%
Leak	11.0%
Line Failure	7.6%
Human Error	7.0%
Hull Failure	5.3%
Equipment Failure	4.7%
Bilge Release	4.7%
Capsize or Sink	2.9%
Valve Failure	2.3%

A survey of documented fuel spills from fuel barges in Alaska, between 1994 and present, indicate that an average of 385 gallons of fuel is spilled per barge incident involving diesel, and an average of 9 gallons of fuel are discharged in barge incidents involving oily bilge releases (ADEC 2002).

Fishing Vessels: Diesel fuel spills account for the majority of spills (frequency) along the Alaska Peninsula, and most of those incidents involved fishing vessels (Whitney 2000). During the summer months, approximately 30 fishing vessels fish in and around Nelson Lagoon, and transit Nelson Lagoon each day. A Peter Pan Seafoods, Inc. tendering vessel sets anchor just off the Nelson Lagoon dock 3-7 days per week during salmon fishing season to buy fish and sell fuel (unleaded and diesel) to vessels. These fuel transfers occur over water in Nelson Lagoon.

Day and Pritchard (2000) found that most fuel releases at fishing harbors occurred during refueling operations. The average diesel spill was 75.1 gallons, and the average gasoline spill was 79.9 gallons. Diesel spills occurred most frequently (68% of known spills) and gasoline spills occurred far less often (1% of known spills) probably because data were collected from harbors with large vessels in the fishing fleet (Day and Pritchard 2000).

Due to the strong winds that consistently blow in the Nelson Lagoon area, it is expected that any diesel fuel spill would readily disperse into the water column. Petroleum products that disperse into the water column can adhere to fine-grained suspended sediments, which then settle out and deposit on the sea floor. This process is particularly likely to occur within systems like Nelson Lagoon where fine-grain sediments are carried in by rivers (NOAA 2002). Diesel fuel is considered to be among the most acutely toxic oil types, killing birds, fish, invertebrates and seaweed that come in direct contact. Furthermore, shellfish, such as blue mussels, an important forage species for Steller's eiders in Nelson Lagoon, can bioaccumulate the toxic oil (NOAA 2002).

Blue mussels occur in subtidal beds, and are located almost exclusively in areas with good currents, especially around offshore islands and in the mouths of estuaries (fwie.fw.vt.edu/WWW/macsis/lists/M060008.htm, accessed on 11/15/02). Hydrocarbons are rapidly taken up by their gill tissues and eventually are deposited in high concentrations in the alimentary canal. Although oil is only slightly toxic to mussels, it may affect their predators. The uptake and loss of petroleum hydrocarbons may be related to the magnitude of exposure. Mussels placed in clean water lose most of the hydrocarbons, but studies have found that significant quantities of #2 diesel and outboard motor oil remained for as long as 35 days after exposure (fwie.fw.vt.edu/WWW/macsis/lists/M060008.htm, accessed on 11/15/02).

There have been no reported fuel spills in Nelson Lagoon to date. However, because 30 fishing vessels transit and fish within Nelson Lagoon, and fuel transfers from the Peter Pan tender to the fishing vessels occur within the Lagoon, small but chronic releases of petroleum likely occur. The expansion of the bulk fuel facility will allow for the population expansion of the community and the construction and operation of a seafood processing facility, both of which will increase the number of fishing vessels transiting Nelson Lagoon. An increase in fishing vessel activity will increase the probability of chronic petroleum releases.

Commercial Seafood Industry

Currently, there is no seafood processing facility in Nelson Lagoon. Fishers sell their product to Peter Pan Seafoods, located at Port Moller, via a tender vessel that anchors in the main channel of Nelson Lagoon 3-7 days a week during the salmon fishing season (1 June through mid September).

The Peter Pan Seafood facility in Port Moller is located just outside of Steller's eider critical habitat, and was discussed in the Biological Opinion on Reissuance of General NPDES Permit No. AK-G52-0000, for Seafood Processors, for the Alaskan Breeding Population of Steller's Eider (*Polysticta stelleri*) (Service 2001b). The aforementioned biological opinion included the following terms and conditions, specific to the seafood processing facility at Port Moller:

1) *EPA shall add a provision to the SGP prohibiting seafood processors from conducting fueling operations within 4 nm of locations that are documented to have been used by 1,000 or more Steller's eiders, as indicated by surveys conducted since 1990 or subsequent to the issuance of this biological opinion.*

Our information indicates 1,000 or more Steller's eiders have recently been documented in the Nelson Lagoon/Port Moller Complex.

2) *For permittees that discharge organic waste into shallow (<10 fathoms) water bodies within 4 nm of locations which have been documented to have been used by 1,000 or more Steller's eiders (as indicated by surveys conducted since 1990 or as indicated by survey efforts undertaken subsequent to the issuance of this biological opinion), EPA shall require the permittee to conduct or pay for a weekly bird census of waters within 1 nm of the facility. Our information indicates that 1,000 or more Steller's eiders have recently been documented in the Nelson Lagoon/Port Moller Complex.*

Adverse affects to Steller's eiders may occur due to the release of organic waste within foraging habitat that results in disruption of the benthic community and therefore their prey base. Moreover, because of the location of processor organic waste outfalls, Steller's eiders may be temporarily drawn into areas where accidental releases of fuel from fueling operations may occur (e.g., outfall located down current/wind of fueling facility; USFWS 2001b).

Commercial fisheries using nets in near-shore waters (within 3 nm of shore) may impact Steller's eiders. At this time, information regarding potential conflicts with nets is not available. However, Steller's eiders are susceptible to entanglement in gill-nets (Zydelis and Skeiveris 1997). Therefore, any fishery employing gill nets in waters that are being used by Steller's eiders may result in harm to this species.

Based on other sites in Alaska, impacts to Steller's eiders resulting from the seafood industry may be associated with: 1) the loss of gill nets in near-shore waters; 2) the accidental release of fuels into the marine environment during refueling operations; 3) the accidental release of petroleum through the release of contaminated bilge water or from grounded/sunk vessels; and 4) collisions with lighted fishing vessels.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of the action on the species or its critical habitat. The effects of the action will be evaluated together with the effects of other activities that are interrelated or interdependent with the action. These effects will then be added to the environmental baseline in determining the proposed action's effects to the species or its critical habitat (50 CFR Part 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Factors to be considered

Proximity to the action:

Steller's eiders numbering in the thousands have been observed near the Nelson Lagoon dock, and 74,000 or more have been observed within the action area of the proposed project (Dau and Mallek 2000). The action area contains eider foraging and resting habitat, and the entire Nelson Lagoon-Port Moller Critical Habitat Unit falls within this action area.

Distribution:

The location of the proposed bulk fuel upgrade and expansion project occurs within the molting, wintering, and staging critical habitat of Steller's eiders.

Timing:

The construction of the proposed bulk fuel facility project is anticipated to begin in July, just prior to the beginning of the molt period for Steller's eiders, and continue throughout the molting period and into the wintering period. Construction activities will have no adverse effects on Steller's eiders. Once the bulk fuel facility is completed, it will operate while Steller's eiders are present in the area. If refueling of the bulk fuel facility follows historic patterns, deliveries will be made in May, when Steller's eiders are departing for the breeding grounds, and in October, when Steller's eiders are completing the molt and arriving for the winter.

Nature of the effect:

We believe that construction of the bulk fuel facility will not result in the direct loss of any acres of Steller's eider habitat including critical habitat in the Nelson Lagoon-Port Moller complex. Indirect effects to the species and their constituent elements, due to chronic releases of petroleum, may be difficult to quantify.

The accidental release of fuels into the Nelson Lagoon-Port Moller complex may result from a number of sources: 1) human error in the management of the bulk fuel facility, 2) transfer of fuels from the fuel barge to the bulk fuel facility, 3) vessels associated with the increased fishing fleet, 4) vessels associated with the increased population. Accidental petroleum releases can adversely affect the Steller's eider through either contamination of feathers, direct consumption of petroleum (e.g., during preening), contamination of food resources, or reduction in prey availability.

The indirect effects anticipated are due to increased fishing vessel activity in Nelson Lagoon that is expected as a result of the expansion of the bulk fuel facility. The anticipated effects include: 1) increased petroleum pollution resulting in the loss and degradation of Steller's eider foraging and resting habitat; 2) increased probability of bird strikes; 3) increased probability of conflicts with fishing gear (loss of gill nets in near-shore waters); and 4) increased disturbance by fishing vessels.

Oil spills typically increase with an increase in boat traffic and refueling operations. The projected community expansion is primarily related to the fishing industry and vessel traffic in the Nelson Lagoon – Port Moller complex is expected to increase. Therefore the risk to Steller's eider from fuel spills is expected to increase in the following way:

because one out of three residents own a fishing vessel, it is assumed that with the addition of 26 people there will be a resultant addition of eight vessels to the fishing fleet. This increase in fishing vessels constitutes a 28.7% increase in fishing vessel activity from 2000 to 2011. Furthermore, even though vessel fueling is not currently planned in conjunction with the upgrade of the bulk fuel facility, it may be a reality in the future.

Vessel traffic may disturb feeding or resting Steller's eiders, which may have an adverse affect due to the energetic output of escape and stress. Disturbance of feeding and resting Steller's eiders has been documented, and may have varying degrees of severity based on season and frequency of disturbance (Lanctot and King 2000). The detrimental effects of disturbance may be amplified during molt, when Steller's eiders are flightless and require high energetic inputs. A 28.7% increase in vessel traffic, particularly during the molting period (late July through mid September), which overlaps the fishing season, may have adverse affects on Steller's eiders. Moreover, a 28.7% increase in fishing activity within the action area may also increase the probability of lost fishing nets, and collisions with fishing vessels.

Duration:

The potential for accidental releases of petroleum to adversely affect Steller's eiders and their foraging habitat is anticipated to exist for as long as the bulk fuel facility is in operation (40-year project life). The probability of accidental releases of petroleum will increase with each 1) increase in number of fuel deliveries, 2) increase in amount of fuel delivered, or 3) increase in number of vessels transiting the area.

The accidental release of petroleum into the habitat of Steller's eiders may have both an immediate and lingering adverse effect. The oiling of a bird may result in sickness or death, depending on the degree of exposure. Petroleum products released into the marine environment can also have adverse effects that last from several months to several years. Anticipated adverse effects range from changes in prey abundance, distribution, and diversity, to the ingestion of chronic toxic levels of petroleum.

Disturbance frequency:

We have little information that would allow us to predict disturbance frequency. Although fuel deliveries represent a one-time disturbance event, we lack information regarding other vessel activity, petroleum spill timing and frequency, and the degree to which these vessels in the project area will disturb Steller's eiders. However, because the population in the village of Nelson Lagoon is expected to grow at a rate of 2.5% per year, we assume that disturbance frequency will increase at a similar rate.

Disturbance intensity:

Although it is difficult to predict the disturbance intensity of the proposed action, logic dictates that disturbance would be most intense July through mid-September. This is when the fishing fleet is transiting, fishing in, and refueling in Nelson Lagoon, and

Steller's eiders are molting. A 28.7% increase in the fishing fleet during the July through mid-September time period will intensify disturbance by some unknown factor.

Disturbance severity:

Steller's eiders show high fidelity for specific molting sites within lagoons (Flint et al. 2000). Additionally, high levels of wintering site fidelity have been found for other species of sea ducks (Robertson et al. 1999, 2000; Cooke et al. 2000), and evidence suggests that Steller's eiders similarly exhibit high wintering site fidelity (Philip Martin, Service, pers. comm.; Paul Flint, USGS, pers. comm.). Ice conditions may displace Steller's eiders from preferred locations. These preferred locations are also important foraging areas and may be a limited resource (Laubhan and Metzner 1999). Indeed, over-winter starvation resulting from displacement from feeding areas is thought to be a contributing factor to mass mortality of common eiders in the Wadden Sea (Camphuysen 2000). Alternative foraging areas of sufficient quality may not be available for some wintering eiders. Thus, eiders displaced by habitat destruction resulting from fuel spills associated with the bulk fuel facility may not be able to simply relocate without being harmed.

Analyses for effects of the action

This section analyzes the direct and indirect effects of the proposed action and all interrelated and interdependent actions identified in the Environmental Baseline section. This includes a discussion of any beneficial effects anticipated to occur as a result of the proposed action.

Beneficial effects:

Beneficial effects are those effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. While the upgrades to the existing bulk fuel facility will substantially reduce the risk of petroleum spills in Nelson Lagoon, construction and operation of this expanded facility will have no wholly beneficial effect on the Steller's eider. That said, several measures included in the project design, may further minimize the risk of harm to this threatened species. Such measures include:

1) One-way check valves in the fuel distribution lines, located at the junction between the dock and land on the landward side, and at the end of the distribution line near the hose connection.
2) Pigging the distribution lines after fuel delivery to clear the lines of a large percentage of remaining fuel. Pigging is not 100% effective, however, it will serve the purpose of reducing risk of spilled oil from distribution lines over water.

The fuel capacity of the distribution line is approximately 350 gallons, with approximately 200 feet of distribution line, with the capacity of 70 gallons, over salt water. By building one-way check valves into the fuel distribution where the land meets the dock, and at the end of the distribution line near the hose connection, fuel can be isolated and the flow back to the hose connection can be limited. Moreover, “pigging” the distribution line after fuel delivery will clear the lines of much (not all) of the fuel.

Direct effects

The construction of the upgraded bulk fuel facility will not result in a permanent loss of any acres of near-shore habitat that are known to be used by wintering Steller’s eiders, and which may also be used by transient and migrating Steller’s eiders. Furthermore, no acres of critical habitat are expected to be lost as a direct result of this project.

Interrelated and interdependent actions

Actions that are interrelated and interdependent with the proposed construction and operation of an upgraded and expanded bulk fuel facility at Nelson Lagoon include the ability to service an increased population in this community reliant on commercial fishing operations. This expansion is expected to include the construction and operation of a seafood processing plant in the foreseeable future (CE2 Engineers, Inc. 2002).

Indirect Effects

Critical habitat: Critical habitat for Steller’s eiders occurs within the action area of the project (65 FR 13262). However, anticipated habitat loss due to the indirect effects of this project (chronic petroleum releases and organic waste outfall) is impossible to predict or determine. Therefore, at this time, the Service does not estimate any acres of adverse modification of critical habitat for Steller’s eiders.

Increased capacity of the upgraded bulk fuel facility: Village leaders estimate a 2.5% annual growth rate in the population of Nelson Lagoon over the next 10 years (CE2 Engineers, Inc. 2002). This estimated growth assumes the construction and operation of a fish processing plant in Nelson Lagoon, expected to be in operation by 2004. The processing plant and employee living quarters are proposed to be located near the dock. Moreover, a new water treatment plant is expected to replace the existing one, and be in place by 2004, and a new clinic and community building are currently under construction. A summary of the current and the projected fuel demands for the year 2011, based on community growth projections, is presented in Table 8 (CE2 Engineers, Inc. 2002).

Table 8. Projected fuel demand for the year 2011, Nelson Lagoon, Alaska (CE2 Engineers, Inc. 2002).

Fuel Type	2001 Demand (Gallons)	Normal Growth 2001-2011 @ 2.5% per year	Proposed Fish Processing Plant Demand	New and Proposed Community Facilities	Total 2011 Demand (Gallons)
#1 Diesel Fuel	45,000	59,000	0	6,000	65,000
#2 Diesel Fuel	35,000	46,000	40,000	4,000	90,000
Unleaded Gas	30,000	39,000	3,000	0	42,000
Aviation Gas	30,000	39,000	0	11,000	50,000
Propane	6,000	7,900	800	0	8,700

The increased demand for diesel fuel alone will result in a 52% increase in volume of diesel fuel delivered and stored at the Nelson Lagoon facility. Assuming the bulk fuel facility maintains its structural integrity throughout the life of the project, the additional risk to Steller's eiders in Nelson Lagoon, as a result of this project, will occur due to 1) human error, 2) increased volume of fuel delivery, 2) petroleum releases from more fishing vessels, 3) more lost fishing nets, 4) more frequent collisions with additional, lighted fishing vessels, and 3) a nuisance attraction to seafood processor outfall.

Exposure to Petroleum Compounds: Exposure to petrogenic hydrocarbons from boating or fishing activities and accidental oil spills have affected or killed Steller's eiders (Fox et al. 1997), and is cause for concern at the wintering areas of Steller's eiders in Alaska.

Petroleum may adversely affect Steller's eiders through: (1) fouling feathers, thus compromising thermoregulation; (2) causing direct toxicity through consumption of petroleum (e.g., during preening); (3) contaminating food resources; and (4) reducing prey availability due to the toxic effects of petroleum on prey species. Furthermore, the gregarious behavior of Steller's eiders may result in acute or chronic poisoning of large numbers of birds from just one spill. Acute exposure due to direct contact with surface oil may result in sickness, death, or impaired physiological function. Chronic exposure to petroleum compounds through contaminated food sources may have sub-lethal effects on reproductive success, immune system function, and overall condition.

Acute -- The upgrades to the bulk fuel facility in Nelson Lagoon will reduce the risk of catastrophic release of petroleum into Steller's eider critical habitat by: 1) using modern equipment, 2) building secondary containment, and 3) developing spill contingency plans. However, there is still a small probability that a catastrophic spill could occur in Nelson Lagoon, due to unforeseen weather conditions, human error, a boat collision with the dock which supports the distribution lines, or mechanical failure or human error during fuel delivery.

Of 21 spills from tank ships or barges in Alaska, 13 were caused by structural failures or groundings (Arthur D. Little, Inc. 1991). The average amount of each spill was 157,242 gallons, and over 50% of the spilled oil consisted primarily of #2 diesel. By reducing fuel deliveries to one per year, when Steller's eiders are not present, the probability of oil spills harming Steller's eiders would be reduced by 50%.

The fuel barge's distribution hose is constantly used for a multitude of fuel deliveries, and may be dragged over sharp rocks on the beach for long distances. Although the hose is supposed to be checked by the barge company, a high risk of failure of this piece of equipment exists. There is an approximate distance of 100 feet across the dock, where the hose transfers fuel from the barge to the marine header. Secondary containment of this hose would reduce the risk of oil spilling into the waters of Nelson Lagoon, should the hose fail.

Chronic -- Steller's eiders using waters also used by fishing vessels, and where refueling occurs, will be susceptible to adverse effects resulting from both petroleum spills and releases through contaminated bilge water. They may also ingest mollusks and marine crustaceans that have been contaminated with petroleum (Rand and Petrocelli 1985). In addition, eiders may suffer from reduced foraging opportunities if petroleum contamination reduces prey availability.

Blue mussels have been used as indicators of ecosystem health. Responses of blue mussels to pollutant exposure can include delay of maturation, inhibition of growth, and increased mortality, which make this species a useful indicator of ecosystem health (Newell 1989). As with many filter-feeding bivalves, blue mussels can filter and concentrate harmful bacteria from sewage, uptake metals from industrial waste, and concentrate petrochemicals from oil pollution (www.csc.noaa.gov/lcr/nyharbor/html/gallery/sgmytilu.html, accessed 11/15/02). The extent of bioaccumulation of hydrocarbons in the Nelson Lagoon-Port Moller complex is currently unknown.

It is known that petroleum products released into the marine environment cause adverse effects on eiders (Stout 1998), other marine birds (Yamato et al. 1996; Trust et al. 2000; Esler et al. 2000; Custer et al. 2000) and their prey (Glegg et al. 1999), and that those effects can remain for years (Hayes and Michel 1999). Moreover, Esler et al. (2000) found that during winter, harlequin duck survival was 5.7% lower in oiled areas compared to unoiled areas. Harlequin ducks, such as those studied by Esler et al. (2000) in Prince William Sound, are considered suitable surrogate species for Steller's eiders due to similarities in size and life history traits. Furthermore, the periodic release of hydrocarbons, that may have caused the 5.7% reduction in survivorship of harlequin ducks in oiled bays of Prince William Sound, may be comparable, in effect, to the periodic releases of hydrocarbons from fishing vessels.

To assess the risk of chronic oil exposure to Steller's eiders, we created a simple model using the following assumptions: 1) the 1996 aerial survey estimate of Steller's eiders breeding on the Arctic Coastal Plain is an accurate representation of the breeding population today, 2) 54% of the Alaska breeding population spends time in Nelson Lagoon, 3) the overall population decline is occurring at a rate of 7.6% annually, 4) reduced survivorship, due to chronic petroleum releases, occurs at a rate of 5.6% annually, and 5) the life of the project is 40 years.

To model the potential effects of increased fishing vessel activity, and therefore increased risk of chronic oiling, one half of the 1996 Alaska breeding population estimate (2543*0.54=1373) was used to represent the number of Steller's eiders of the listed entity in Nelson Lagoon in year one of the model. The population reduction factor of 5.7% for chronic oiling was applied in an additive fashion to the assumed overall population decline of 7.6% annually. This series of calculations represents the baseline effects in Nelson Lagoon.

Because one of three residents of Nelson Lagoon operates a fishing vessel during the fishing season, the projected population increase in Nelson Lagoon suggests that within 10 years, eight more fishing vessels will be transiting, fishing and refueling in Nelson Lagoon. This represents a 28.7% increase in fishing vessel activity. Therefore, to calculate the effects of this project, we assumed that after year 11 of the project, reduced survivorship due to chronic oiling is 28.7% more likely to occur. The added risk to Steller's eiders is 28.7% of the sum of reduced survivorship from year 11 to year 40 (Appendix I). **Based on the calculations using these assumptions, approximately 40 Steller's eiders of the listed entity will be at risk of harm or death due to chronic exposure to petroleum as a result of this project.**

<u>Seafood Processors</u>: A multi-species seafood processing facility is proposed for construction and operation at Nelson Lagoon by 2004. Indirect affects to Steller's eiders may result if eiders congregate near processor waste outfalls, consequently leading to increased risk of contact with spilled petroleum, solvents, as well as to pathogens and parasites not normally encountered by the species.

Waste products associated with these processors may be detrimental to Steller's eiders. According to the EPA, discharge from seafood processors may affect the water column, sea floor, or shore directly or indirectly through burial and smothering, putrification and decay, deoxygenation, nutrient loading and eutrophication, and alteration of habitats, aquatic communities and food webs. In addition, the growth of noxious or toxic phytoplankton or bacteria may be promoted by the discharges. As such, foraging areas of Steller's eiders may be degraded by the temporary or long-term deposition of organic waste from seafood processors and the birds may be subsequently harmed.

The smothering of benthic communities from organic waste outfall reduces foraging opportunities for Steller's eiders in the area of the outfall by reducing benthic diversity, distribution and abundance. But, it is unknown what effects actual consumption of the outfall may have on the species (USFWS 2001b). Increased catcher vessel activity near processors likely results in increased levels of petroleum contamination not associated with refueling activities (e.g., discharge of oily bilge water and on-deck spills). Furthermore, vessel traffic may disturb birds and increase their energetic expenditures while perhaps decreasing caloric intake (Service 2001b).

Past and present impacts to Steller's eiders resulting from the seafood industry at other sites in Alaska may be associated with: 1) the degradation of habitat due to the release of organic waste into near-shore marine waters; 2) the loss of gill nets in near-shore waters; 3) the accidental release of fuels into the marine environment during refueling operations; 4) the accidental release of petroleum through the release of contaminated bilge water or from grounded/sunk vessels; and 5) collisions with lighted fishing vessels.

Future impacts associated with the commercial seafood industry may increase with the construction and operation of a seafood processor in Nelson Lagoon. Fishing vessel traffic is anticipated to increase, causing the increased risk of petroleum releases, loss of gill nets in near-shore waters, and collisions with lighted fishing vessels. The anticipated take due to petroleum releases and collisions with lighted fishing vessels are discussed in other sections.

Conservation recommendations put forth in the Biological Opinion on the NPDES Permit No. AK-G52-0000, for Seafood Processors, for the Alaskan Breeding Population of Steller's Eider (*Polysticta stelleri*) (Service 2001b) states that:

> *EPA should add a provision to the Statewide General Permit (SGP) prohibiting seafood processors from discharging organic waste into shallow (<10 fathoms) water bodies within 4.0 nm of locations that are documented to have been used by 1,000 or more Steller's. Our information indicates that 1,000 or more Steller's eiders have recently been documented in the Nelson Lagoon/Port Moller Complex.*

<u>Collisions with Lighted Vessels</u>: Anecdotal evidence that eiders and other sea ducks may become disoriented and strike vessels and other lighted structures in adverse weather conditions supports the assumption that Steller's eiders staging, molting and wintering in close proximity to fishing vessels are at increased risk of similar collisions. Because lights are not required during most of the salmon fishing season, when Nelson Lagoon fishers have their vessels in the water, this risk is lessened. However, if a multi-species seafood processor is constructed and operated in Nelson Lagoon, the fishing season may extend into time periods requiring vessels to be lighted. **It is estimated that one Steller's eider belonging to the listed Alaska breeding population will be injured or killed in this manner.**

<u>Displacement from Foraging Areas</u>: Lanctot and King (2000) observed that Steller's eiders within Akutan Harbor were exposed to a large number of vessels, including large and small fishing vessels, small skiffs, and barges, on a daily basis. Steller's eiders showed variable responses to approaching vessels. When approached to within 100 meters, Steller's eiders sometimes responded by swimming then flying from the area. Other times Steller's eiders flushed at a distance of 200-300 meters from the vessel. Variability in tolerance to approaching vessels may be a function of seasonal sensitivity, or conditioning or a combination of these factors (Lanctot and King 2000). Based on this information, it is possible that vessel traffic may cause disturbance to molting and

foraging Steller's eiders, however, we do not anticipate that the increase of eight vessels to Nelson Lagoon will cause significant additional harm in the form of disturbance.

Species' response to a proposed action

Numbers of individuals/populations in the action area affected

Fall aerial survey data indicate that on average, 52,151 Steller's eiders use waters within the action area of this proposed project. Assuming that 4.2% of wintering Steller's eiders breed in Alaska, 2190 Steller's eiders may be affected by increased vessel traffic associated with expansion of the bulk fuel facility in Nelson Lagoon.

Sensitivity to change: Steller's eider behavior appears to change with changing environmental conditions. At times, they have also been observed foraging in close proximity to human made structures. They have also been observed foraging and resting adjacent to docks. However, we have observed that they move and maintain a distance of at least 100 meters from humans and vessels. As such, we do not anticipate total abandonment of areas due to the increased vessel traffic associated with the proposed project, but anticipate some level of disturbance due to the increased human activity.

Resilience: We have little information suggesting what sort of resilience to perturbations is inherent in this species. We do note, however, that the world population has declined by 80% since the 1940s, from 1,000,000 (Tugarinov 1941 as in Solovieva 1997) to 200,000 in 1994 (Solovieva 1997). Extensive banding efforts and aerial survey efforts over the past decade indicate that the trend for the world population continues to be negative (Flint et al. 2000, Larned 2000b). As such, the Steller's eider does not appear to be resilient enough to overcome the mortality factors causing its decline. Whether this lack of resilience is due to low fecundity, low recruitment, or excessive adult mortality is unknown.

We note that Steller's eiders now exhibit an atypical sex ratio for sea ducks (See "Allee affect"). Whatever may be causing this observed shortage of males may in turn be affecting this species resilience to perturbations.

Recovery rate: The natural recovery rate of Steller's eiders is not known. Recovery rate is a relative response and is tied, in large part, to traits of the species' life history. In general, long-lived species with low annual fecundity should have a relatively slow recovery rate compared to short-lived species with high annual fecundity. Given the Steller's eider's observed low fecundity, i.e., small clutch sizes, high variability in nesting attempts, and generally low nest success (Quakenbush et al. 1995, D. Solovieva, Zoological Institute, Russian Academy of Science, pers. comm.), the recovery rate for this species may be quite slow. Unnaturally high mortality of breeding adults may even prevent recovery of this species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Fisheries conducted in near-shore waters may impact this federally protected sea duck. The potential for conflict is especially high where large numbers of this species congregate to molt. At this time, information regarding those types of conflicts is not available. However, scientists in Lithuania observed that Steller's eiders are susceptible to entanglement in gill nets (Zydelis and Skeiveris 1997). Therefore, any fishery employing gill nets in waters that are also being concurrently used by Steller's eiders may result in harm to this species. It is unknown to what extent Steller's eiders are endangered by derelict gear from such net-based near-shore fisheries, but we assume that there is some risk of birds becoming entangled in such gear. Fishing vessels operating with bright lights near-shore during adverse weather conditions may cause Steller's eider mortality by inducing collisions between the vessel and flying, disoriented Steller's eiders. Furthermore, petroleum releases from fishing vessels associated with the development of multi-species fisheries and seafood processing may increase the risk of chronic oil effects on Steller's eiders and their prey.

CONCLUSION

After reviewing the current status of the Alaskan breeding population of Steller's eiders, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species, nor is it likely to adversely modify or destroy Steller's eider critical habitat. Critical habitat for this species has been designated at the Nelson Lagoon – Port Moller Unit, however, this action does not affect that area and no destruction or adverse modification of that critical habitat is anticipated.

The regulations (51 FR 19958) that implement section 7(a)(2) of the Act define "jeopardize the continued existence of "as" to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." We have concluded that the proposed action is not likely to jeopardize the continued existence of the Alaska breeding population of Steller's eiders or adversely modify or destroy its critical habitat. However, we do recognize that, while impossible to predict with certainty, adverse impacts may occur, primarily as a result of increased fishing vessel activity, and the potential for releases of petroleum into habitat potentially occupied by staging, molting and wintering Steller's eiders.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service 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, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the DC and BIA so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The DC and BIA have a continuing duty to regulate the activity covered by this incidental take statement. If the DC and BIA: (1) fail to assume and implement the terms and conditions, or (2) fail 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. In order to monitor the impact of incidental take, the DC and BIA or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

Amount or extent of take anticipated

We anticipate that incidental take of Steller's eiders will be difficult to document because: 1) the effects of the loss of a foraging area to Steller's eiders that use that area will be difficult to quantify; 2) Steller's eiders exposed to petroleum levels that are not immediately lethal may not die near the location of contact; 3) Steller's eiders exposed to sub-lethal levels of petroleum will not exhibit readily apparent signs of toxicity; 4) impacts to prey abundance and distribution from released petroleum products will not be readily apparent; 5) the extent to which petroleum contamination can be attributed to the proposed action will be difficult or impossible to determine; and 6) the exact number of Steller's eiders belonging to the Alaska breeding population at this site is unconfirmed.

The Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Take Related to Bulk Fuel Facility Construction

The Service does not expect that construction of the bulk fuel facility will result in take because no in-water work is scheduled and no destruction of near-shore habitat will occur.

Take Related to Acute Exposure to Petroleum Compounds

The Service believes that the probability of catastrophic releases of petroleum, due to distribution line failure, or sunken or otherwise compromised fishing or barge vessels, while possible, is low and unpredictable.

Take Related to Chronic Exposure to Petroleum Compounds

The Service anticipates that, as a result of this project, petroleum releases will increase in association with equipment failure, contaminated bilge water discharges, and fuel deliveries over water. This recognition by the Service is not intended to legitimize the otherwise illegal act of releasing petroleum into the environment. Based on our model estimate, 40 eiders of the listed entity are at risk of chronic and lethal exposure to fuel (Appendix I). This model assumes that there is a current level of chronic oil exposure, and that this level will increase in the future. However, because Flint et al. (2000) found no significant difference in survival between Nelson Lagoon and Izembek Lagoon (where there is limited commercial fishing and no over-water refueling), we believe a reasonable, yet conservative approach for estimating take due to chronic oiling is to use the mid-point of these two estimates (0 and 40). **Therefore, we estimate that, over the life of this project, no more than 20 Steller's eiders of the listed Alaska breeding population will be taken as a result of chronic petroleum releases that occur within the Nelson Lagoon-Port Moller complex.** This take is expected to be in the form of harm or direct lethal take.

Take Related to Collisions with Vessels or Structures

The Service expects that the installation of an expanded bulk fuel facility and subsequent operation of a multi-species seafood processor, will increase the number and duration of vessels fishing and transiting the Nelson Lagoon-Port Moller complex. This increase in frequency and duration (months where vessels will require lighting) will result in harm or direct lethal take of birds striking vessels. We anticipate that this take will be in association with the use of bright lights during poor weather. **We estimate that no more than one Steller's eider of the listed Alaska breeding population will be taken as a result of striking vessels fishing and transiting Nelson Lagoon.**

Take Related to Fishing Nets

The Service believes that the probability of lethal take, as a result of interaction with fishing nets, is probable. However, the frequency with which these interactions occur is unclear and at this time unpredictable.

Total Take

In total, the Service expects that the construction and operation of the upgraded and expanded bulk fuel facility in Nelson Lagoon, Alaska will result in the take of 21 Steller's eiders of the Alaska breeding populations.

This amount of take is approximately 0.8% of the known population of Alaskan breeding Steller's eiders, and is the largest incidental take estimated, to date, for a formal section 7 consultation including Steller's eiders. The importance of the Nelson Lagoon-Port Moller complex for staging, molting, and wintering Steller's eiders cannot be understated, as is verified by the fact that a majority of the wintering population and half the Alaskan breeding population use this area.

We are currently unable to distinguish between North American breeding Steller's eiders and Steller's eiders that breed elsewhere when the birds are present on their molting or wintering areas. Future research may enable us to distinguish between listed and non-listed populations. Absent such capabilities, we will assume the expected take levels associated with this Incidental Take Statement to have been exceeded if any of the following occur:

1) Greater than 1 Steller's eider of the listed entity is harmed or killed as a result of striking vessels fishing or transiting Nelson Lagoon;
2) Greater than 24 (=1 ÷ 0.042) Steller's eiders are harmed or killed as a result of striking vessels fishing or transiting Nelson Lagoon;
3) Greater than 20 Steller's eiders of the listed entity are harmed or killed as a result of petroleum releases that occur in association with the expanded bulk fuel facility;
4) Greater than 476 (=20 ÷ 0.042) Steller's eiders are harmed or killed as a result of petroleum releases that occur in association with the expanded bulk fuel facility;

Effect of the take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the Steller's eider or the destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Steller's eider:

1) The DC and the BIA shall minimize the potential for impacts to Steller's eiders during operation of the bulk fuel facility.

2) The DC and the BIA shall monitor impacts to Steller's eiders and their critical habitat due to the increase in vessels fishing and transiting the Nelson Lagoon-Port Moller complex, that would not otherwise occur but for the expansion of the bulk fuel facility.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the DC and BIA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions implement Reasonable and Prudent Measure No. 1: "The DC and the BIA shall minimize the potential for impacts to Steller's eiders during operation of the bulk fuel facility."

1.1 The DC shall facilitate the development of a Memorandum of Agreement (MOA) between Nelson Lagoon Enterprises and the Service, whereby Nelson Lagoon Enterprises will ensure that fuel will be delivered to the bulk fuel facility no more than one time per year, and that delivery will occur between 1 June and 15 July. This MOA shall be developed and signed by all parties before the start of construction of the new bulk fuel facility;

1.2 The DC shall fund the design and construction of a secondary containment apparatus to house the barge distribution hose that extends over the Nelson Lagoon dock to the marine header. The purpose of this secondary containment apparatus is to collect any fuel leakage from the barge's distribution hose that may occur during fuel offloading. This secondary containment apparatus can be portable. The design and construction of this secondary containment apparatus must be completed before the first fuel delivery, once the upgrades of the facility are completed. Alternatively, the DC and/or BIA may require Nelson Lagoon Enterprises to design and construct the secondary containment apparatus.

1.3 The BIA shall fund the development of a Geographic Response Strategy (GRS) for Nelson Lagoon. The GRS is a site-specific aid for first responders, identifying Steller's eider concentration areas and known areas of high forage value, and providing tactical solutions in the event of a fuel spill. GRS are intended to be flexible so as to allow the spill responders to modify them, as necessary, to fit the prevailing conditions at the time of a spill.

1.3.1 The BIA shall contract an oil spill response expert or organization to develop the GRS and conduct the site test. The GRS will be developed to use the local workforce of Nelson Lagoon, including their vessels for initial response to a spill.

1.3.2 The BIA shall ensure that the equipment needed to implement this GRS within the Nelson Lagoon-Port Moller complex is procured and readily available for deployment. Equipment will be stored and maintained in Nelson Lagoon. Local workforce and local vessels will be used. GRS development and site testing shall be completed by 15 July of the year that operation of bulk fuel facility commences.

1.3.3 The BIA shall ensure that the appropriate agencies (USFWS, ADEC, Alaska Department of Fish and Game, CG, National Oceanic and Atmospheric Association) review and comment on the GRS. The final version is to be published in the Aleutians Subarea Contingency Plan and on the ADEC GRS website.

1.3.4 The BIA shall obtain all necessary equipment, as per ADF&G recommendations, and required training and permits to haze Steller's eiders away from oil spilled in Nelson Lagoon (see Appendix II for list of hazing equipment, and permit and training information). The necessary hazing equipment shall be obtained and training completed by 15 July of the year that operation of the bulk fuel facility commences. (ADEC may provide funding for hazing training.)

The following terms and conditions implement Reasonable and Prudent Measure No. 2: "The DC and the BIA shall monitor the potential impacts of increased vessel activity in Nelson Lagoon on critical habitat."

2.1 The DC and/or BIA shall require the local project sponsors to report to the Service all dead, injured, or contaminated Steller's eiders resulting from collisions or petroleum releases by the bulk fuel facility or vessels associated with the Village of Nelson Lagoon. Dead, injured, and contaminated eiders shall be handled according to the dead and injured eider protocol (Appendix III). Costs of rehabilitation of injured and contaminated eiders shall be borne by the Service.

CONSERVATION RECOMMENDATION

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act 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.

1.1 The BIA and DC, or the local project sponsor, shall partner with the Service to compete for funding resources and monitor the potential for hydrocarbon contamination of important forage species for Steller's eiders that stage, molt and winter in Nelson Lagoon. This study will monitor the effects of chronic discharges of petroleum on those forage species including blue mussels (*M. edulis*) and possibly clams (*M. balthica*). Design of this monitoring study shall be developed in collaboration with the U.S. Fish and Wildlife Service. Monitoring shall commence before the completion of the bulk fuel facility and continue on a yearly basis for the first 3 years. Information gathered during this monitoring study will be summarized in an annual report submitted to the Service. The goals of this study are to:

1. Understand the effects of chronic petroleum spills on important forage species;
2. Understand the extent of toxic contamination in key areas of the Nelson Lagoon-Port Moller complex.

REINITIATION NOTICE

This concludes formal consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation 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 at least one of the following factors occurs: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a matter or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species not covered by this opinion is listed or critical habitat designated that may be affected by this action. For this project, reinitiation could occur under (2) above if results of the monitoring study on forage species reveal significant information regarding presence or absence of hydrocarbons at levels sublethal to birds. In instances where the amount or extent of incidental take is exceeded, any operations causing such take should cease pending reinitiation.

LITERATURE CITED

ABR, Inc. 1999. Results of Steller's eider surveys near Barrow, Alaska. Prepared for U.S. Fish and Wildlife Service, Fairbanks, Alaska.

Agler, B. A., S. J. Kendall, P. E. Seiser, and D. B. Irons. 1994. Monitoring seabird populations in areas of oil and gas development on the Alaskan Continental Shelf: Estimates of marine bird and sea otter abundance in lower Cook inlet, Alaska, during summer 1993 and winter 1994.

Andersen, R. M. 1913. Arctic game notes. Distribution of large game animals in the far North: extinction of the musk ox; the chances for survival of moose and caribou; mountain sheep, polar bear and grizzly. Natural History. Vol 13. p. 5-21.

Anderson et al. 1992. Philopatry, dispersal and the genetic structure of waterfowl populations. Pages 365-395, *in* B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu (eds.), Ecology and management of breeding waterfowl. University of Minnesota Press, Minneapolis.

Arthur D. Little, Inc. 1991. Study of noncrude tank vessels and barges. Final report for Alaska Department of Environmental Conservation. Arthur D. Little, Inc., Acorn Park, Cambridge, Massachusetts. Reference 66727-00.

Begon, M. and M. Mortimer. 1986. Population ecology: a unified study of animals and plants. 2nd ed. Blackwell Scientific Publications. Cambridge, MA.

Bellrose, F. C. 1980. Ducks, geese and swans of North America. A wildlife management institute book sponsored jointly with the Illinois Natural History Survey. Stackpole Books, PA.

Bengtson, S. A. 1972. Breeding ecology of the harlequin duck (*Histrionicus histrionicus*) in Iceland. Ornis Scand. 3:1-19.

Bent, A. C. 1987. Life Histories of North American waterfowl. Two parts bound as one. Dover Publications, Inc., New York.

Brackney, A. W. and R. J. King. 1996. Aerial breeding pair surveys of the arctic coastal plain of Alaska: Distribution and abundance 1995. U. S. Fish and Wildlife Service, Migratory Bird Management.

Brandt, H. 1943. Alaska bird trails. Cleveland: Bird Research Foundation. 464 p.

Brooks, W. S. 1915. Notes on birds from east Siberia and arctic Alaska. Bulletin of the Museum of Comparative Zoology. Harvard University. v. 59, no. 5, p. 361-413.

Bustnes, J. O., M. Asheim, T. H. Bjorn, H. Gabrielsen, and G. H. Systad. 2000. The diet of Steller's eiders wintering in Varangerfjord, Northern Norway. Wilson Bull., 112(1):8-13.

Camphuysen, K. 2000. Mass mortality of Common Eiders in the Wadden Sea, winter 1999/2000: food related parasite outbreak? Atlantic Seabirds 2:47-48.

CE2 Engineers, Inc. 2002. Conceptual design report Nelson Lagoon fuel facilities. Unpublished document prepared by CE2 Engineers Inc., Anchorage, AK.

Conover, H.B. 1926. Game birds of the Hooper Bay region, Alaska. Auk 43: 162-180.

Cooke, F., G. J. Robertson, C. M. Smith, R. I. Goudie, and W. S. Boyd. 2000. Survival, emigration and winter population structure of harlequin ducks. Condor 102:137-144.

Custer, T.W., C.M. Custer, R.K. Hines, D.W. Sparks, M.J. Melancon, D.J. Hoffman, J.W. Bickham and J.K. Wickliffe. 2000. Mixed-function oxygenases, oxidative stress and chromosomal damage measured in lesser scaup wintering on the Indiana Harbor Canal. Archives of Environmental Contamination and Toxicology, 38(4): 522-529.

Dau, C. P. 1987. Birds in nearshore waters of the Yukon-Kuskokwim Delta, Alaska. Murrelet, vol. 68, no. 1, p. 12.

Dau, C.P. 1991. Population size and migratory phenology of Soviet breeding Steller's eiders at the Izembek National Wildlife Refuge, (Abstract), Alaska Bird Conference and Workshop, 19-22 November 1991. Anchorage AK.

Dau, C.P. and E.J. Mallek. 2000. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, spring 2000. Unpublished document, USFWS, Waterfowl Management, 1011 E. Tudor Road, Anchorage, AK.

Dau, C.P. and E.J. Mallek. 2001. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, spring 2001. Unpublished document, USFWS, Waterfowl Management, 1011 E. Tudor Road, Anchorage, AK.

Dau, C.P. and E.J. Mallek. 2002. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, spring 2002. Unpublished document, USFWS, Waterfowl Management, 1011 E. Tudor Road, Anchorage, AK.

Dau, C. P., P. L. Flint, and M. R. Petersen. 2000. Distribution of recoveries of Steller's eiders banded on the lower Alaska Peninsula, Alaska. In Press. J. Field Ornithology.

Day, R.H. 2001. Unpublished document of a personal communication with Trish Kaminsky, Seward. Alaska Biological Research, Fairbanks, Alaska.

Day, R. H. and A. K. Pritchard. 2000. Task 2C. Estimated future spills. Prepared for the U.S. Army Engineer District, Alaska. ABR, Inc., Fairbanks, Alaska.

Dick, M.H. and L.S. Dick. 1971. The natural history of Cape Pierce and Nanvak Bay, Cape Newenham National Wildlife Refuge, Alaska. USFWS Unpublished Report., Bethel, Alaska. 77pp.

Dow, H., and S. Fredga. 1983. Breeding and natal dispersal of the goldeneye (*Bucephala clangula*). J. Anim. Ecol. 53:679-692.

Esler, Daniel, J. A. Schmutz, R. L. Jarvis, and D. M. Mulchay. 2000. Winter survival of adult female harlequin ducks in relation to history of contamination by the Exxon Valdez oil spill. J. Wildl. Manage. 64(3):839-847.

Fay, F.H., and T.J. Cade. 1959. An ecological analysis of the avifauna of St. Lawrence Island Alaska. Univ. Calif. Public. In Zool. 63(2):73-150. Berkeley, CA.

Finley, D. B., G. I. Scott, J. W. Daugomah, S. L. Layman, L. Reed, M. Sanders, S. K. Sivertsen, E. D. Strozier. 1999. Case study: Ecotoxicological assessment of urban and agricultural nonpoint source runoff effects on the grass shrimp, *Palaemonetes pugio*, p. 243-273, *in* M. A. Lewis, F. L. Mayer, R. L. Powell, M. K. Nelson, S. J. Klaine, M. G. Henry, and G. W. Dickson [eds], Ecotoxicology and Risk Assessment for Wetlands. A special publication of SETAC

Flint, P. L., M. R. Petersen, and J. B. Grand. 1997. Exposure of spectacled eiders and other diving ducks to lead in western Alaska. Can. J. Zool.

Flint, P. L and M. P. Herzog. 1999. Breeding Steller's eiders, *Polysticta stelleri*, on the Yukon-Kuskokwim Delta, Alaska. Canadian Field-Naturalist 113:306-308.

Flint, P. L., M.. R. Petersen, C. P. Dau, J. E. Hines, J. D. Nichols. 2000. Annual survival and site fidelity of Steller's eiders molting along the Alaska Peninsula. J. Wildl. Manage. 64(1):261-268.

Fox, AD, C Mitchell, G Henriksen, E Lund and B Frantzen (1997) The conservation of Steller's eider (*Polysticta stelleri*) in Varanger Fjord, Finnmark, Norway. Wildfowl, 48:156-165.

Gabrielson, I.N., and Lincoln, F.C. 1959. The birds of Alaska. Harrisburg: Stackpole CO 922 p.

Gill, R.E., Jr., M.R. Petersen, and P.D. Jorgensen. 1981. Birds of the northcentral Alaska Peninsula, 1976-1980. Arctic, 34:286-306.

Gillham, C.E. 1941. Report of Alaska waterfowl investigations, Lower Yukon River, Chevak, Hooper Bay. Unpubl. Report, U.S. Department of Interior, Fish and Wildlife

Service, Juneau, Alaska. Available at the ARLIS Library, 3150 C Street, Anchorage, Alaska 99503.

Gilpen, M. E. 1987. Spatial structure and population vulnerability, p. 125-139, *in* M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, New York.

Glegg, G. A., L. Hickman, and S. J. Rowland. 1999. Contamination of limpets (*Patella vulgator*) following the Sea Empress oil spill. Marine Pollution Bulletin. Vol. 38. No.2:119-125.

Goodman, D. 1987. The demography of chance extinctions. Pages 11-34, *in* M. E. Soule, editor, Viable populations for conservation. Cambridge University Press, New York.

Goudie, R. I., and C. D. Ankney. 1986. Body size, activity budgets, and diets of sea ducks wintering in Newfoundland. Ecology 67:1475-1482.

Hayes, M.O. and J. Michel. 1999. Factors determining the long-term persistence of Exxon Valdez oil in gravel beaches. Marine Pollution Bulletin, 38: 92-101.

Hodges, J. I., J. G. King, B. Conant, and H. A. Hanson. 1996. Aerial surveys of waterbirds in Alaska 1957-94: Population trends and observer variability. U. S. Department of the Interior. National Biological Service.

Holmes, W. N. 1984. Reviews in environmental toxicology 1. Editor Ernest Hodgson, North Carolina State University. Elsevier Science Publishers, New York.

Holmes, W. N., J. Cronshaw, and J. Gorsline. 1978. Some effects of ingested petroleum on seawater-adapted ducks (*Anas platyrhynchos*). Environmental Research. 17:177-190.

Holmes, W. N., J. Gorsline, J. Cronshaw. 1979. Effects of mild cold stress on the survival of seawater-adapted mallard ducks (*Anas platyrhynchos*) maintained on food contaminated with petroleum. Environmental Research. 20:425-444.

Johnsgard, P. A. 1994. Arena birds, sexual selection and behavior. Smithsonian Institution Press, Washington and London.

Kertell, K. 1991. Disappearance of the Steller's eider from the Yukon-Kuskokwim Delta, Alaska. Arctic 44:177-187.

Laing, K. 1995. A pilot survey to determine distribution and abundance of Steller's eiders on the Alaska Arctic Coastal Plain. U.S. Fish and Wildlife Service, Migratory Bird Management.

Lanctot, R.B. and J.C. King. 2000. Steller's eider and other waterbird numbers and distribution at Akutan Harbor, Alaska, winter of 1999/2000. Unpublished report prepared by LGL Alaska Research Associates, Inc., 4175 Tudor Centre Drive, Suite 202, Anchorage, AK 99508.

Lande, R., and G. F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pages 87-123, *in* M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, New York.

Larned, W. W. 1998. Steller's eider spring migration surveys, 1998. U.S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W. 2000a. Aerial surveys of Steller's eiders and other waterbirds and marine mammals in southwest Alaska areas proposed for navigation improvements by the U.S. Army Corps of Engineers, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W. 2000b. Steller's eider spring migration surveys, 2000. U.S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W. 2001. Steller's eider spring migration surveys, 2001. U.S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W. 2002. Steller's eider spring migration surveys, 2002. U.S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W., and G. Balogh. 1996. Eider breeding population survey, Arctic coastal plain, Alaska, 1992-96. U. S. Fish and Wildlife Service.

Larned, W. W., B. Butler, and G. Balogh. 1993. Progress report: Steller's eider spring migration surveys southwest Alaska, 1993. U. S. Fish and Wildlife Service, Migratory Bird Management Project.

Larned, W. W. and T. Tiplady. 1996. Distribution and abundance of sea ducks in Kuskokwim Bay, Alaska, September 1996. Migratory Bird Management, U.S. Fish and Wildlife Service.

Larned, W. W., T. Tiplady, R. Platte, and R. Stehn. 1999. Eider breeding population survey Arctic coastal plain, Alaska, 1997-98. U. S. Fish and Wildlife Service, Migratory Bird Management.

Larned, W. W. and D. Zwiefelhofer. 1995. Distribution and abundance of Steller's eiders (Polysticta stelleri) in the Kodiak Archipelago, Alaska, March 1994. 18pp.

Laubhan, M.K. and Metzner, K.A. 1999. Distribution and diurnal behavior of Steller's Eiders wintering on the Alaska Peninsula. Condor. 101(3): 694-698.

Leighton, F. A. 1993. The toxicity of petroleum oils to birds. Environmental Review. Vol.1:92-103.

Leighton, F. A., D. B. Peakall, and R. G. Butler. 1983. Heinz-body hemolytic anemia from the ingestion of crude oil: A primary toxic effect in marine birds. Science. 220:271-273.

LGL Alaska Research Associates, Inc. 2000a. Abundance and distribution of Steller's eiders and other waterbirds at False Pass, Alaska, January through March of 2000.

LGL Alaska Research Associates, Inc. 2000b. Steller's eider and other waterbird numbers and distribution at Akutan Harbor, Alaska, Winter of 1999/2000.

Mallek, E.J., R. Platte, and R. Stehn. 2002. Aerial breeding pair surveys of the Arctic Coastal Plain of Alaska-2001. Unpublished document, USFWS, Waterfowl Management, 1412 Airport Way, Fairbanks, AK.

Mallek, E.J. and C.P. Dau. 2000. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2000. Unpublished document, USFWS, Waterfowl Management, 1412 Airport Way, Fairbanks, AK.

Mallek, E.J. and C.P. Dau. 2001. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2001. Unpublished document, USFWS, Waterfowl Management, 1412 Airport Way, Fairbanks, AK.

Mallek, E.J. and C.P. Dau. 2002. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2002. Unpublished document, USFWS, Waterfowl Management, 1412 Airport Way, Fairbanks, AK.

Mallek, E. J., and R. J. King. 2000. Aerial breeding pair surveys of the Arctic coastal plain of Alaska. U.S. Fish and Wildlife Service, Waterfowl Management, 1412 Airport Way, Fairbanks, AK.

Martin, P. D. and T. Obritschkewitsch. 2002. Breeding biology of Steller's eiders nesting near Barrow, Alaska 2001. U.S. Fish and Wildlife Service Technical Report, NAES-TR-02-01, Fairbanks, Alaska.

McEwan, E. H. and P. M. Whitehead. 1980. Uptake and clearance of petroleum hydrocarbons by the glaucous-winged gull (*Larus glaucescens*) and the mallard duck (*Anas platyrhynchos*). Canadian Journal Zoology. 58:723-726.

Metzner, K. A. 1993. Ecological strategies of wintering Steller's eiders on Izembek Lagoon and Cold Bay, Alaska. A Thesis presented to the faculty of the Graduate School, University of Missouri, Columbia.

Morrison, M.L. and K.H. Pollock. 2000. Development of a practical modeling framework for estimating the impact of wind technology on bird populations. *In* Proceedings from the National avian-wind power planning meeting III, San Diego, California, May 1998. http://www.nationalwind.org/pubs/avian98/27-Morrison_Pollock-Modeling.pdf/accessed 12 March, 2003.

Morrison, M.L., K.H. Pollack, A.L. Olberg, and K.C. Sinclair. 1998. Predicting the response of bird populations to wind energy-related deaths. Unpublished report, National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

Murie, O.J. 1924. Report on investigations of birds and mammals of the Hooper Bay section of Alaska during the spring and summer of 1924. Unpublished report, U.S. Department of Agriculture, Biological Survey, Washington D.C.

Murie, O.J. and V.B. Scheffer. 1959. Fauna of the Aleutian Islands and Alaska Peninsula, with notes on the invertebrates and fishes collected in the Aleutians, 1936-38. North American Fauna No. 61. 406 pp.

Newell, R.I.E. 1989. Species Profile of the Blue Mussel, *Mytilus edulis*. U.S. Fish. Wildl. Ser. Biol. Rep. 82(11). U.S. Army Corps of Engineers, TR El-82-4. 4O pp.

NOAA. 2000. Small diesel spills in marine waters: a fact sheet. In John Whitney, author, *The Aleutian Islands and lower Alaska Peninsula: oceanographic conditions and NOAA's oil spill response history during 1981-1999.* HAZMAT report 2000-3, Hazardous Materials Response Division, Office of Response and Restoration, National Ocean Service, NOAA, Anchorage, AK.

Petersen, M. R. 1980. Observations of wing-feather molt and summer feeding ecology of Steller's eiders at Nelson Lagoon, Alaska. Wildfowl 31:99-106.

Petersen, M. R. 1981. Population, feeding ecology and molt of Steller's eiders. Condor 83:256-262.

Petersen, M.R. and M.J. Sigman. 1977. Field studies at Cape Pierce, Alaska – 1976. P. 633-693, *in* Environmental Assessment of the Alaskan Continental Shelf, Annual reports of Principal Investigators, V. 4, NOAA, Boulder, CO

Petersen, M. R, D. N. Weir, and M. H. Dick. 1991. Birds of the Kilbuck and Ahklun Mountain Region, Alaska. U. S. Fish and Wildlife Service, Anchorage, Alaska.

Portanko, L.A. 1972. Birds of the Chukchi Peninsula and Wrangel Island. Part 1. Leningrad: Nauka Press, 446 pp.

Quakenbush, L. T., R. S. Suydam, K. M. Fluetsch, and C. L. Donaldson. 1995. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1991-1994. Technical Report, U.S. Fish and Wildlife Service and North Slope Borough, Department of Wildlife Management.

Rand, G. M. and S. r. Petrocelli. 1985. Fundamentals of aquatic toxicology. Hemisphere Publishing Corporation, Washington.

Robertson, G. J. 1997. Pair formation, mating system, and winter philopatry in harlequin ducks. Dissertation, Simon Fraser University, Vancouver, British Columbia, Canada.

Robertson, G. J., F. Cooke, R. I. Goudie, and W. S. Boyd. 1999. Within-year fidelity of Harlequin Ducks to a moulting and wintering area, p. 45-51, *in* R. I. Goudie, M. R. Petersen, and G. J. Robertson [eds.], Behaviour and ecology of sea ducks. Canadian Wildlife Service Occasional Paper Series No. 100, Ottawa, Ontario, Canada.

Rocke, T. E., T. M. Yuill, and R. D. Hinsdill. 1984. Oil and related toxicant effects on mallard immune defenses. Environmental Research. (33) 343-352.

Savard, J. P. L. 1985. Evidence of long-term pair bonds in Barrow's Goldeneye (*Bucephala islandica*). Auk 102:389-291.

Savard, J. P. L. and J. M. Eadie. 1989. Survival and breeding philopatry in Barrow's and common goldeneyes. Condor 91:198-203.

Scribner, K. T., R. L. Fields, S. Talbot, J. Pearce, M. Petersen, and R. K. Chesser. 2000. Sex-biased gene flow in spectacled eiders (Anatidae): Inferences from molecular markers with contrasting modes of inheritance. Evolution, 55(10): 2105-2115.

Shaffer, M. 1987. Minimum viable populations: coping with uncertainty. Pages 69-86, *in* M. E. Soule, editor, Viable populations for conservation. Cambridge University Press, New York.

Schmutz, J. A., R. F. Rockwell, and M. R. Petersen. 1997. Relative effects of survival and reproduction on the population dynamics of emperor geese. Journal of Wildlife Management 61:191-201.

Solovieva, D. 1997. Timing, habitat use and breeding biology of Steller's eider in the Lena Delta, Russia. Wetlands International Seaduck specialist Group Bulletin.

Sterns, S. C. 1992. The evolution of life histories. Oxford University Press, New York, New York, USA.

Stout, J.H. 1998. Spectacled eider (*Somateria fischeri*) contaminants summary report. U.S. Fish and Wildlife Technical Report No. WAES-TR-98-01, Anchorage, Alaska, 19 pp.

Swarth, H.S. 1934. Birds of Nunivak Island, Alaska. Pacific Coast Avifauna No 22. 64 pp.

Trust, K. A., E. Esler, B. R. Woodin, and J. J. Stegeman. 2000. Cytochrome P450 1A induction in sea ducks inhabiting near shore areas of Prince William Sound, Alaska. Marine Pollution Bulletin 40:397-403.

U.S. Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants; threatened status for the Alaska breeding population of the Steller's eider. Federal Register/Vol. 62, No. 112. 31738.

U.S. Fish and Wildlife Service. 2001a. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the Steller's eider. Federal Register/Vol. 65, No. 49. 13262.

U.S. Fish and Wildlife Service. 2001b. Biological Opinion on Reissuance of General NPDES Permit No. AK-G52-0000, for Seafood Processors, for the Alaskan Breeding Population of Steller's Eider (*Polysticta stelleri*). Unpublished document prepared by Ecological Services, Anchorage, 605 W. 4th Ave, Rm G61, Anchorage, AK.

U.S.G.S. 2001.Trip report: an investigation of capture techniques, site fidelity, and contaminants exposure of wintering Steller's eiders at Dutch Harbor, Alaska. February – March 2001. Unpublished report. United States Department of the Interior, Biological Resouces Division, Alaska Biological Science Center, 1011 East Tudor Road, Anchorage, Alaska 99503

John Whitney. 2000. The Aleutian Islands and lower Alaska Peninsula: oceanographic conditions and NOAA's oil spill response history during 1981-1999. HAZMAT report 2000-3, Hazardous Materials Response Division, Office of Response and Restoration, National Ocean Service, NOAA, Anchorage, AK.

Wilk, R.J., K.I. Wilk, and R.C. Kuntz, II. 1986. Abundance, age, composition and observations of emperor geese in Cinder Lagoon, Alaska Peninsula, 17 September – 10 October 1986. USFWS Unpublished Report, King Salmon, AK 41 pp.

Yamato, O., I. Goto, and Y. Maede. 1996. Hemolytic anemia in wild seaducks caused by marine oil pollution. J. Wildl. Diseas. 32(2). Pp. 381-384.

Zydelis, R. and R. Skeiveris. 1997. Increasing conflict between gill-net fishery and Steller's eiders wintering along the Lithuanian coast. Wetlands International Seaduck Specialist Group Bulletin.