



**PEBBLE PROJECT
ENVIRONMENTAL BASELINE DOCUMENT
2004 through 2008**

**CHAPTER 44.
MARINE WILDLIFE
Cook Inlet Drainages**

PREPARED BY:
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ACRONYMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
AIC	Akaike Information Criterion
AIC _c	Akaike Information Criterion corrected for small sample size
ANOVA	analysis of variance
CFR	Code of Federal Regulations
CI	confidence interval
DPS	distinct population segment
ESA	Endangered Species Act of 1973
FR	Federal Register
GIS	geographic information system
IDW	inverse distance weighted
km ²	square kilometer(s)
m	meter(s)
mm	millimeter(s)
MMPA	Marine Mammal Protection Act of 1972
MMS	Minerals Management Service
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
OCSEAP	Outer Continental Shelf Environmental Assessment Program
PCE	primary constituent element
SE	standard error
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
w _i	Akaike Weight

44. MARINE WILDLIFE

44.1 Introduction

This chapter presents the findings of the marine wildlife surveys in the Cook Inlet marine study area from 2004 through 2008. The study examined the distribution and abundance of marine-oriented wildlife (birds and mammals) during eight boat-based surveys conducted during four sampling periods (summer, early winter, late winter, and spring) in each of 2 study years (2004/2005 and 2005/2006); airplane-based surveys of birds during spring and fall migration in 2004 and 2005; airplane-based surveys of harbor seals between April and December 2005, between May and October 2007, and between June and August 2008; and helicopter-based surveys for Steller's Eiders and sea otters throughout the year in 2006 through 2008. The surveys included species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA; 16 USC 1531) (i.e., Steller's Eider, sea otter, Steller's sea lion, beluga), species that have been considered for listing under the ESA (i.e., Kittlitz's Murrelet), and birds and mammals in general (including breeding species). (This report follows the *Check-list of North American Birds* [American Ornithologists' Union, 2008] and *Recent Mammals of Alaska* [MacDonald and Cook, 2009].) Common and scientific names of bird and mammal species observed are listed in Appendix 44A.

44.2 Study Objectives

The overall goal of the study was to describe the seasonal distribution and abundance of marine birds and mammals in the Cook Inlet marine study area. The specific objectives of this study were as follows:

- Determine the seasonal distribution and abundance of birds and mammals during several annual cycles.
- Determine the seasonal distribution and abundance of birds during spring and fall migration.
- Determine the distribution of and seasonal patterns of use for harbor seal haulouts.
- Describe the seasonal species composition of the bird and mammal communities.
- Determine and describe the use of the area by rare, threatened, and endangered species.

44.3 Study Area

The Cook Inlet marine study area (referred to as the study area) encompassed the following areas (Figure 44-1):

- The shorelines of Iniskin and Iliamna bays (including Cottonwood Bay).
- The shoreline of the nearby outer coastline (east almost to Oil Bay and south to the southern end of Ursus Head).
- Islands and islets near the mouth of Iniskin Bay (the Mushroom Islets and Scott, Vert, Iniskin, and Pomeroy islands and small islets and rocks; hereafter, the Iniskin Islands).

- Islands and islets near the mouth of Iliamna Bay (White Gull Island, Turtle Reef, and Black Reef).
- Deeper water in the centers of Iliamna and Iniskin bays (aerial surveys only) and in the open bight southeast of them (boat-based surveys only).
- Gull Island, intertidal mudflats, and waters off these areas in Chinitna Bay (aerial surveys).

The study area included both nearshore waters and adjacent coastline, and offshore waters; therefore, surveys were conducted in all habitats used by marine wildlife.

44.4 Previous Studies

44.4.1 Marine Bird Studies

Little research on birds has been done in the study area or nearby areas (e.g., lower Cook Inlet in general, Chinitna Bay, Lake Clark National Park and Preserve, Katmai National Park and Preserve). The amount of previous ornithological research in this area is scant, consisting mainly of species inventories.

Osgood (1901) conducted research on the natural history of Cook Inlet in late summer and fall 1900; his research did not include the study area, and the only site visited on the western side of Cook Inlet was Tyonek. Osgood (1904) also summarized the information on birds from an expedition to the base of the Alaska Peninsula in summer and fall 1902. The survey route went up Iliamna Bay to the former site of Iliamna village and farther inland, and ended at Nushagak, in upper Bristol Bay. Unfortunately, no specific data on birds in the study area are presented in this work.

Cahalane (1959) conducted basic inventory surveys of wildlife in Katmai National Monument in 1953 and 1954; he also added data from a visit there in 1940, along with unpublished data from other observers who had visited the area as far back as 1899. However, other than annotated lists of species to be found on “marine coastal waters and bays” and “marine beaches and mud flats,” little information was applicable to the present study.

Williamson and Peyton (1962) studied the distribution and abundance of birds in the Iliamna Lake area in spring 1958 and 1959 and described taxonomic relationships, habitat use, and faunal assemblages of birds in this area. Because none of their research was conducted in coastal areas, that work is of little applicability to this study; however, they did provide information on some species that occur both coastally and inland.

In 1976, Erikson (1977) conducted a seasonal survey of the distribution and abundance of marine-oriented birds in lower Cook Inlet, including western Cook Inlet from Cape Douglas to the West Foreland, as part of the studies for the Outer Continental Shelf Environmental Assessment Program (OCSEAP). Erikson also located and counted breeding seabird colonies in the Iliamna and Iniskin bays area.

Arneson (1981) surveyed the distribution and abundance of marine-oriented coastal birds from the northeastern Gulf of Alaska to the eastern Aleutian Islands and Bristol Bay from 1975 through 1977, also as part of OCSEAP studies; part of these surveys included lower Cook Inlet. On the western side of the

inlet, the area surveyed extended from Cape Douglas to the West Foreland. Arneson's findings incorporated the work of Erikson (1977).

Agler et al. (1995) studied the distribution and abundance of seabirds and marine mammals in lower Cook Inlet during at-sea surveys in summer 1993 and winter 1994; in addition, aerial surveys were conducted in winter 1994. Both the small-boat surveys and the aerial surveys examined the distribution and abundance of birds on the western side of lower Cook Inlet, from Tuxedni Bay to Cape Douglas.

Bennett (1996) conducted resource inventories of the Cook Inlet coastline of Lake Clark National Park and Preserve, including the Chinitna Bay area, in 1994 through 1996. The emphasis of these surveys was on waterfowl, which use this area extensively during migration, and on raptors, shorebirds, and seabirds.

Gill and Tibbitts (1999) studied the seasonal and interannual distribution and abundance of shorebirds in upper Cook Inlet (Knik Arm to Tuxedni Bay on the western side) from winter 1997 to winter 1999. The emphasis of this work was on geographic variation in use of Cook Inlet, on the timing and numbers of birds during migration, and on the ecology of wintering shorebirds.

Piatt (2002) and colleagues conducted the first interdisciplinary study of the oceanography and biology of lower Cook Inlet from 1995 through 1999; one area of emphasis was the seabirds of the lower inlet. Although none of their information was collected near Iliamna and Iniskin bays or near Chinitna Bay, the researchers provided a good description of the summer oceanography of the area.

Larned (2006a, 2006b) conducted aerial surveys for Steller's Eiders throughout lower Cook Inlet in 2004 and 2005. The emphasis of his work was on the distribution and abundance of Steller's Eiders in the lower inlet, with data on other waterfowl species collected when possible.

The U.S. Fish and Wildlife Service (USFWS) *Catalog of North Pacific Seabird Colonies* (USFWS, n.d.[b]) is another source of information on birds in this area. This catalog is an on-line database of seabird colony locations, sizes, and species composition throughout the state and other countries. The USFWS archives in Anchorage are also available for examination of data on colony visits and population estimates for Alaska colonies through time.

44.4.2 Marine Mammal Studies

Marine mammals are federally protected under the Marine Mammal Protection Act of 1972 (MMPA), as amended (16 USC 1361). Two federal agencies have management responsibility for different species under the MMPA: the National Marine Fisheries Service (NMFS; also known as NOAA Fisheries) is responsible for seals, sea lions, and cetaceans (whales, dolphins, and porpoises), whereas USFWS is responsible for the sea otter, walrus, and polar bear. The National Marine Mammal Laboratory (NMML) of NMFS produces stock assessment reports for Alaska populations of marine mammals (e.g., Hill and DeMaster, 1998, 1999; Ferrero et al., 2000; Angliss et al., 2001; Angliss and Lodge, 2002, 2003; Angliss and Outlaw, 2005; Angliss and Allen 2009). For each population stock, these reports discuss population size and trends, potential biological removal rates, annual human-caused mortality and injury, the overall status of each stock, and conservation concerns about each stock. The population stocks of several marine mammal species in lower Cook Inlet have been identified as species of conservation concern. As a result, a substantial amount of information has been collected on marine mammals in lower Cook Inlet, Chinitna

Bay, and to a lesser degree, in the vicinity of Iliamna and Iniskin bays. The most relevant information is described briefly below.

The first attempts at comprehensive studies of marine mammal populations in lower Cook Inlet were undertaken during OCSEAP-funded research in the 1970s (e.g., Schneider, 1977; Calkins, 1979; Pitcher and Calkins, 1983) to provide baseline information on wildlife resources in areas proposed for offshore oil and gas leasing and exploration. Additional species-specific studies, described below, have encompassed lower Cook Inlet. Some of these studies provided incidental sightings of marine mammals other than the focal species.

44.4.2.1 Sea Otter

Because of concern about its steadily declining size (Estes et al., 2005; Burn and Doroff, 2005), the southwest Alaska population of the northern sea otter subspecies (*Enhydra lutris kenyoni*) was designated as a candidate for listing under the ESA in November 2000 (65 FR 67343). Nearly 5 years later, in August 2005, the “southwest Alaska DPS” (distinct population segment) of the northern sea otter was listed as threatened (70 FR 46366). The USFWS background report supporting that listing provided a succinct summary of the biological information on the southwest Alaska DPS, which reaches its northeastern extent in the Kamishak Bay portion of southwestern Cook Inlet (including the study area). A recovery team has been established by the USFWS and they have released a recovery plan for the southwest Alaska DPS of the northern sea otter (USFWS, 2005).

Designation of critical habitat for the southwest Alaska DPS was proposed by USFWS in December 2008 (73 FR 76454), and the final rule was published in October 2009 (74 FR 51988). USFWS identified the following primary constituent elements (PCEs) of critical habitat as being important for the conservation of the DPS:

- Shallow, rocky areas in waters less than 2 meters deep, where marine predators such as killer whales are less likely to forage.
- Nearshore waters within 100 meters of the mean high-tide line, which may provide protection or escape from predators.
- Kelp forests in waters less than 20 meters deep, which also provide protection from predators.
- Prey resources within the preceding three types of habitats.

The study area is located within designated critical habitat for sea otters (Figure 44-2); the greatest proportion of the critical habitat area in the study area and vicinity is composed of waters within the 20-meter isobath (depth contour).

Schneider (1977) summarized early reports of the occurrence of sea otters in Kamishak Bay, and Alaska Department of Fish and Game (ADF&G) biologists recorded incidental sightings of sea otters in the area of Iliamna and Iniskin bays during herring surveys from 1978 to 2002 (see Section 44.7.2.3, subsection on sea otters). Larned (2005, 2006a, 2006b) recorded sea otters encountered incidentally during aerial surveys for Steller’s Eiders throughout lower Cook Inlet in 2004 and 2005; he found them in the vicinity of Iliamna and Iniskin bays, but greater numbers were present in Kamishak Bay south of that area. The Kamishak Bay subpopulation of sea otters (in whose range the study area is located) was estimated at 6,918 animals (95 percent confidence interval [CI] \pm 4,271) in June 2002, with a minimal population

estimate of 5,340; no previous estimates of the size of this subpopulation were available for comparison (70 FR 46369; USFWS, 2002b).

44.4.2.2 Steller's Sea Lion

After a dramatic population decline in the late 1970s and 1980s (Merrick et al., 1987), Steller's sea lion was listed by NMFS as a threatened species under the ESA in November 1990 (55 FR 49204). In August 1993, critical habitat was designated within 20 nautical miles of rookeries and haulouts (58 FR 45269); no critical habitat was designated in lower Cook Inlet in the vicinity of Iliamna and Iniskin bays (50 CFR 226.202).

The Alaska population of Steller's sea lion was reclassified in May 1997 into two DPSs, one east and one west of 144° West longitude (near Cape Suckling); the western DPS was listed as endangered, whereas the eastern DPS retained its threatened listing (62 FR 24345). Sea lions in the study area belong to the endangered western stock, which formerly represented approximately 75 percent of the total world population of the species and has declined to a fraction of that. The eastern DPS currently is being considered for delisting (75 FR 77602). The western DPS was estimated to number approximately 45,000 animals in Alaska in 2005 after increasing at an average rate of 3 percent annually from 2000 through 2004, the first increase recorded for this stock since the 1970s (NMFS, 2008a; Angliss and Allen, 2009).

The Steller's sea lion recovery plan (NMFS, 1992) provided an overview of the status and biology of the species and outlined steps to be taken to help the population recover. The recent revision of the plan (NMFS, 2008a) provides a concise reference on the current status of the two population stocks in Alaska. Extensive research has been undertaken throughout the North American range of this species because of the population decline and conservation concerns, the designation of critical habitat (especially around breeding rookeries and haulouts), and resulting restrictions placed on commercial fishing (Ferrero and Fritz, 2002; NMFS, 2008a).

Trites and Larkin (1996) discussed population trends of Steller's sea lions across Alaska from 1956 to 1992. Their analysis indicated that the easternmost part of the western DPS (the "Central Gulf of Alaska" count area, which extends from Cook Inlet to the Kodiak Archipelago and part of the Alaska Peninsula) increased from 1956 to 1967 and from 1973 to 1978 (the same time during which the species was declining across Alaska as a whole), but then declined precipitously after 1978, from approximately 83,000 animals in 1978 to approximately 11,000 animals in 1992. Historically, this count area had the most sea lions of all count areas in Alaska, primarily on haulouts and rookeries around Kodiak Island. ADF&G biologists recorded incidental observations of sea lions in the area of Iliamna and Iniskin bays during herring surveys from 1978 to 2002 (see Section 44.7.2.3, subsection on Steller's sea lions).

44.4.2.3 Harbor Seal

The harbor seal is neither threatened nor endangered, but it is protected under the MMPA. OCSEAP-funded studies (Calkins, 1979; Pitcher and Calkins, 1983) reviewed data on the distribution and abundance of harbor seals in lower Cook Inlet, including the vicinity of Iliamna and Iniskin bays. ADF&G biologists recorded incidental observations of harbor seals in the vicinity of Iliamna and Iniskin bays during herring surveys from 1978 to 2002 (see Section 44.7.2.3, subsection on harbor seals). National Park Service coastal resource surveys during 1994 through 1996 included harbor seal haulouts in Chinitna Bay (Bennett, 1996).

The population of harbor seals in major portions of southern Alaska, such as the Gulf of Alaska, Prince William Sound, and the Aleutian Islands has declined in recent decades (Pitcher, 1990; Boveng et al., 2003; Small et al., 2008). The population of harbor seals in western Cook Inlet (including the vicinity of Iliamna and Iniskin bays) was estimated at 5,268 animals in summer 1996 (Boveng et al., 2003). Small et al. (2003) summarized trends from 1983 through 2001 in the number of harbor seals at haulouts and rookeries in four locations across southern Alaska. Those data suggested an increasing population trend at Kodiak (the area nearest to Iliamna and Iniskin bays), in contrast to the population decline recorded in Prince William Sound and the Aleutian Islands.

Population-trend counts of harbor seals are conducted by NMFS throughout Alaska. NMFS formerly conducted aerial surveys at 5-year intervals, rotating among different regions of the state (Withrow, pers. comm., 2006). When the Pebble marine wildlife surveys began in 2004, the most recent trend-count survey in Cook Inlet had been conducted in August 2002 and the next was scheduled for August 2007. In 2008, however, the NMML revised its statewide monitoring approach to sample a larger number of haulouts annually, prioritizing those with the highest historical counts (London et al., 2009).

As part of the NMML Polar Ecosystems Project, intensive field work was conducted on harbor seals in Cook Inlet from 2004 through 2006 for two research projects funded by the Minerals Management Service (MMS) (Boveng et al., 2005a, 2005b, 2007). One study focused on factors affecting the distribution and abundance of seals in lower Cook Inlet (including the vicinity of Iliamna and Iniskin bays) and employed intensive surveys at four times during the year (April, June, August, and October; Boveng et al., 2005a, 2007). The second study examined movements and habitat use by attaching satellite-linked depth recorders to seals (Boveng et al., 2005b, 2007; Montgomery et al., 2007). Field work on these studies ended in May 2006 (Boveng, pers. comm., 2006).

44.4.2.4 Beluga

Following a gradual decline since the 1970s and a sharp decline (nearly 50 percent) from 1994 through 1998, the Cook Inlet population of the beluga (also called belukha or white whale) became the focus of a status review by NMFS in November 1998 (63 FR 64228; Moore and DeMaster, 2000). As a result of the decline, which NMFS concluded was caused by overharvest, the population was proposed for designation as a depleted stock under the MMPA in October 1999 (64 FR 56298). That status was formalized on May 31, 2000, effective June 30, 2000 (65 FR 34590). The Cook Inlet beluga population, which is isolated geographically and genetically from the four other Alaska populations (O’Corry-Crowe et al., 1997), was determined by NMFS to be a DPS in June 2000, but a listing under the ESA was considered unwarranted at that time (65 FR 38778). Because the population had not shown signs of recovery, however, a second status review was initiated in March 2006 (71 FR 14836). As a result of that status review, completed in November 2006, NMFS published a proposed rule in April 2007 (72 FR 19854) to list the DPS as endangered. NMFS issued the final listing rule in October 2008 (73 FR 62919). The Cook Inlet DPS has been the focus of two environmental impact statements evaluating restrictions on subsistence harvest (NMFS, 2003, 2008b) and a conservation plan, the final version of which was released in October 2008 (NMFS, 2008c). According to a news release by NMFS on October 6, 2009, the 2009 population estimate was 321 belugas (NMFS, 2009).

At the time the Cook Inlet DPS was listed as endangered, NMFS deferred designation of critical habitat pending further analysis. An advance notice of designated rulemaking and solicitation of comments on critical habitat was published in April 2009 (74 FR 17131), and a rule designating 7,809 square

kilometers (km²) of Cook Inlet waters as critical habitat was published in December 2009 (74 FR 63080). Critical habitat was designated for the Cook Inlet DPS in April 2011, effective May 11, 2011 (76 FR 20180). Five PCEs are considered to be essential for conservation of the Cook Inlet DPS:

- Intertidal and subtidal waters up to 9.1 meters deep (below the mean lower low water datum) and within 8 kilometers of high- and medium-flow-accumulation streams hosting spawning runs of anadromous fish species.
- The presence of nine species of fish constituting primary prey.
- Absence of toxins and other harmful agents.
- Unrestricted passage within and between critical habitat areas.
- Absence of in-water noise levels known to cause abandonment of habitat.

Two areas of critical habitat were designated, each containing multiple PCEs: Area 1, consisting of upper Cook Inlet waters north of a line between Threemile Creek on the west and Point Possession on the east, containing habitats important for calving, foraging, molting, and escape from predators, where the greatest numbers of belugas concentrate from spring through fall; and Area 2, waters located south of that line (middle and lower Cook Inlet) containing habitats used in a less-concentrated fashion for transit and foraging, mainly during the fall and winter months. The proposed Areas 1 and 2 correspond to the Type I and Type II habitats, respectively, delineated in the final conservation plan (NMFS, 2008c), which incorporated the results of satellite tracking of tagged individuals (Hobbs et al., 2005) and modeling of habitat use (Goetz et al., 2007). All designated critical habitat within the study area is in critical habitat Area 2 (Figure 44-2); in that area, all waters within 2 nautical miles of the mean higher high water datum have been designated as critical habitat.

NMFS has conducted annual aerial surveys for belugas in Cook Inlet since 1993, usually covering the Pebble marine wildlife survey area in June (Rugh et al., 2000a, 2000b, 2001, 2002, 2003, 2004a, 2004b, 2005a, 2005b, 2005c, 2006a, 2006b, 2007; Sheldon et al., 2008, 2009). Survey coverage typically included Chinitna, Iniskin, and Iliamna bays and the bight between the latter two bays. These surveys demonstrated that the existing beluga population in Cook Inlet (fewer than 400) was considerably smaller than was previously estimated (approximately 1,300 whales) and that the summer distribution of the population had retracted to upper Cook Inlet. The beluga population surveys also included sightings of other marine mammals, revealing large numbers of harbor seals in the vicinity of Iniskin Bay and documenting the presence of sea otters and harbor porpoises in the vicinity.

Satellite telemetry was used by NMFS biologists to track the movements of belugas in Cook Inlet from September 2000 through March 2003 (Hobbs et al., 2005). Satellite tracking provided detailed information on seasonal movements and habitat use and demonstrated that belugas move farther down the inlet in winter than in summer. None of the 14 belugas tagged in that study moved south of Chinitna Bay, however.

Participants in a March 1999 workshop provided summaries of the available information on Cook Inlet belugas, and the proceedings were published in 2000 as a special issue of the journal *Marine Fisheries Review* (Hobart, 2000). Moore et al. (2000) reviewed seasonal habitat associations of belugas in Cook Inlet from survey sightings. Speckmann and Piatt (2000) summarized beluga sightings recorded during extensive at-sea marine bird surveys in lower Cook Inlet in 1995 through 1999. Although no surveys were

conducted near Iliamna, Iniskin, or Chinitna bays, data were collected to the north (vicinity of Tuxedni Island), east (Kachemak Bay), and southeast (Barren Islands).

ADF&G biologists occasionally recorded belugas in the area of Iliamna and Iniskin bays during herring surveys from 1978 to 2002 (see Section 44.7.2.3, subsection on belugas).

44.5 Scope of Work

The research and field work for this study were conducted from mid-2004 to the end of 2008. The study was conducted by Robert H. Day, Adrian E. Gall, Brian E. Lawhead, Stephen M. Murphy, Alexander K. Prichard, and Ann M. Wildman of ABR, Inc.—Environmental Research & Services, Fairbanks, Alaska. Assistance in the field was provided by Jennifer H. Boisvert, Andrew P. Cyr, Tim Obritschkewitsch, Julie P. Parrett, John R. Rose, Pamela E. Seiser, Matthew Evans, Jeremy J. Maguire, and Spencer Rearden, and assistance with the report was provided by Pamela Odom and Allison L. Zusi-Cobb, all of the same organization.

In summary, this study was designed to accomplish the following:

- Measure the distribution and abundance of marine wildlife (birds and mammals) in the vicinity of Iliamna, Iniskin, and Chinitna bays with two types of standardized boat-based surveys (nearshore and offshore), fixed-wing-aircraft surveys, and helicopter-based surveys.
- Plot locations of marine wildlife recorded during nearshore and offshore boat-based and helicopter-based surveys and digitize those locations.
- Describe the activity of marine wildlife.

44.6 Methods

44.6.1 Boat-based Surveys

Boat-based surveys for marine birds and mammals were conducted in Iniskin and Iliamna bays in early summer (June 21–25) and early winter (December 9–13) 2004; in late winter (March 11–14), spring (May 9–15), summer (June 17–22), and early winter (November 13–17) 2005; and in late winter (March 11–14) and spring (May 3–8) 2006. Both nearshore and offshore surveys were conducted, as described in Chapter 12 of the consolidated study plan for Pebble Project (a copy of which is provided in Appendix E of this environmental baseline document). All nearshore surveys were conducted from a skiff that followed the shoreline approximately 30 meters from shore (Figure 44-3). During each nearshore survey, researchers identified, counted, and mapped all birds and mammals seen in the nearshore zone (200 meters or less from shore, on the beach, or 100 meters or less inland) or birds flying over it; however, flying birds were not mapped. The mapped locations then were digitized into a geographic information system (GIS) with the software *ArcGIS*. Offshore surveys were conducted as a series of strip transects in the offshore zone (central portion) of each bay and in the bight between the bays. During these offshore surveys, the ship's speed, the time, and the beginning and ending coordinates for each transect were recorded, and all birds and mammals seen within 150 meters on either side of the boat were counted. The midpoints of each sampling transect were used to map abundance of each species on the offshore transects.

For both sampling methods, sums of counts for each species were used to calculate species composition by survey. For surveys on which two replicates of the survey were completed (May 2005 and May 2006), maximal counts for each species were the higher of the two results from the replicate surveys. Counts were converted to estimates of animals/km² of area surveyed. For surveys with two replicates, densities for each species were calculated as the mean of densities from each replicate. For summaries of species composition, researchers used species-groups. The bird species-groups consisted of the following:

- Waterfowl: geese, swans, ducks.
- Waterbirds: loons, grebes.
- Seabirds: cormorants, jaegers, larids (gulls, terns), alcids.
- Raptors: hawks, eagles, falcons.
- Shorebirds: plovers, curlews, godwits, turnstones, phalaropes, all other shorebirds.
- Corvids: crows, jays, magpies.

The following mammal species-groups were used:

- Carnivores: sea otters, seals, sea lions.
- Cetaceans: whales, porpoises.

During the two summer sampling periods (2004 and 2005), researchers also searched for and attempted to census colonies of nesting seabirds on the islands around the mouths of Iniskin and Iliamna bays. Because of concerns about excessive disturbance of nesting colonies, however, researchers did not land and conduct extensive counts of nests or search for nesting burrows.

Although the 2004 study plan (Appendix E of this environmental baseline document) indicated that the early winter sampling in 2004 would be conducted in November, sampling could not be conducted at that time. Weather in fall 2004 included numerous low-pressure systems tracking through the northern Gulf of Alaska in quick succession; consequently, a window of suitable weather did not occur until early December 2004. Other research cruises, however, occurred during the desired periods.

44.6.2 Fixed-wing-aircraft Surveys

Surveys from fixed-wing aircraft (hereafter, fixed-wing surveys) were used to study concentrations of waterfowl, loons, grebes, cormorants, and gulls on coastal bays during migration in 2004 and 2005. Fixed-wing surveys also were used to study harbor seals in Iliamna and Iniskin bays and in nearby Chinitna Bay in 2005 and 2007.

44.6.2.1 Bird Surveys

Fixed-wing surveys were flown for migrating and staging birds every 7 to 10 days during spring and fall in 2004 and 2005. In 2004, four surveys were conducted in spring (April 21 and May 3, 13, and 22), and five surveys were conducted in fall (September 3, 14, and 24; and October 6 and 21). More surveys were added in 2005 to cover the fall migration period more completely. In 2005, four migration surveys were

conducted in spring (April 24 and May 3 to 4, 15, and 21), and seven surveys were conducted in fall (August 18 and 30; September 7, 13, and 29; and October 6 and 11).

Bays were divided into sections based on geographic boundaries. Iliamna and Iniskin bays and the bight between them were surveyed in both 2004 and 2005 (Figure 44-4). In 2004, only the western halves of Iniskin and Iliamna bays were surveyed, whereas both bays were surveyed entirely in 2005. All of Cottonwood Bay was surveyed in both years. In 2005, the southern half of Chinitna Bay also was surveyed.

Standard operating procedures for both years called for one observer and a pilot to conduct surveys from a Piper PA-18 “Super Cub” airplane. Exceptions included the first survey in April 2004, which was conducted with two observers and a pilot in a Cessna 206, and three fall surveys in 2004 and one fall survey in 2005, which were conducted in a Robinson R-44 helicopter. All surveys were flown at an altitude of 60 to 90 meters above sea level and a speed of 105 to 145 kilometers per hour.

During these surveys, the flight line followed the shoreline approximately 250 meters from the shore, and the observer counted and identified all birds within a zone from the shoreline out to 500 meters in the bays. Large groups of birds seen outside of this 500-meter search zone, in the middle of bays, also were counted. All birds on the mudflats also were counted. Because surveys were flown at different tide heights, the amount of exposed mudflat and water in the bays varied among surveys. Because the exact same areas were not surveyed every time and because large flocks of birds on mudflats and in the centers of bays (but outside of the 500-meter sampling zone) were counted, accurate densities cannot be calculated; however, the data are useful in documenting overall distribution, abundance, and timing of movements of waterbirds through the study area.

The observers recorded all data on a tape recorder, including the survey section; the number, sex, and species of birds; and whether the birds were on the water, on the shore, or flying. Data were transcribed from tapes onto data sheets and were entered in a computer database for analysis. Some waterfowl species are difficult to distinguish during aerial surveys—particularly Trumpeter and Tundra swans, Lesser and Greater scaup, Common and Barrow’s goldeneyes, and Common and Red-breasted mergansers; these birds usually were recorded as unidentified swans, scaup, goldeneyes, or mergansers, respectively. Data were summarized by species, species-group, survey section, and date of survey. Spring and fall distribution and abundance values are presented as the greatest number of birds seen in each section during any survey flown.

44.6.2.2 Harbor Seal Surveys

Nineteen aerial surveys of harbor seal haulout locations in the Iliamna, Iniskin, and Chinitna bays area were conducted between April 24 and December 13, 2005 (one survey was incomplete); 16 surveys were conducted between May 21 and October 12, 2007; and 10 surveys were conducted between June 19 and August 18, 2008 (two were incomplete). Aerial surveys were flown at an altitude of 305 meters above sea level in a Cessna 206 or Piper PA-18 Super Cub fixed-wing airplane. Each survey, except the incomplete December 2005 survey and the surveys on August 16 and August 17, 2008, examined all exposed rocks and tidal mudflats in Iliamna, Cottonwood, Iniskin, and Chinitna bays and the Iniskin Islands (Figure 44-5). Haulout locations were circled by the plane until the observer(s), who were using image-stabilizing binoculars, could get a good count of hauled-out seals and seals nearby in the water and could photograph them with a 35-millimeter (mm) camera with a 70- to 210-mm zoom lens or a 5-megapixel

image-stabilizing digital camera with a 12-X optical-zoom lens. Surveys were flown as close to low tide as possible (almost always within 2 hours of the low) because that is when the highest number of seals haul out (Boveng et al., 2003; Simpkins et al., 2003). Seals in the photographs were counted, and population estimates were generated with the statistical procedures described below. During the surveys conducted in June 2008, researchers spent extra time surveying to get accurate counts of harbor seal pups in the survey area. For data summaries and depiction on map figures in the results section below, the haulouts depicted in Figure 44-5 were grouped geographically according to their proximity to islands, reefs, or rock ledges.

Tide height during each survey was estimated based on the predicted tide height from stations in the National Water Level Observation Network (Hicks, 1989) with the program WXTIDE32 (<http://www.wxtide32.com>). The two closest tide stations were Iliamna Bay (153°35'W, 59°37'N) and Oil Bay (153°16'W, 59°38'N). Low tide at Oil Bay was 1 hour later than at Iliamna Bay, and most of the seals recorded during the surveys were located on the Iniskin Islands, roughly halfway between the two tide stations. Therefore, the tide height at the Iniskin Islands at the time of the survey was estimated as the average of the tide height at Iliamna Bay 30 minutes before surveying the Iniskin Islands and the tide height at Oil Bay 30 minutes after surveying the Iniskin Islands. This averaged value was assumed to be the average tide height of the survey. Because the surveys began in Iliamna Bay and ended in Chinitna Bay, and because tidal changes proceeded in the same direction, the tide height was assumed to remain roughly the same at all points of the survey. The height of the closest low tide was calculated as the average of the low tide height at the two tide stations. Researchers used these values to derive variables for height above the closest low tide (relative tide height). The time to solar midday also was calculated as the absolute value of the number of hours between the time the Iniskin Islands were surveyed and solar midday for the study area. Solar midday was calculated as the midpoint between sunrise and sunset and was about 2:15 p.m. during midsummer in the study area.

Although some surveys were scheduled close to the time of year and tide conditions for which peak numbers were expected to be hauled-out, they were unlikely to capture ideal conditions perfectly. Researchers examined various factors affecting haulout numbers in each year for use in approximating the number of seals expected to be hauled out under optimal conditions. This analysis was restricted to July and August data because the peak count of seals was expected to occur during the molting season in late July and August and because data from other months may be influenced by other factors (e.g., pupping, which occurs in June). The largest source of variation in observed counts was date. Researchers first used a general linear model to fit separate second-order polynomial equations of Julian date to the total observed harbor seal counts for each year. They then calculated the unstandardized residuals (observed count minus predicted count) of this model and used the residuals as a response variable in an analysis of the effects of tide and time of day on haulout numbers. In this way, researchers removed the influence of the major factor (date) on haulout numbers, then determined whether any secondary factors (e.g., time of day, tide) had significant additional effects on the number of harbor seals hauled out during a survey.

A candidate set of eight models was developed to examine the effects of three covariates on harbor seal numbers after correcting for date as described above. The covariates were time to solar midday (Time to Midday), tide height at time of survey (Tide Height), and height above low tide at time of survey (Relative Tide Height). All combinations of these three covariates were used. An Intercept Only model (no significant variables) also was considered, but no interaction terms were included in any models. All

surveys in July and August were conducted before solar midday except the survey on July 26, 2005, which was conducted approximately 0.5 hour after solar midday.

Competing models were compared with an information–theoretic approach (Burnham and Anderson, 2002). For each model, the Akaike Information Criterion (AIC) corrected for small sample sizes (AIC_c; Hurvich and Tsai, 1989; Burnham and Anderson, 2002) was calculated. The probability that each model was the “best model” in the candidate set was estimated with the Akaike Weight (w_i). The sum of all Akaike Weights for all models containing a given variable provided an estimate of the probability that the given variable was in the best model.

Because the focus of the analysis was on calculating the maximal number of harbor seals in the survey area, the results of the peak-count surveys (the maximal observed number hauled out in each year) were analyzed separately. After selecting the best model from the candidate set, the peak observed haulout counts were adjusted by using the parameter estimates of the appropriate covariates from the Julian date model and the best tide and time-of-day model to estimate the number of seals that would have been hauled out under ideal peak conditions (peak date and peak tide or time of day). After calculating the adjusted counts of hauled-out seals, each estimate was corrected for the proportion of seals that were not hauled out by using the correction factor of 1.198 (standard error [SE] = 0.039) developed by Simpkins et al. (2003) to account for seals that were not hauled out at the time of the surveys conducted under optimal conditions. This correction factor was calculated for covariate-adjusted harbor seal estimates at two locations (Simpkins et al., 2003), but it may be applicable to other areas as well (Boveng et al., 2003).

The covariate-adjusted count was calculated and the variance in the adjustment was estimated with a parametric bootstrap. In 3,000 simulations, parameter estimates from the Julian date and best model were selected randomly from normal distributions with means equal to the parameter estimates and standard deviations based on the standard errors of the parameter estimates. For each set of new parameter estimates, the adjusted count for the annual peak was calculated. The variance in the 3,000 samples was used as an estimate of the variance in the adjusted count. Then, the correction factor and its associated SE from Simpkins et al. (2003) were used to calculate the variance of the population level with the formula for addition of two independent variance estimates (Goodman, 1960; Boveng et al., 2003).

44.6.3 Helicopter-based Surveys

Helicopter-based surveys for Steller’s Eiders, sea otters, and other marine birds and mammals were conducted in Iniskin and Iliamna bays in 2006 (February 23 to 24, March 14 to 15, April 13 to 14, October 16, November 14, and December 8), 2007 (January 24, February 10 to 12, March 9 and 29 to 30, April 13 to 14, May 1 to 2, August 24 to 25, September 6 and 26 to 27, October 6 and 22 to 23, November 14 to 15 and 27 to 29, and December 11 to 12), and 2008 (January 27 to 29, February 20, March 7 to 8 and 16 to 17, and April 2 and 17). When possible, surveys were conducted on two consecutive days that represented replicate samples; however, severe weather precluded all sampling during January 2006 and occasional replicate days during the rest of the surveys.

During these surveys, researchers flew over nearshore waters and searched for Steller’s Eiders and sea otters there and in the centers of bays, as described in Chapter 12 of the consolidated study plan for Pebble Project (a copy of which is provided in Appendix E of this environmental baseline document). All surveys were flown in a Robinson R-44 helicopter that followed the shoreline approximately 250 meters

from the water line so that the helicopter was located far enough offshore to permit visibility of the entire 200-meter nearshore zone from one side of the aircraft (Figure 44-6). When necessary, surveys occasionally deviated from the nearshore trackline to verify the identification of a large group of birds or mammals in the centers of bays.

During each survey, researchers identified, counted, and mapped Steller's Eiders, sea otters, and observations of other birds and mammals seen in the nearshore zone (as described above for boat-based surveys) and concentrations (five or more individuals) of birds or mammals in the centers of bays; however, single or small groups (less than five individuals) of birds in the centers of bays generally were not counted or mapped. For surveys on which two replicates were completed, counts for each species were the higher of the two results from the replicate surveys.

The helicopter-based surveys were flown at speeds of 80 to 130 kilometers per hour and at an altitude of approximately 60 meters above sea level, with both Steller's Eiders and sea otters being surveyed at the same time. If other marine mammals were seen during these surveys, the helicopter rose to approximately 150 meters above sea level and/or skirted around them to minimize disturbance. When possible, surveys were conducted within 2 hours of high tide to minimize the disturbance of harbor seals, which commonly haul out around low tide.

Locations of Steller's Eiders, sea otters, and concentrations of other species of interest were digitized, as described above for the boat-based surveys. Counts were summed to show maximal numbers of the two species of interest and additional information on other species. Maps of locations for taxa of interest then were generated from the digitized files. When the data were adequate, researchers generated maps of density by overlaying a grid with a 500-by-500-meter cell size over the study area, then counted the total number of birds or mammals in each grid cell for all surveys combined. Researchers converted those counts to estimates of average density (birds/km²/survey or mammals/km²/survey) in each cell and assigned the density value to the centroid of the cell. They then used the inverse-distance-weighted (IDW) interpolation technique of the Spatial Analyst extension of ArcMap GIS software (Environmental Systems Research Institute, Inc., Redlands, California) to generate contours of similar density, based on the mean density for each grid-cell centroid. To conduct the IDW analysis, researchers first overlaid a 50-by-50-meter grid over the study area. The IDW interpolation technique calculated the distance-weighted mean density of all centroids within 500 meters of each 50-meter pixel in the study area (power = 1). This analysis produced color maps showing surface models of the density of all birds or mammals observed over the entire survey area, to create an easily understood visual portrayal of the data. Researchers also categorized locations of all mapped observations in Iliamna and Iniskin bays and the nearby bight as either inside (in) or outside (out) those bays (Figure 44-6) and calculated the percentage of birds or mammals inside or outside bays by season (fall, mid-winter, and late winter-spring). Finally, researchers calculated the mean group size across all observations by time period and tested for differences in group sizes among season with a one-way analysis of variance (ANOVA).

44.6.4 Determination of Species of Conservation Concern

Analysis and summary of the data involved determining which species are considered to be of conservation concern. Researchers compared information from a variety of lists that provide insights into conservation concerns about seabirds and marine mammals. In general, the goal in preparing these lists is not to identify only those species treated formally by the USFWS under the Endangered Species Act;

instead, it is to identify species that currently may be fairly common but for which there are concerns about the long-term viability of their populations (see below). Lists examined here differed between birds and mammals.

44.6.4.1 Birds

To determine which bird species occurring in the Cook Inlet marine study area currently are listed as species of conservation concern, researchers consulted bird-conservation lists from federal and state management agencies, conservation organizations, and bird working-groups that directly address the conservation concerns for Alaskan birds. The conservation lists reviewed were those that primarily considered Alaska birds and were published as of 1998, and primarily as of 2005: the USFWS's *Birds of Conservation Concern* (USFWS, 2008) and *Endangered, Threatened, Proposed, Candidate, and Delisted Species in Alaska* (USFWS, 2010a); the Bureau of Land Management's *Special Status Species List for Alaska* (BLM, 2005); the U.S. Forest Service's *2009 Alaska Region Sensitive Species List* (Goldstein et al., 2009); the Alaska Department of Fish and Game's *Species of Special Concern* (ADF&G, 1998), *Comprehensive Wildlife Conservation Strategy* (ADFG, 2006), and *Endangered Species List* (ADFG, 2010); Audubon Alaska's *Watchlist 2010* (Kirchhoff and Padula, 2010); the Alaska Natural Heritage Program's *Vertebrate Species Tracking List for 2008* (AKNHP, 2008); the Alaska Shorebird Group's *Alaska Shorebird Conservation Plan* (ASG, 2008); and the *North American Waterbird Conservation Plan* (Kushlan et al., 2002). In addition, the Boreal Partners in Flight Working Group's *Landbird Conservation Plan for Alaska Biogeographic Regions* was consulted, but none of the species discussed occurred in the Cook Inlet marine study area, so it is not presented here.

The nine bird-conservation lists reviewed here variously considered several criteria related to population persistence in Alaska that included population trend, population size, known threats during the breeding and nonbreeding seasons, and range size both during breeding and nonbreeding. Species were ranked and categorized by conservation class (e.g., high, moderate, or low concern) on some of these lists, whereas a single category of conservation concern was used on other lists. Alaska stewardship or monitoring concerns also were considered on some lists for those cases in which a large proportion of the global population of the species resides in Alaska. For this study, in an attempt to identify those species for which there is genuine conservation concern, as opposed to stewardship concern or moderate or low conservation concern, researchers selected species of conservation concern based on two criteria:

- The species had to be listed in the highest conservation category(ies), if applicable, within the classification system used (species of moderate or low concern were not considered). On those lists in which a single conservation class was used, however, all species of conservation concern occurring in the study area were considered.
- The species had to be listed as of conservation concern on at least two of the lists. This criterion helped to eliminate species of moderate or low concern that only occur on a single bird-conservation list.

Additional research reports were reviewed for each species of conservation concern recorded in the Cook Inlet marine study area to provide background ecological information on the reasons for conservation concern (see Section 44.7.1.4, below).

44.6.4.2 Mammals

To determine which mammal species occurring in the Cook Inlet marine study area currently are listed as species of conservation concern, researchers consulted mammal-conservation lists similar to those consulted for birds. The conservation lists reviewed were those that primarily considered Alaska mammals and were published as of 1998, and primarily as of 2005: the USFWS's *Endangered, Threatened, Proposed, Candidate, and Delisted species in Alaska* (USFWS, 2010a); the National Marine Fisheries Service Office of Protected Resources' *List of Species Under the Endangered Species Act* (NMFS, 2007a) and *Species of Concern and Candidate Species* (NMFS, 2007b); the Bureau of Land Management's *Special Status Species List for Alaska* (BLM, 2005); the Alaska Department of Fish and Game's *Species of Special Concern* (ADF&G, 1998), *Comprehensive Wildlife Conservation Strategy* (ADF&G, 2006), and *Endangered Species List* (ADF&G, 2010); and the Alaska Natural Heritage Program's *Vertebrate Species Tracking List for 2008* (AKNHP, 2008).

The five mammal-conservation lists reviewed here variously considered several criteria related to population persistence in Alaska that included population trend, population size, known threats during the breeding and nonbreeding seasons, and range size both during breeding and nonbreeding. Similar to what was done for the bird section, researchers selected species of conservation concern based on two criteria:

- The species had to be listed in the highest conservation category(ies), if applicable, within the classification system used (species of moderate or low concern were not considered). On those lists in which a single conservation class was used, however, all species of conservation concern occurring in the study area were considered.
- The species had to be listed as of conservation concern on at least two of the lists. This criterion helped to eliminate species of moderate or low concern that only occur on a single mammal-conservation list.

44.7 Results and Discussion

44.7.1 Birds

44.7.1.1 Survey Results

Boat-based Surveys

Researchers successfully completed surveys of the entire study area in summer 2004, spring 2005, summer 2005, and spring 2006. Partial surveys were only conducted when ice covered the inner 50 to 75 percent of both Iliamna and Iniskin bays and restricted access to the study area in early winter 2004 and late winter 2006. In addition, during both the 2004 and 2005 early-winter surveys, seas around Black Reef (a set of small islands and reefs between the mouths of Iliamna and Iniskin bays) were too rough for small boats; therefore, that location was not surveyed during nearshore surveys at those times. The absence of those data, however, did not affect the results or conclusions because the Black Reef area is small and because densities were standardized as the number of individuals divided by the area of the nearshore zone sampled.

During the nearshore surveys, at least 59 species of birds were recorded, plus two additional species were seen only off-transect (Appendices 44B and 44C). During the offshore surveys, at least 32 species of birds (including six not seen during nearshore surveys) were recorded, and no additional species were seen only off-transect (Appendices 44D and 44E). In the first year of the surveys (summer 2004 through spring 2005), researchers counted 14,613 birds during four nearshore surveys and 884 birds during four offshore surveys. In the second year of the surveys (summer 2005 through spring 2006), researchers counted 42,662 birds during four nearshore surveys and 360 birds during four offshore surveys. Counts during individual nearshore surveys ranged from 1,134 to 9,555 birds in 2004/2005 and from 489 to 38,304 birds in 2005/2006 (Appendix 44B). Counts during individual offshore surveys ranged from 45 to 368 birds in 2004/2005 and from 29 to 163 birds in 2005/2006 (Appendix 44D).

Seven species of birds were seen on all eight nearshore surveys: Harlequin Duck, Surf Scoter, Pelagic Cormorant, Bald Eagle, Mew Gull, Glaucous-winged Gull, and Black-billed Magpie. Another six species were recorded on seven of the eight surveys (Mallard, White-winged Scoter, Black Scoter, Long-tailed Duck, Common Merganser, and Common Raven), and three species were recorded on six of the eight surveys (Common Goldeneye, Barrow's Goldeneye, and Marbled Murrelet). In contrast, 16 of the 59 species were rare, being recorded on only one of the eight surveys (Appendices 44B and 44C).

During the offshore surveys, only one species was seen on all eight surveys (Glaucous-winged Gull), no species were recorded on seven of the eight surveys, and four species were recorded on six of the eight surveys (White-winged Scoter, Long-tailed Duck, Pelagic Cormorant, and Black-legged Kittiwake). In contrast, 14 of the 32 species were rare, being recorded on only one of the eight surveys (Appendices 44D and 44E).

Fixed-wing Surveys

Thirty-one species of birds were recorded during the surveys in 2004 and 2005 (Appendices 44F and 44G). The species-groups and subgroups recorded are identified below:

- Waterfowl.
 - Geese (one species).
 - Swans (one species).
 - Ducks (16 species).
- Waterbirds.
 - Loons and grebes (three species).
- Shorebirds (three species).
- Seabirds.
 - Cormorants (two species).
 - Larids (three species).
 - Alcids (two species).

Counts during individual surveys ranged from 41 to 2,930 birds in 2004 (Table 44-1) and from 1,955 to 12,751 birds in 2005 (Table 44-2). More birds were recorded in 2005 in part because the survey area that year (111 km²) was considerably larger than in 2004 (61 km²; Figure 44-4); more birds also may have been present in 2005, although the survey areas differed enough between years that this possibility cannot be evaluated with confidence.

Only one species (Glaucous-winged Gull) was seen during all nine surveys conducted in Iliamna and Iniskin bays in 2004 (Appendix 44F) and during 10 of the 11 surveys conducted in Iliamna, Iniskin, and Chinitna bays in 2005 (Appendix 44G). During the nine surveys in 2004, four species were recorded on five to seven of the surveys (Mallard, Harlequin Duck, Surf Scoter, and Black Scoter; Appendix 44F). During the 11 surveys in 2005, nine species were recorded on six to 10 of the surveys (Mallard, Northern Shoveler, Northern Pintail, Green-winged Teal, Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, and Long-tailed Duck; Appendix 44G).

Helicopter-based Surveys

The helicopter-based surveys were conducted in February through April and October through December 2006, in January through May and August through December 2007, and in January through April 2008, with Chinitna Bay sampled only in 2007 and 2008 (Table 44-3, Appendices 44H through 44L). Surveys planned for January 2006 were cancelled because of high winds and extreme cold. In addition, occasional periods of inclement weather sometimes prevented researchers from conducting a second, replicate sample during a survey visit and prevented any sampling in Chinitna Bay in late April and late November 2007 and in January 2008.

At least 36 species of birds were recorded in the Iliamna-Iniskin bays area, and at least 30 species of birds (including five not seen in the Iliamna-Iniskin area) were recorded in the Chinitna Bay area during these surveys, for a total of 40 species (Table 44-3, Appendices 44H through 44L). Altogether, researchers counted a maximum of 50,624 birds during 26 surveys in the Iliamna-Iniskin bays area (Table 44-3, Appendices 44H through 44J) and a maximum of 18,689 birds during 17 surveys in Chinitna Bay (Table 44-3, Appendices 44K and 44L). The total number counted on an individual survey in the Iliamna-Iniskin bays area ranged from 197 birds on January 24, 2007, to 5,304 birds on September 6, 2007. The total number counted on an individual survey in Chinitna Bay ranged from 28 birds on January 24, 2007, to 3,354 birds on April 2, 2008.

In Iliamna and Iniskin bays, no individual bird species was recorded on all 26 surveys, one (Harlequin Duck) was recorded on 25 surveys, one (Glaucous-winged Gull) was recorded on 23 surveys, one (Black Scoter) was recorded on 22 surveys, one (Long-tailed Duck) was recorded on 21 surveys, and two (White-winged Scoter, Bald Eagle) were recorded on 20 surveys; in addition, Pelagic Cormorants and unidentified cormorants (most of which probably were Pelagic Cormorants) were recorded on 23 surveys combined (Appendices 44H through 44J). Another five species (Mallard, Steller's Eider, Bufflehead, Barrow's Goldeneye, Mew Gull) were recorded on 10 to 19 surveys, and Greater Scaup and unidentified scaup (probably all of which were Greater Scaup) were recorded on 13 surveys combined. The remaining species were recorded on fewer than 10 surveys. Because unidentified gulls were recorded on the three surveys on which Glaucous-winged Gulls were not recorded and because Glaucous-winged Gulls are the numerically dominant species in this region, it is highly probable that this species occurred in the area on all 26 surveys.

In Chinitna Bay, no individual bird species was recorded on all 17 surveys, one (Black Scoter) was recorded on 14 surveys, one (Long-tailed Duck) was recorded on 12 surveys, one (Harlequin Duck) was recorded on 12 surveys, and one (Mallard) was recorded on 10 surveys; in addition, Glaucous-winged Gulls and unidentified gulls (many of which probably were Glaucous-winged Gulls) were recorded on 14 surveys (Appendices 44K and 44L). The remaining species were recorded on fewer than 10 surveys.

44.7.1.2 Patterns of Distribution and Abundance

Seasonal Patterns

Boat-based Surveys. During nearshore surveys, densities of birds were highest (but most variable) in the spring, second highest in the summer, lowest in early winter, and only slightly higher in late winter than in early winter (Figure 44-7). Spring densities, which averaged 297 birds/km² in 2005 and 917 birds/km² in 2006, were strongly influenced by the presence of gulls and migrating shorebirds. This effect was particularly strong in spring 2006, when researchers recorded flocks totaling 20,300 shorebirds feeding on mudflats in Iniskin Bay. In spring 2005, two flocks of 1,000 Glaucous-winged Gulls each were seen on mudflats in Iniskin Bay; however, no large flocks of shorebirds were seen, suggesting that the large pulse of migrating shorebirds already had passed through the study area by the time of the survey. In addition to the large number of shorebirds in spring 2006, large flocks of waterfowl (flocks of 30 to 200 Green-winged Teal, 30 to 200 Northern Shovelers, and 30 to 60 Northern Pintails) also were seen.

Densities during nearshore surveys in the summer were considerably lower than those in the spring (Figure 44-7), averaging 126 birds/km² in 2004 and 107 birds/km² in 2005. Summer densities were dominated numerically by Harlequin Ducks, scoters (three species), and Glaucous-winged Gulls; smaller numbers of breeding birds, especially breeding seabirds, also were present.

Densities during nearshore surveys in early winter were less than 50 percent of those in the summer and less than 20 percent of those in the spring (Figure 44-7), averaging 45 birds/km² in 2004 and 55 birds/km² in 2005. Bird densities in early winter were dominated numerically by Harlequin Ducks, Long-tailed Ducks, Barrow's Goldeneyes, and Pelagic Cormorants; smaller numbers of other overwintering birds, especially scoters, Rock Sandpipers, and Glaucous-winged Gulls, also were present.

Densities during nearshore surveys in late winter were similar to those in early winter (Figure 44-7), averaging 47 birds/km² in 2004 and 67 birds/km² in 2005. Bird densities in late winter were dominated numerically by Harlequin Ducks, Long-tailed Ducks, Barrow's Goldeneyes, and Glaucous-winged Gulls; smaller numbers of other overwintering birds, especially scoters, also were present.

During offshore surveys, densities of birds were highest (and most variable) in the spring (both years), second highest in the summer (2004) or early winter (2005), and lowest in early winter (2004) or late winter (2006; Figure 44-7). In general, however, densities were much more variable among offshore surveys than they were during nearshore surveys and were an order of magnitude or more lower than densities during nearshore surveys during the same season and year.

Densities during offshore surveys in spring averaged 35 birds/km² in 2005 and 20 birds/km² in 2006 (Figure 44-7). Spring densities were dominated numerically by White-winged Scoters and, in 2006, Long-tailed Ducks (presumably late-leaving birds that were going elsewhere to breed); smaller numbers of other birds such as Glaucous-winged Gulls also were present.

Densities during offshore surveys in summer averaged 23 birds/km² in 2004 and 4 birds/km² in 2005 (Figure 44-7). Bird densities in summer 2004 were dominated numerically by White-winged Scoters, Glaucous-winged Gulls, and Black-legged Kittiwakes; smaller numbers of other birds, such as Common Murres, also were present that summer. Few birds of any species were observed in summer 2005, although Glaucous-winged Gulls, Black-legged Kittiwakes, and White-winged Scoters dominated numerically.

Densities during offshore surveys in early winter averaged 5 birds/km² in 2004 and 7 birds/km² in 2005 (Figure 44-7). Although few birds were present, bird densities were dominated numerically by Long-tailed Ducks, Glaucous-winged Gulls, and in 2005, Mew Gulls; smaller numbers of other birds such as unidentified cormorants and Marbled Murrelets also were present in one of the years.

Densities during offshore surveys in late winter averaged 12 birds/km² in 2005 and 3 birds/km² in 2006 (Figure 44-7). Although few birds were present, bird densities were dominated numerically by Long-tailed Ducks and Glaucous-winged Gulls; smaller numbers of other birds such as Black Scoters and Mew Gulls also were present in at least one of the years.

Fixed-wing Surveys. During the fixed-wing surveys, numbers of birds were highest in fall (Tables 44-1 and 44-2). The peak count in fall 2004 represented about 80 percent more birds than the peak count in the spring. Similarly, in 2005, about 60 percent more birds were recorded in the peak count for fall than in the peak count for spring. The peak of spring migration in both years occurred in early May, when 1,615 birds were recorded in 2004 and 7,896 were recorded in 2005. The peak of fall migration in both years occurred in late August/early September, when the largest number of birds in a single survey was 2,930 birds in 2004 and 12,751 birds in 2005.

Peak counts in 2004 indicated that ducks were the most abundant birds during two of the four spring surveys and during three of the five fall surveys (Table 44-1, Appendix 44F). Based on peak counts, ducks were the most abundant birds during all but one spring survey in 2005 (shorebirds dominated on that survey) and during all seven fall surveys (Table 44-2, Appendix 44G). Gulls (mostly Glaucous-winged Gulls) were the second most abundant birds during spring 2004 and during fall in both years. Together, ducks and gulls composed more than 91 percent of the birds recorded during all migration surveys, except one. During the survey on May 3, 2005, researchers counted 5,216 shorebirds in Chinitna Bay—66 percent of all birds observed during that entire survey—around the time of the peak of spring shorebird migration. Other subgroups recorded, in decreasing order of abundance, included cormorants, alcids, geese, grebes, swans, and loons.

In spring, Mallards were the first ducks to arrive, with hundreds staging at river outlets in both 2004 and 2005. By early May, the study area was dominated numerically by large flocks of scaup and scoters (Surf, White-winged, and Black scoters). The peak abundance of scaup and scoters occurred in early May in 2004 (83 percent of all waterfowl) and in mid-May in 2005 (83 percent of all waterfowl). Scaup and scoters were the dominant waterfowl species during all subsequent spring surveys in both years, composing 76 percent or more of all waterfowl. Other ducks that were common during spring included Long-tailed Ducks, Harlequin Ducks, mergansers (both Common and Red-breasted mergansers), and goldeneyes.

In fall, scoters were the most-common ducks from late August/early September through September in both 2004 and 2005 (Appendices 44F and 44G). Their peak numbers occurred on September 3, 2004

(1,454 scoters), and on August 30, 2005 (6,454). All three species of scoters were recorded, but Surf Scoters appeared to be the most common. Scaup were recorded in the thousands in August 2005 but were uncommon during September and October of that year. No surveys were conducted in August 2004, but similar to the pattern seen in 2005, scaup were uncommon during the 2004 September and October surveys. Mergansers were the only other common diving duck during the fall surveys. Five species of dabbling ducks (American Wigeon, Mallard, Northern Shoveler, Northern Pintail, and Green-winged Teal) were common during the August and early September surveys in 2005; most were feeding near river outlets in Chinitna Bay, which was not surveyed in 2004. The number of Mallards remained high through September 2005, and by October, they were the most common duck in the study area.

Gulls (mostly Glaucous-winged Gulls) were the second most abundant species-group, with hundreds (from 204 to 824 in various locations) observed during the springs of 2004 and 2005 (see Larids in Tables 44-1 and 44-2). Thousands of gulls were recorded in the fall, with the peak number occurring in early September in both years.

Helicopter-based Surveys. Numbers of birds in area of Iliamna and Iniskin bays in 2006 and 2007 varied markedly among surveys (Figure 44-8, Appendices 44H through 44J). In 2006, overall numbers decreased from February to April and increased from October to December. In 2007, numbers increased from January to May, peaked in August and early September, and generally were lower afterward, except in November when a large number of birds were seen. In 2008, numbers increased from January through the first half of April, then declined in late April (Figure 44-8). Numbers often decline at this time, presumably as wintering birds leave the area and spring migrants have not arrived. The August-September 2007 peak in numbers matched the timing of peak numbers seen on the fixed-wing surveys in 2005 (Appendix 44G). The most waterfowl recorded in Iliamna and Iniskin bays during any given helicopter-based survey (4,079 birds) were seen on September 6, 2007.

Numbers of birds in Chinitna Bay in 2007 and 2008 also exhibited substantial variability among surveys; however, no surveys were conducted there in 2006 (Figure 44-9, Appendices 44K and 44L). In 2007, numbers generally increased from January through May (although numbers in February also were high), peaked in August, and generally were low in the fall and early winter before a large influx occurred in November and December. In 2008, numbers were extremely variable, with the peak number recorded in April. The August 2007 peak in numbers matched the timing of peak numbers seen on the fixed-wing surveys in 2005 (Appendix 44G). Indeed, the most waterfowl recorded in Chinitna Bay during any given helicopter-based survey (2,174 birds) were seen on the survey of August 24-25, 2007, and the total waterfowl in Iliamna and Iniskin bays and in Chinitna Bay on that survey (5,065 birds) was fairly similar to the 6,390 waterfowl seen in these areas during the fixed-wing survey of August 18, 2005.

Interannual Patterns

Boat-based Surveys. During nearshore surveys, both numbers and densities of birds varied interannually, although the patterns were not consistent (Figure 44-7, Appendices 44B and 44C). In three of the four seasons (all except summer), mean densities were lower in 2004/2005 than in 2005/2006, although in most cases, standard errors overlapped, indicating no statistical difference in estimated densities. In the spring, however, mean densities in 2006 were more than three times those in 2005, primarily because of the more than 20,000 shorebirds seen only in 2006.

During offshore surveys, both numbers and densities of birds again varied interannually, although the patterns again were not consistent (Figure 44-7, Appendices 44D and 44E). In three of the four seasons (all except early winter), mean densities were higher in 2004/2005 than in 2005/2006, although in most cases, standard errors overlapped, indicating no statistical difference in estimated densities. In summer, however, mean densities in 2004 were about six times higher than those in 2005, primarily because of the presence of large numbers of scoters and gulls in 2004.

Fixed-wing Surveys. Numbers of birds varied interannually (Tables 44-1 and 44-2), primarily because the survey area differed in size between years (Figure 44-4). Eighty-two percent more area was surveyed in 2005 than in 2004, and for surveys that occurred on similar dates in both years, 50 percent to 390 percent more birds were recorded in 2005 than in 2004. In addition, more surveys were conducted during fall in 2005 than in 2004, contributing to a higher overall number of birds recorded in 2005. Despite the differences in survey-area size and survey frequency, the patterns of abundance of the most common species-groups (ducks and gulls) were similar between years.

Helicopter-based Surveys. More surveys were conducted in Iliamna and Iniskin bays in 2007 than in 2006 and 2008, contributing to a higher overall number of birds recorded in 2007 (Figure 44-8, Table 44-3). Numbers of birds in Iliamna and Iniskin bays were higher on all surveys conducted in 2007 than on surveys that occurred on similar dates in 2006, except December surveys. Numbers of birds in Iliamna and Iniskin bays were higher on two of four surveys conducted in 2008 than on surveys that occurred on similar dates in 2007, were lower in 2008 in one case, and were nearly identical between years in one case. However, the one survey when all years were represented (mid-April) showed higher numbers in 2007 than in 2006 but lower numbers in 2008 than in 2007. In general, 2007 appeared to be the year with the greatest number of birds, followed in decreasing order by 2008 and 2006.

More surveys were conducted in Chinitna Bay in 2007 than in 2008, contributing to a higher overall number of birds recorded in 2007 (Figure 44-9, Table 44-3). Numbers of birds in Chinitna Bay were higher in 2007 than in 2008 on two of four surveys and were higher in 2008 than in 2007 on two of four surveys. Therefore, no clear interannual pattern was identified for abundance.

Taxonomic Patterns

Boat-based Surveys. Species richness of birds was high during boat-based surveys, with researchers recording at least 50 species for both nearshore and offshore surveys combined in 2004/2005 and at least 60 species for both survey types combined in 2005/2006. Species richness was highest in spring of both survey years for both the nearshore and offshore surveys (Figure 44-10). For the nearshore surveys, 39 species were recorded in 2004/2005 and 46 species were recorded in 2005/2006; during offshore surveys, 20 and 18 species were recorded in 2004/2005 and 2005/2006, respectively. In both years, species richness in both survey types declined from spring through late winter, to lows of 21 and 13 species during nearshore surveys in 2004/2005 and 2005/2006, respectively, and seven and five species during offshore surveys in 2004/2005 and 2005/2006, respectively; however, within survey types, years differed slightly for a given season. In general, interannual patterns in richness were not consistent for either survey type.

Species composition varied substantially among seasons, between survey types, and between years (Figure 44-11). During nearshore surveys, waterfowl, shorebirds, and seabirds were the numerically dominant species-groups. Shorebirds were abundant only during spring 2006, when a large number staged

and fed on mudflats, especially those in Iniskin Bay and inner Iliamna Bay. With the exception of spring 2006, waterfowl composed 35 to 45 percent of all birds seen in spring and summer; however, in early and late winter, waterfowl increased to compose 62 to 73 percent of birds. Shorebirds composed 1 to 2 percent of all birds in spring and summer, with the exception of spring 2006, as indicated earlier, when they composed 73 percent of all birds; in early winter, they composed 10 to 15 percent of birds, and in late winter, shorebird numbers dropped to 0 to 1 percent of birds. Seabirds composed 52 to 61 percent of birds in spring and summer (again, with the exception of spring 2006); in early winter, they composed 9 to 24 percent of birds, and in late winter, shorebird numbers increased to 29 to 31 percent of birds. All other species-groups formed a minor component of all birds.

During offshore surveys, waterfowl and seabirds were the numerically dominant species-groups (Figure 44-11). Waterfowl were the numerically dominant species-group in both springs (80 and 92 percent of all birds in 2005 and 2006, respectively) and in late winter 2005 (91 percent); they were second in abundance at all other times. Seabirds were the numerically dominant species-group in both summers (57 and 76 percent in 2004 and 2005, respectively), in both early winters (66 and 67 percent in 2004 and 2005, respectively), and in late winter 2006 (71 percent); they were second in abundance at all other times. All other species-groups formed a minor proportion of all birds.

Fixed-wing Surveys. Species richness of birds during fixed-wing surveys varied both seasonally and interannually (Figure 44-12). Species richness by season ranged from 13 species in fall 2004 to 28 species in spring 2005. In both years, the number of species was higher in spring than in fall, even though more surveys were conducted in fall (Appendices 44F and 44G). The number of species in a particular season was higher in 2005 than in 2004.

Species composition was dominated numerically by waterfowl and seabirds (Figure 44-13), as was seen for the boat-based surveys; shorebirds composed a small, but noticeable, portion of all birds, and waterbirds accounted for less than 1 percent (i.e., a trace). Waterfowl composed 43 to 54 percent of all birds in the spring and 53 to 66 percent of all birds in the fall. Seabirds composed 21 to 44 percent of all birds seen in the spring and 34 to 47 percent of all birds seen in the fall. Shorebirds were numerically important only in spring 2005, when more than 5,200 were recorded; otherwise, they composed only 8 percent of birds overall. Waterbirds accounted for only a trace of all birds.

Helicopter-based Surveys. Species richness of birds varied seasonally in Iliamna and Iniskin bays (Figure 44-14). Richness was high during both late spring (migration and beginning of the breeding season) and early fall (migration and end of the breeding season) and was low during December and January in most years. Richness also was low in late February-early March, when cold snaps froze the water in the bays and when wintering birds were starting to leave the area, and in October, when breeding birds and many migrants had left the area and overwintering birds had not arrived. Species richness increased overall from mid-winter to late spring (e.g., from eight species in January 2007 to 24 species in May 2007), then decreased overall from early fall to mid-winter (e.g., from 19 species in August 2007 to 9 species in December 2007). These seasonal patterns were similar among years, although no year was consistently higher than another.

Species composition in Iliamna and Iniskin bays was dominated numerically by waterfowl and seabirds (Figure 44-15), as was seen during the boat-based surveys. Waterfowl composed 70 percent of birds overall and were the most abundant species-group on all but four surveys. Seabirds composed 28 percent of birds overall and were more abundant than waterfowl in April 2006, October 2007, and January 2008.

Shorebirds were numerically dominant only in November 2006, when more than 400 Rock Sandpipers were recorded and composed 62 percent of all birds; otherwise, shorebirds composed only 3 percent of birds overall. Waterbirds, raptors, and corvids each accounted for less than 1 percent (i.e., a trace) of birds overall.

Species richness of birds in Chinitna Bay exhibited a bimodal seasonal pattern, similar to the pattern seen in Iliamna and Iniskin bays (Figure 44-16). From mid-winter to spring, richness was lowest in January (four species) or mid-February (two species) and increased to a maximum of 15 species in May. From the fall to mid-winter, species richness generally declined from 13 species in August to four species in December, with one high count (12 species) in mid-November.

Similar to the pattern seen in Iliamna and Iniskin bays, species composition in Chinitna Bay was dominated numerically by waterfowl and seabirds (Figure 44-17). Waterfowl composed 72 percent of birds overall and was the most abundant species-group on all but one survey. Seabirds composed 27 percent of birds overall and were more abundant than waterfowl only in February 2007. Waterbirds, raptors, shorebirds, and corvids each accounted for less than 1 percent of birds overall.

Spatial Patterns

Boat-based Surveys. Mean densities of birds exhibited distinct spatial patterns during each season. In the spring, most birds were concentrated in the nearshore zone within the study bays and on and near islands near the mouths of those bays (i.e., the Iniskin Islands); few birds were recorded during offshore surveys (Figure 44-18). (Note that, in Figures 44-18 through 44-21, the data for 2005 and 2006 are pooled for each season to show an average spatial pattern.) This spatial pattern reflected two important avian components present at the time: migrating shorebirds, which concentrated on the mudflats within the bays (especially within Iniskin Bay), and breeding birds, which concentrated on and near the nesting islands, all of which are concentrated near and off the mouths of the bays.

In summer, most birds were concentrated in the nearshore zone, and densities in the offshore zone were low, except in areas where scattered flocks of summering seaducks occurred (Figure 44-19). Densities were high on the nesting islands near the mouths of the bays and in general along the outer coasts. In a few locations, densities within bays also were high where large flocks of summering seaducks congregated (e.g., in eastern Iniskin Bay and outer Iliamna Bay) and where large flocks of gulls congregated (e.g., on mudflats near the head of Iniskin Bay).

In early winter, most birds were concentrated in the nearshore zone within the bays and, to a lesser extent, near the mouths of the bays; however, small but regular numbers of birds also were seen throughout much of the offshore zone (Figure 44-20). Similar to the pattern seen in the summer, densities were particularly high in Iniskin Bay, again because of the large number of seaducks and gulls that congregated there.

In late winter, most birds again were concentrated in the nearshore zone within the bays and, to a lesser extent, near the mouths of the bays; however, small but regular numbers of birds again were seen throughout much of the offshore zone (Figure 44-21). To some extent, this distribution might be modified by the presence of sea ice within the bays during especially cold periods. Similar to the pattern seen in summer and early winter, densities were particularly high in Iniskin Bay because of the large number of gulls and, to a lesser extent, seaducks that congregated there.

Fixed-wing Surveys. The spatial distribution of birds seen during fixed-wing surveys was determined to a certain extent by the tide level, which differed among surveys. During middle and low tides, gulls were spread out across the exposed mudflats in the bays, whereas at high tides they were concentrated on land (i.e., rocky islands and shoreline). At low tide, the amount of water in the upper parts of the bays is minimal, greatly reducing the amount of habitat available to ducks. Ideally, surveys all would have been conducted at the same tide level, but that consistency was not possible because of weather and logistical constraints. Sea conditions also may have played a role in the distribution of birds.

During spring migration in 2004, birds were distributed throughout Iliamna and Iniskin bays and the bight between them, with the highest number occurring in upper Iliamna Bay (553 birds) and in the bight between Iliamna and Iniskin bays (792 birds; Figure 44-22). The largest numbers of birds counted in Cottonwood, lower Iliamna, upper Iniskin, and lower Iniskin bays in spring 2004 were 172, 310, 183, and 139 birds, respectively.

During fall migration in 2004, the largest concentration of birds (1,800 ducks and 573 gulls) occurred in lower Iniskin Bay (Figure 44-23). Large numbers of gulls were counted in Cottonwood Bay (580) and in upper Iniskin Bay (214). The largest numbers of birds counted in upper and lower Iliamna Bay and in the bight between the bays in fall 2004 were 499, 111, and 112 birds, respectively.

During spring migration in 2005, birds concentrated in Chinitna Bay, where 5,470 birds were counted on May 3 (Figure 44-24); of those birds, 5,216 were shorebirds. Large numbers of birds also were counted in upper and lower Iniskin Bay (987 and 1,160 birds, respectively). Eighty-six percent of the birds seen in lower Iniskin Bay were ducks, whereas in upper Iniskin Bay, 50 percent were ducks, 28 percent were gulls, and 20 percent were shorebirds. In contrast to the large number seen in 2004, researchers recorded only 97 birds in the bight between Iliamna and Iniskin bays in 2005. The greatest numbers counted in Cottonwood, upper Iliamna, and lower Iliamna bays in spring 2005 were 492, 603, and 411 birds, respectively.

During fall migration in 2005, large concentrations of 2,000 to 4,500 birds were recorded in Chinitna, Iniskin, and Cottonwood bays (Figure 44-25). Ducks composed 79 to 89 percent of the birds in Chinitna and Iniskin bays, whereas gulls composed 99 percent of the birds in Cottonwood Bay. Gulls in Cottonwood Bay concentrated at river outlets, where they were feeding on salmon carcasses. Similar to the pattern seen in fall 2004, few birds were found in Iliamna Bay and the bight between Iliamna and Iniskin bays in fall 2005. The largest numbers counted in upper and lower Iliamna Bay and the bight between the bays in fall 2004 were 576, 258, and 332 birds, respectively.

Helicopter-based Surveys. Composite maps for Iliamna and Iniskin bays showing all observations from the nearshore zone and concentrations of five or more birds farther offshore illustrate a spatial pattern similar to that described above for the boat-based surveys. In general, birds concentrated along shorelines (especially among the Iniskin Islands) and congregated in large flocks within bays. Concentrations in the centers of Iliamna and Iniskin bays were largest during late winter and spring, when ice choked the shallow areas and forced birds away from nearshore areas.

In Iliamna and Iniskin bays, many concentrations of birds occurred in the same areas during all seasons (Figures 44-26 through 44-28). In particular, areas that consistently were used by large numbers of birds included the narrows near the upper end of Iliamna Bay, the vicinity of White Gull Island, and the middle of Iliamna Bay off the mouth of Cottonwood Bay (two of three seasons). In Iniskin Bay, areas that

consistently were used by large numbers of birds included the shallow reefs near the mouth of the bay, Right Arm and the area immediately outside of it, the main channel at the northern end of the bay, and the vicinity of the possible port site (two of three seasons). Outside these bays, areas used consistently included the Iniskin Islands, Turtle Reef, and the mouth of Y Valley (2 of 3 years). The only other spatial pattern seen was the consistently high densities of birds, probably mostly gulls, in the fall near salmon streams near the head of Cottonwood Bay and in Right Arm and in the northwest part of Iniskin Bay (Figure 44-26).

For all birds combined, 78 percent occurred within Iliamna and Iniskin bays, rather than in the bight outside those bays (Figure 44-29). Exhibiting a seasonal pattern, the percentage of birds within bays decreased slightly from 83 percent in the fall to 81 percent in mid-winter, then decreased considerably to 73 percent in late winter and spring. For all birds combined, mean group size averaged $21.0 \pm \text{SE } 0.8$ birds (Figure 44-30). Group size also differed significantly among seasons ($F = 4.932$; $df = 2$; $P = 0.007$); the pattern was mid-winter group sizes larger than those in late winter-spring, but no other seasons were significantly different.

In Chinitna Bay, birds concentrated during fall and winter primarily along the shoreline and on or near the rocky Gull Island at the mouth of the bay (Figures 44-26 through 44-28). Numbers of birds seen in the center of the bay generally increased from February to May, as the nearshore and shallow areas of the bay became covered in ice. During late winter and spring, birds congregated closer to the mouth of the bay than they did in the fall. Similar to the spatial pattern seen in Iliamna and Iniskin bays in the fall, birds concentrated near the salmon stream that flowed into Chinitna Bay at Fitz Creek (Figure 44-26).

Discussion. The results of this study are consistent with the results of previous surveys, which indicate that the number of birds concentrating in the area encompassing Iliamna, Iniskin, and Chinitna bays is substantial (Erikson, 1977; Arneson, 1981; Agler et al., 1995; Bennett, 1996). For example, in the mid-1970s, the largest wintering concentration of seabirds in all of lower Cook Inlet occurred in Iniskin Bay; the area encompassing Iliamna and Iniskin bays was the location of one of three concentrations of summering scoters in western Cook Inlet; gulls, dabblers, and scaup all concentrated in Iniskin and Chinitna bays in the summer; and large numbers of dabblers concentrated in Chinitna Bay in fall (Erikson, 1977). A similar concentration of waterfowl, both dabblers (especially Mallards) and sea ducks (especially scaup, scoters, and Long-tailed Ducks), was recorded in Chinitna Bay in the 1990s by Bennett (1996).

Similar to the findings of Erikson (1977), Arneson (1981) found that the area encompassing Iliamna, Iniskin, and Chinitna bays was of great importance to birds in the late 1970s. For example, in spring, the density of all birds combined in Iliamna and Iniskin bays was the fifth highest of all areas surveyed in lower Cook Inlet, and that in Chinitna Bay was the ninth highest; large numbers of shorebirds concentrated in Iliamna and (especially) Iniskin bays (second highest density in all of lower Cook Inlet) and in Chinitna Bay (fourth highest density). In summer, Iniskin and Iliamna bays held important concentrations (several thousands) of summering scoters. Further, the fall density of all birds combined in Chinitna Bay was the fifth highest in all of lower Cook Inlet. Finally, the wintering density of all birds combined in Iliamna and Iniskin bays was the sixth highest in all of lower Cook Inlet. Surprisingly, Arneson (1981) found that Iliamna and Iniskin bays were used little by birds in the fall, in contrast to the large numbers of waterfowl recorded there in this study.

In the early 1990s, the area encompassing Iliamna, Iniskin, and Chinitna bays again was found to be important to birds. For example, the boat-based surveys of Agler et al. (1995) indicated that the vicinity of the mouth of Iniskin Bay encompassed one of six concentrations of birds on the west side of lower Cook Inlet (Tuxedni Bay to Cape Douglas) in summer. In addition, their aerial surveys in winter indicated that the total number of all birds combined (primarily waterfowl) in the area encompassed by Iliamna and Iniskin bays was the highest in western lower Cook Inlet and the third highest in all of lower Cook Inlet. Those surveys also found that the total number in Chinitna Bay was the fourth highest in western lower Cook Inlet.

Gill and Tibbitts (1999) found that large numbers of shorebirds pass through upper Cook Inlet on migration, especially in the spring. Similarly, Erikson (1977) found large numbers of shorebirds concentrating in the area encompassing Iliamna, Iniskin, and Chinitna bays in the spring. The timing of the nearby Homer Shorebird Festival, which occurs in the first week of May, correlates with the large number of shorebirds recorded in this study in spring 2006.

44.7.1.3 Breeding Birds

Several species of birds have been recorded breeding in the study area. Historical surveys for breeding birds were conducted in 1976 and 1978 by P. Arneson and D. Erikson, who both were working for the ADF&G at the time. According to Erikson (pers. comm., 2005), researchers camped in this area and surveyed the shorelines and islands for breeding birds during the course of a few weeks in the mid-summer of each year; when surveying the islands, they landed the boat and climbed onto the islands to survey birds. In the 1970s, more than 4,100 birds of eight species were estimated to be breeding in the study area (Table 44-4). Tufted Puffins and Glaucous-winged Gulls were the most frequently recorded birds, together representing 85 percent of all birds nesting in the area. Double-crested Cormorants, Horned Puffins, Pelagic Cormorants, and Pigeon Guillemots nested in substantial numbers, and Common Eiders and Black Oystercatchers nested in small numbers.

During these 1970s surveys, the largest numbers of nesting birds occurred on the Iniskin Islands, on White Gull Island, and along the bight between Iliamna and Iniskin bays; in addition, a substantial nesting colony of Glaucous-winged Gulls occurred in upper Iniskin Bay (Figure 44-31). The researchers recorded Common Eiders nesting on the Iniskin Islands, where they were interspersed among gull nests in the large Glaucous-winged Gull colonies present at that time. The numerically dominant species on those islands, however, was the Tufted Puffin, with nearly 1,700 birds estimated to be nesting.

In 2004 and 2005, Pebble Project researchers surveyed the same area from a small boat and recorded information on probable nesting locations and approximate numbers of nesting birds and on locations of nests that were visible from the boat. During these surveys, the researchers did not go ashore on the islands because they wanted to minimize disturbance to nesting birds.

In summer 2004 surveys, more than 1,200 birds of 10 species were recorded in the study area, although not all were believed to be breeding (Figure 44-32, Table 44-4). Evidence of nesting was noted for at least six of these species. One Double-crested Cormorant nest was seen high on a cliff on Knoll Head, in the same location where an estimated 25 birds nested in the 1970s. The most common nesting cormorant was the Pelagic Cormorant, with at least 21 nests seen on White Gull Island (at the mouth of Iliamna Bay) and on the Iniskin Islands. Although Red-faced Cormorants were present and possibly nested with the Pelagic Cormorants at White Gull Island (many nests had failed by the time surveys occurred in June), no direct

evidence of nesting was seen. The Glaucous-winged Gull was the most common nesting species, with counts identifying 126 birds on the large colony on White Gull Island, more than 41 nests on the Iniskin Islands, four nests along the bight between Iliamna and Iniskin bays, and one nest on a small islet in Cottonwood Bay. Perhaps the greatest changes in this species since the 1970s were the disappearance of the large nesting colony seen far up in Iniskin Bay and the large decline in the number of nesting gulls on the Iniskin Islands.

Pigeon Guillemots occurred in small colonies where scattered cliff crevices and crevices in talus slides were present; altogether, more than 61 birds were counted near this appropriate nesting habitat. Tufted Puffins occurred primarily on the Iniskin Islands and on White Gull Island, where more than 25 birds were counted on colonies. Nesting burrows were seen at both locations, although it was impossible to get an exact count without ground-based searches. Tufted Puffins showed the greatest reduction in nesting numbers from the 1970s, with the colonies on the Iniskin Islands declining the most. Finally, Horned Puffins were seen near suitable nesting habitat (large crevices in cliffs or talus) near one of the Iniskin Islands and especially on rocky cliffs with crevices along the bight between Iliamna and Iniskin bays; at least 25 birds were seen near this suitable nesting habitat, and one was seen in a cliff crevice.

In summer 2005 surveys, approximately 1,500 birds of 10 species were recorded in the study area, although not all birds were believed to be breeding (Figure 44-33, Table 44-4). Evidence of nesting was noted for at least seven of these species. One Double-crested Cormorant nest was seen high on a cliff on Knoll Head, in the same area where the species nested in both the 1970s and 2004. Although Pelagic Cormorants were not definitely recorded nesting in 2005, eight abandoned nest platforms seen along the bight between Iliamna and Iniskin bays were small enough to belong to this species. Glaucous-winged Gulls were widespread, with at least 22 nests recorded, primarily on the Iniskin Islands; again, it was difficult to get counts of nests without going ashore, although up to 108 birds were seen on some islands. Mew Gulls were recorded nesting, with two single nests seen on small islets in Cottonwood Bay. Pigeon Guillemots occurred in scattered small groups near suitable nesting habitat, with at least 33 birds seen. Tufted Puffins occurred in small numbers, with more than 27 birds and more than three nesting burrows seen on the Iniskin Islands. Finally, Horned Puffins again occurred in or near suitable nesting habitat, especially on the Iniskin Islands, on or near cliffs on Knoll Head, and along the bight between Iliamna and Iniskin bays.

The number of breeding birds has declined since the 1970s (Table 44-4). In the 1970s, almost 4,200 birds were estimated to be nesting in this area. In contrast, the data from the 2004 surveys suggest that only about 1,200 birds of potentially breeding species were seen in the entire nearshore survey area and that only a small percentage of them actually were nesting. In 2005, only about 1,500 birds of these potentially breeding species were seen in the entire nearshore survey area, and as in 2004, only a small percentage were believed to be nesting. Numbers of Double-crested Cormorants, Common Eiders, Glaucous-winged Gulls, Pigeon Guillemots, Tufted Puffins, and Horned Puffins all indicated that substantial declines have occurred since the 1970s. In fact, some species, such as Common Eiders, do not appear to nest in this area anymore, although they do summer here. In contrast, numbers of Black Oystercatchers appear to have remained fairly steady through time. Although fewer oystercatchers were recorded in 2004, numbers rebounded in 2005. Finally, numbers of Red-Faced Cormorants (which probably nest in small numbers) and Mew Gulls (which were recorded nesting in 2005) have increased through time, although surveys identified only minimal nesting by the gull and no direct evidence of nesting by the cormorant. Overall, the greatest decline appears to have occurred in the Tufted Puffin population (approximately 95 percent

decline), with a smaller, but substantial, decline appearing to have occurred in the Glaucous-winged Gull population (33 to 45 percent decline).

44.7.1.4 Species of Conservation Concern

Nineteen species of birds that are classified as being of conservation concern were recorded or almost certainly occur in the study area (Table 44-5). Altogether, these 19 species consisted of five species of waterfowl, two waterbird species, two raptor species, six shorebird species, and four seabird species.

Steller's Eider

Steller's Eiders occurred in the study area only in the winter, and they occurred in locations that were not sampled well or at all by the boat-based surveys (i.e., the birds almost always occurred in areas farther offshore than those covered by the nearshore surveys but in waters too shallow to be surveyed by the larger boats during offshore surveys). Consequently, Steller's Eiders were detected primarily during the helicopter-based surveys in 2006 through 2008 (Figures 44-34 and 44-35, Appendices 44H through 44L). During helicopter-based surveys, Steller's Eiders were seen from the second half of November through the first half of April, primarily as large flocks resting and foraging within the centers of Iliamna and Iniskin bays, with one small flock seen near the Iniskin Islands and none seen in Chinitna Bay. In addition, two off-transect records of Steller's Eiders in the survey area were reported during nearshore boat-based surveys, with small flocks of two birds each seen in central and outer Iniskin Bay in December 2004. Steller's Eiders were not seen in Chinitna Bay. The concentration of Steller's Eiders primarily in lower Iniskin Bay in this study is similar to that seen in winter by Larned (2006b); however, he also had a few more records than from this study in the Iniskin Islands, saw none in Iliamna Bay, recorded one small flock in Chinitna Bay, and recorded a few birds as early as October (Figure 44-35, Appendix 44M).

Data presented by Larned (2006b) suggest that Steller's Eiders in western Cook Inlet occur only as far north as Iliamna, Iniskin, and (occasionally) Chinitna bays. The species appears to occur primarily in southern Kamishak Bay and moves as far north as the study area, primarily in mid- to late winter. In addition, limited aerial-survey data from Kamishak Bay for September 2005 suggest that Steller's Eiders occur only in the southern part of the bay at the beginning of the winter (Larned, 2005). The study area has been known for several years to be important to wintering Steller's Eiders, because Agler et al. (1995) recorded 435 Steller's Eiders in Iliamna and Iniskin bays in winter 1993/1994.

For all Steller's Eider counts combined, more than 99 percent of the birds occurred within Iliamna and Iniskin bays, rather than in the bight outside of them (Figure 44-36). A seasonal pattern was evident, with no birds occurring within the study area in the fall, 100 percent occurring within bays in mid-winter, and 99.9 percent occurring within bays in late winter and spring. Mean group size in the two seasons when the species is present averaged $155.5 \pm SE 33.4$ birds (Figure 44-37). As might be expected from an examination of Figure 44-37, group size did not differ significantly between winter and spring ($F = 1.715$; $df = 1$; $P = 0.203$).

The Alaska breeding population of Steller's Eider is on four of the eight lists of species of conservation concern (Table 44-5). It is a species of concern primarily because the breeding population in Alaska is extremely low, and there may be years when the species does not breed at all (USFWS 2002a). It was listed because of the small, declining population and because the cause(s) of the decline and obstacles to recovery were not known.

Kittlitz's Murrelet

Researchers did not definitively record Kittlitz's Murrelets during any of the surveys, suggesting that these small seabirds are extremely rare, if present, in the study area. However, one unidentified *Brachyramphus* murrelet was recorded during a nearshore survey in summer 2004 (Appendix 44B). The bird was glimpsed only briefly before it dived, and the observers were unable to relocate it to identify it to species. The lack of observations of this species in the study area is surprising because the species typically occurs in protected bays that are near potential nesting areas (i.e., near glaciers or alpine scree slopes or fell-fields) and forages primarily in highly turbid water of glacial origin (Day et al., 1999, 2003)—all habitats that occur in the study area. In addition, these birds prefer to forage in turbid water of glacial origin (Day et al., 2003), and much of this type of foraging habitat occurs in the study area. Therefore, several potential nesting areas for this species occur within the study area, and the entire area is potentially suitable for foraging. In the Iliamna Bay area, these potential nesting sites include several unnamed glaciers between the Williams River and Cottonwood Bay. In the Iniskin Bay area, these potential nesting sites include Roscoe Glacier on Roscoe Peak, several unnamed glaciers on and near Sugarloaf Mountain, and two unnamed glaciers that drain into the head of the Iniskin River. The Kittlitz's Murrelet is on seven of the eight lists of species of conservation concern (Table 44-5). The Kittlitz's Murrelet is classified as a candidate species under the ESA because the overall range is not large (Alaska and northeastern Russia), the overall population size is not believed to be large (Day et al., 1999), and there is evidence that the population may be declining in some areas.

Common Eider

Common Eiders were seen during both nearshore and offshore boat-based surveys (Appendices 44B through 44E). During nearshore surveys, in which they were most common, the birds were recorded during both spring and summer surveys in both years (2004/2005 and 2005/2006), and the only place they were seen was on the Iniskin Islands. They also were recorded off-transect during nearshore surveys in early winter 2004 and late winter 2005, but were absent from nearshore waters in early winter 2005 and late winter 2006 (Appendix 44B). During offshore surveys, researchers saw Common Eiders twice in the bight between the two bays (Figure 44-38); a single bird was observed in early winter 2004 and a flock of five birds was observed in early winter 2005 (Appendix 44D). In addition, two Common Eiders were recorded during fixed-wing surveys in spring 2005 (Appendix 44G), and several were recorded during helicopter-based surveys in 2006 through 2008 at and inside the mouth of Iniskin Bay, in the Iniskin Islands, off of Ursus Head, and in Chinitna Bay (Figure 44-38, Table 44-3, Appendices 44H through 44L). This species is a rare visitor to the northern Gulf of Alaska, and it breeds in lower Cook Inlet (Isleib and Kessel, 1973). Common Eiders nested on the Iniskin Islands in the 1970s (Figure 44-31), especially in and among nesting Glaucous-winged Gulls (Erikson, pers. comm., 2005); however, they did not appear to be breeding there during boat-based surveys in 2004 or 2005. Primary concerns for this species are dramatic declines in its breeding population in western and northern Alaska and in Canada (Kirchhoff and Padula, 2010). The Common Eider is on three of the eight lists of species of conservation concern (Table 44-5).

Surf Scoter

Surf Scoters were recorded during all nearshore boat-based surveys (Appendices 44B and 44C) and were recorded during all offshore boat-based surveys except late winter 2005 and early winter 2005 (Appendices 44D and 44E). Surf Scoters also were common during waterbird fixed-wing surveys in

spring and fall 2004 and (especially) 2005 (Appendices 44F and 44G) and were common, and sometimes abundant, during helicopter-based surveys throughout Iniskin and Iliamna bays and Chinitna Bay in 2006 through 2008 (Figure 44-39, Table 44-3, Appendices 44H through 44L). The species is an abundant resident of the northern Gulf of Alaska, being the most numerous scoter and seaduck in inshore waters at all times (Isleib and Kessel, 1973). Primary concerns for this species are significant declines in its breeding population in western Alaska and its vulnerability to oil spills during the marine phase of its annual cycle (BLM, 2005; ADFG, 2006). The Surf Scoter is on two of the eight lists of species of conservation concern (Table 44-5).

American Scoter

American Scoters were recorded during all nearshore boat-based surveys except late winter 2006 (Appendices 44B and 44C) and were recorded during offshore boat-based surveys in late winter 2005, early winter 2005, and spring 2006 (Figure 44-38, Appendices 44D and 44E). They were common in mixed-species flocks with other scoters and with Long-tailed Ducks, and were concentrated primarily within Iliamna and Iniskin bays. American Scoters also were common during waterbird fixed-wing surveys in spring and fall 2004 and 2005 (Appendices 44F and 44G) and were abundant during helicopter-based surveys, on which thousands were seen throughout Iniskin and Iliamna bays, the Iniskin Islands, and Chinitna Bay in 2006 through 2008 (Figure 44-38, Table 44-3, Appendices 44H through 44L). In general, American Scoters occurred primarily in nearshore areas and shallow offshore areas (e.g., over shoals). The species is a resident of the northern Gulf of Alaska, being an uncommon summer visitor, a fairly common migrant, and a common winter visitor (Isleib and Kessel, 1973). The American Scoter is a species of concern because of significant declines in the breeding population in western Alaska, vulnerability to oil spills during the marine phase of its annual cycle, and possible problems caused by contaminants (BLM, 2005; ADFG, 2006; Kirchhoff and Padula, 2010). The American Scoter is on four of the eight lists of species of conservation concern (Table 44-5).

Long-tailed Duck

Long-tailed Ducks were common to abundant during boat-based surveys, especially in nearshore waters (Appendices 44B through 44E). In nearshore waters, they occurred during all surveys except summer 2004, and they generally were least common in the study area in the summer. In offshore waters, they occurred during all surveys except summer 2004 and 2005. They occurred in essentially all nearshore waters, although they were most common in offshore areas within bays, where they occurred in mixed-species flocks with scoters. Long-tailed Ducks were seen during fixed-wing surveys in spring 2004 and 2005, but were extremely rare in the fall, with just a few being recorded in fall 2005 (Appendices 44F and 44G). These ducks were seen in large numbers from October to May during helicopter-based surveys in 2006 through 2008 and were the most-common bird species recorded in those surveys (more than 20 percent of all birds counted). During these surveys, they occurred in numerous small flocks near the shore and in larger flocks in the centers of the bays (Figures 44-40 through 44-42, Table 44-3, and Appendices 44 H through 44L). Long-tailed Ducks were rare in the fall and more common the rest of the winter, and were concentrated almost entirely within bays, with the few records outside of bays occurring off Ursus Head, in the Iniskin Islands, and at Black Reef. The species is a resident of the northern Gulf of Alaska, being an uncommon summer visitor, a common migrant, and a common winter visitor (Isleib and Kessel, 1973). Concerns for this species include declines in its populations, its vulnerability to oil spills during

the marine phase of its annual cycle, and its vulnerability to contaminants (BLM, 2005; ADFG, 2006). The Long-tailed Duck is on seven of the eight lists of species of conservation concern (Table 44-5).

Red-throated Loon

Red-throated Loons were recorded only twice during nearshore boat-based surveys: a single bird was seen along the bight between Iliamna and Iniskin bays in spring 2005, and a group of four was seen in Cottonwood Bay in summer 2005 (Figure 44-43, Appendices 44B and 44C). No Red-throated Loons were recorded during the fixed-wing surveys, but some were seen during the helicopter-based surveys in Iliamna and Iniskin bays and in the bight between them (Table 44-3, Appendices 44H through 44L). The species is a resident of the northern Gulf of Alaska, being a locally common breeder, a common migrant, and an uncommon to common winter visitor (Isleib and Kessel, 1973). Concerns for this species include significant recent declines in populations, habitat loss, and vulnerability as fishing-related bycatch and to oil spills during the marine phase of its annual cycle (BLM, 2005; ADFG, 2006; Kushlan et al., 2006; Kirchhoff and Padula, 2006). The Red-throated Loon is on five of the eight lists of species of conservation concern (Table 44-5).

Horned Grebe

Horned Grebes were recorded in the nearshore boat-based surveys only in early winter 2004 and spring 2006 and were recorded off-transect on offshore surveys in spring 2006 (Appendices 44B through 44E). They also were recorded during fixed-wing surveys in early May 2004 (Appendices 44F through 44G.) and on helicopter surveys in early May 2007 (Figure 44-43, Appendices 44H through 44L). All Horned Grebes occurred in small groups of up to eight birds scattered throughout both Iliamna and Iniskin bays, and most occurred in shallow waters. The species is a resident of the northern Gulf of Alaska, being an uncommon local breeder and summer visitor, a common migrant, and a fairly common winter visitor (Isleib and Kessel, 1973). Concerns for this species include declines in the breeding range, apparent population declines, and population threats during both breeding and non-breeding seasons (ADFG, 1998, 2006, Kushlan et al., 2002; USFWS, 2008, 2010a). The Horned Grebe is on three of the eight lists of species of conservation concern (Table 44-5).

Red-faced Cormorant

Red-faced Cormorants were recorded in the nearshore boat-based surveys only in summer 2004 and spring and summer 2005 and were recorded in offshore surveys in summer 2004 and 2005 (Appendices 44B through 44E); however, some records of unidentified cormorants probably were of this species. Red-faced Cormorants occurred primarily in the Iniskin Islands and on and near White Gull Island, in the mouth of Iliamna Bay (Figure 44-44). They may have attempted to breed on the latter island in summer 2004, when they were seen sitting with many Pelagic Cormorants near several failed nests. Red-faced Cormorants were not definitively recorded during either fixed-wing surveys or helicopter-based surveys, although some unidentified cormorants noted during these surveys probably were of this species. The Red-faced Cormorant is an uncommon resident of the northern Gulf of Alaska that had not been recorded in the northern gulf prior to 1969 and expanded eastward rapidly to become a common cormorant (Isleib and Kessel, 1973). Now, however, the species is rare in the northern Gulf of Alaska (R. Day, personal observation), suggesting that its primary range has retracted westward again. Concerns for this species include population declines, the small total world population and small breeding range, and its vulnerability to oil spills throughout the year are major reasons for concern (ADFG, 2006; Kushlan et

al., 2006; Kirchoff and Padula, 2010). The Red-faced Cormorant is on five of the eight lists of species of conservation concern (Table 44-5).

Pelagic Cormorant

Pelagic Cormorants were recorded during all nearshore boat-based surveys (Appendices 44B and 44C) but were not recorded during any offshore boat-based surveys (Figure 44-44, Appendices 44D and 44E), reflecting their preference for shallow water. Pelagic Cormorants were rare during waterbird fixed-wing surveys in both 2004 and 2005 (Appendices 44F and 44G) and during helicopter-based surveys throughout Iniskin and Iliamna bays and Chinitna Bay in 2006 through 2008 (Table 44-3, Appendices 44H through 44L), presumably because of identification difficulties from the air. Because this species was, by far, the most abundant species of cormorant in the study area during boat-based surveys, it probably formed a high percentage of the substantial number of unidentified cormorants seen on the fixed-wing and helicopter-based surveys. The species is an abundant resident of the northern Gulf of Alaska (Isleib and Kessel, 1973) and is the most abundant cormorant seen throughout this region (Day, personal observation). Concerns for this species include apparent population declines and population threats during both breeding and non-breeding seasons (Kushlan et al., 2002; USFWS, 2008, 2010a). The Pelagic Cormorant is on two of the eight lists of species of conservation concern (Table 44-5).

Golden Eagle

Golden Eagles were recorded three times during nearshore boat-based surveys, all as single birds and all over mountainous habitats (Appendices 44B and 44C). One was seen flying over the bight between Iliamna and Iniskin bays in summer 2004, one was seen perched on the mountainous area on the eastern coast just inside the mouth of Iliamna Bay in spring 2005 (Figure 44-43), and one was seen flying over the Cottonwood Bay area in early winter 2005. (Because flying birds were not mapped, only one of these three observations is shown on the map.) Golden Eagles were not recorded during either fixed-wing surveys or helicopter-based surveys. The species is rare along the coast of the northern Gulf of Alaska, breeding in mountainous areas that primarily are inland from the coast itself (Isleib and Kessel, 1973). Concerns about this species include a lack of knowledge about population size and trends, a lack of information about migration corridors and potential risks, and habitat loss on wintering grounds (ADFG, 2006). The Golden Eagle is on two of the eight lists of species of conservation concern (Table 44-5).

Peregrine Falcon

Peregrine Falcons were recorded during boat-based surveys only three times: single birds on the outer mainland east of Iniskin Bay and near the point by the northern entrance to Cottonwood Bay (Diamond Point), both in spring 2005, and a single bird on one of the eastern Iniskin Islands in summer 2005 (Figure 44-43, Appendices 44B and 44C). Peregrine Falcons were not recorded during fixed-wing surveys, but one was seen near the mouth of Chinitna Bay during helicopter-based surveys in August 2007 (Figure 44-43, Table 44-3, and Appendices 44 H through 44L). Based on range, the subspecies occurring in this area should be the coastal subspecies *pealei*, although the birds observed were light in plumage, suggesting that they possibly were intergrades between coastal *pealei* and inland *anatum* birds (Ritchie, pers. comm., 2006). The only Peregrine Falcon nest occurring in or near the study area was located at Diamond Point in both 2004 and 2005 (see Chapter 41, section on raptors). The species is a rare resident along the coast of the northern Gulf of Alaska (Isleib and Kessel, 1973). The primary concern for the *pealei* subspecies is its small total world population and its vulnerability to contaminants because of

its trophic position and prey (ADFG, 2006). The Peregrine Falcon is on three of the eight lists of species of conservation concern (Table 44-5).

Black Oystercatcher

Black Oystercatchers were common in the study area during boat-based surveys, being seen during all nearshore surveys except early winter 2004 and 2005 and late winter 2006 (Appendices 44B and 44C). Oystercatchers apparently leave the study area in fall and early winter and return in late winter. They probably still were absent from the study area in late winter 2006 because the cold weather had caused most of the bays to become completely frozen, resulting in the lowest overall number of birds recorded during any of the nearshore boat-based surveys—less than 50 percent of the previously lowest number (Appendix 44B). Oystercatchers were seen during fixed-wing surveys in fall 2004 and spring and fall 2005 (Appendices 44F and 44G), and they were recorded during the helicopter-based surveys on rocky shores in Iliamna and Iniskin bays and in Chinitna Bay in April, May, August, and September of 2006 through 2008 (Table 44-3, Appendices 44H through 44L). They occurred primarily in rockier parts of Iliamna Bay, in the Iniskin Islands, and along the shoreline between Iliamna and Iniskin bays; a few also were seen during helicopter-based surveys at Gull Island, near the mouth of Chinitna Bay, in the spring (Figure 44-45). The behaviors of the Black Oystercatchers during the two summer boat-based surveys suggested breeding in Iliamna Bay, although juveniles were not actually seen. The species is a fairly common resident in the northern Gulf of Alaska (Isleib and Kessel, 1973). Primary concerns for this species include its low world population size (approximately 11,000 birds), its narrow range of habitat use, and its limited breeding range—more than half of all Black Oystercatchers breed only in Alaska, and up to 48 percent of all oystercatchers breeding in the northern Gulf of Alaska breed in only one place, Middleton Island (Gill et al., 2004; ADFG, 2006; Kirchhoff and Padula, 2010), which lies approximately 250 miles (~400 km) to the southeast of the study area. In addition, oystercatchers are extremely susceptible to oil spills, disturbance, and mammalian predators (ASG, 2008; Kirchhoff and Padula, 2010). The Black Oystercatcher is on six of the eight lists of species of conservation concern (Table 44-5).

Marbled Godwit

Marbled Godwits were recorded only during boat-based nearshore surveys and only in spring 2006 (Appendices 44B and 44C). A total of nine birds occurred in two flocks in upper Iniskin Bay (Figure 44-46). The species is extremely rare in Alaska, with a small population of the Beringian relict subspecies *beringiae* migrating through the northern Gulf of Alaska on its way to and from breeding grounds in and near Ugashik Bay, on the northern Alaska Peninsula (Gibson and Kessel, 1989). The total population of this subspecies, which is geographically separate from the main breeding population on the northern Great Plains of central North America, is believed to be very small, on the order of less than 3,000 birds (ASG, 2004). Concerns about this species include the small total world population of the subspecies (populations of only a few other American bird species are smaller, and those are primarily protected under the ESA), the limited nesting distribution of the species, and the lack of information on population trends (ADFG, 2006; AKNHP, 2008; ASG, 2008; Kirchhoff and Padula, 2010). The Marbled Godwit is on six of the eight lists of species of conservation concern (Table 44-5).

Black Turnstone

Black Turnstones were recorded only during nearshore boat-based surveys and only in spring 2005 (48 birds in three flocks) and 2006 (24 birds in three flocks; Appendices 44B and 44C). They occurred

primarily along the outer coasts of the study area—on the Iniskin Islands, on White Gull Island, and on Turtle Reef—with one record in inner Iliamna Bay (Figure 44-46). The species is resident in the northern Gulf of Alaska, being abundant in some locations along the outer coast (Isleib and Kessel, 1973). The major concern for Black Turnstones is that the entire world population nests only in Alaska—primarily along a narrow section of the outer Yukon-Kuskokwim Delta—making the species susceptible to the effects of global sea-level rise (ASG, 2008). In addition, a high percentage of the world population concentrates in Prince William Sound to feed on herring spawn during spring migration (Kirchhoff and Padula, 2010), making the species vulnerable to oil spills. The Black Turnstone is on three of the eight lists of species of conservation concern (Table 44-5).

Surfbird

Surfbirds were recorded only during nearshore boat-based surveys and only in spring 2005, when 18 birds were seen during a nearshore survey (Appendices 44B and 44C). They occurred only on the outer coast—along the bight between Iliamna and Iniskin bays, on White Gull Island, and on Turtle Reef (Figure 44-46). The species is a resident of the northern Gulf of Alaska, migrating in spring primarily with Black Turnstones and Rock Sandpipers (Isleib and Kessel, 1973). There is concern about Surfbirds because 75 percent of the world population nests only in Alaska and because a high percentage of the world population concentrates in Prince William Sound in spring, making the species vulnerable to oil spills (ASG, 2008; Kirchhoff and Padula, 2010). The Surfbird is on three of the eight lists of species of conservation concern (Table 44-5).

Rock Sandpiper

Rock Sandpipers were recorded during nearshore boat-based surveys in early winter 2004 and 2005, late winter 2005, and spring 2005 and 2006 (Appendices 44B and 44C). On the helicopter-based surveys, they were recorded in rockier parts of Iliamna and Iniskin bays and primarily from late October through late January, with a few smaller flocks recorded in March and April 2006 through 2008 (Figure 44-47, Table 44-3, Appendices 44H through 44L). In addition, a few small flocks of unidentified small shorebirds seen on helicopter-based surveys in January and mid-February 2007 (Appendix 44I) probably were of this species, and records of unidentified shorebirds in Chinitna Bay from January to March 2007 (Appendix 44K) probably were of this species. All records suggest a late fall and mid-winter movement into the study area and a smaller late winter-early spring movement back through it. They occurred in a variety of locations and habitats, from the rocky shorelines of the outer coasts and outer parts of Iliamna and Iniskin bays to the extensive mudflats and soft-sediment substrates of the inner bays. The largest flocks were seen inside Iliamna and Iniskin bays (Figure 44-47). The species is a common migrant and winter visitor to the northern Gulf of Alaska. Although it prefers to winter on rocky shores and reefs, it may move onto mudflats within protected bays during the coldest part of the winter (Isleib and Kessel, 1973). Concerns for this species include population declines resulting from habitat alteration on the restricted breeding grounds (islands in the Bering Sea), the small overall population of this subspecies, and the fact that the entire world population of the nominate race (*tilocnemis*) winters in Cook Inlet and, hence, is highly vulnerable to a variety of factors (Gill and Tibbitts, 1999; ASG, 2008; Kirchhoff and Padula, 2010). The Rock Sandpiper is on five of the eight lists of species of conservation concern (Table 44-5).

Dunlin

Dunlins occurred only during nearshore boat-based surveys (Appendices 44B and 44C). They were not recorded in spring 2005, but were recorded in the thousands in spring 2006, suggesting that the peak of shorebird migration had moved through the area prior to the survey in spring 2005. They concentrated primarily on the mudflats in both Iniskin Bay (especially those near the head of the bay) and Iliamna Bay (Figure 44-45). In addition, one flew by the ship in the open bight during offshore surveys in spring 2006. The species is an abundant migrant in the northern Gulf of Alaska, especially in spring, when they commonly migrate with Western Sandpipers (Isleib and Kessel, 1973). Concerns about both Alaska subspecies of Dunlins include their restricted breeding distributions, evidence that both populations are declining, and large-scale loss of wintering habitat, especially in Asia (ASG, 2008; Kirchhoff and Padula, 2010). The Dunlin is on three of the eight lists of species of conservation concern (Table 44-5).

Marbled Murrelet

Marbled Murrelets were seen only during boat-based surveys, being recorded during both nearshore and offshore surveys (Figure 44-44, Appendices 44B through 44C). During nearshore surveys, they were seen during all surveys, except late winter 2006 (but including birds seen only off-transect in summer 2005). During offshore surveys, they were recorded sporadically, being seen during both spring surveys, in summer 2004, and in early winter 2005. During nearshore surveys, they occurred primarily along the outer coasts, but many also were seen within the outer part of Iliamna Bay; during offshore surveys, they occurred in the bight between the two bays, but they also occurred within bays at times. The species is an abundant resident in the northern Gulf of Alaska, although it is rare in winter (Isleib and Kessel, 1973; Day, 2006). Concerns for this species include its listing as a threatened species in the Pacific Northwest and a similar level of protection in western Canada, the great overall loss of old-growth nesting habitat across the species' nesting range, evidence of population declines in Alaska, environmental changes, and fisheries bycatch (ADFG, 2006; Kushlan et al., 2006; AKNHP, 2008; Kirchhoff and Padula, 2010). The Marbled Murrelet is on six of the eight lists of species of conservation concern (Table 44-5).

44.7.1.5 Other Species of Interest

One species, the Harlequin Duck, is not on lists from any of the organizations, but it is included here because it has been considered by the USFWS for listing under the ESA. This species also has been a high-profile species of conservation concern because of the *Exxon Valdez* oil spill and has been subject to hunting restrictions since the 1990s to restrict mortality (Rothe, pers. comm., 2006).

The Harlequin Duck was one of the most common bird species occurring in the study area, especially in nearshore waters (Appendices 44B through 44L)—this species occurred during offshore surveys only once in eight boat-based surveys. These ducks are resident in the study area, although their numbers vary seasonally (Figure 44-48). During nearshore surveys, densities were high in the spring, as birds were preparing to breed, and then declined in the summer, as many birds entered breeding streams and/or migrated out of the area to breed elsewhere; the remaining birds that were summering are presumed to be nonbreeders. Densities were considerably lower in early winter than in summer, suggesting that most Harlequin Ducks summering in this area go elsewhere in the winter. Densities increased slightly in late winter, suggesting that some birds move into this area at that time and/or that spring migration already has begun by mid-March; however, this latter hypothesis is less likely because mid-March would be early

for any spring migration to be occurring and because researchers have not seen Harlequin Ducks migrating elsewhere in the northern Gulf of Alaska in March (R. Day, personal observation).

Harlequin Ducks also exhibited pronounced spatial patterns throughout the annual cycle, as seen on a series of seasonal maps of distribution and abundance during boat-based surveys (Figures 44-49 through 44-52). These patterns reflect a variety of factors, including habitat differences within the study area (rocky shorelines and foraging substrates along the outer coastlines and just inside the bay mouths, and muddy shorelines and foraging substrates farther out in the bays), the reproductive cycle (some birds occur near nesting streams in the spring, even if the marine areas near stream mouths are poor-quality foraging habitat), and perhaps weather-related effects (birds may be forced inside bay mouths to escape severe weather). In the spring, Harlequin Ducks seen during boat-based surveys were widespread throughout the entire study area (Figure 44-49), perhaps as some birds prepared to enter breeding streams. In the summer, densities were low in the bays, with large numbers of nonbreeding birds concentrating along the rocky outer shorelines (Figure 44-50). The highest densities occurred along the bight between Iliamna and Iniskin bays and in the Iniskin Islands, whereas birds were absent within the bays themselves except near their mouths. In early winter, densities were highest along the rocky outer coast and were much lower within the bays (Figure 44-51). The highest densities occurred along the bight between Iliamna and Iniskin bays, in the Iniskin Islands, and off of Knoll Head, and birds were generally absent within the bays, except near their mouths. In late winter, densities were highest along the rocky outer coastlines and inside the bay mouths (Figure 44-52). Similar to the pattern seen in early winter, the highest densities occurred along the bight between Iliamna and Iniskin bays, in the Iniskin Islands, and off Knoll Head, and birds were generally absent within the bays themselves except near their mouths.

A similar pattern of winter distribution is shown in the locations of individual observations of Harlequin Ducks seen during helicopter-based surveys in 2006 through 2008 (Figures 44-53 through 44-55). Similar to the pattern seen during the boat-based surveys, the largest numbers of birds and the greatest numbers of flocks occurred along rocky shorelines bordering the bight between Iliamna and Iniskin bays, in the Iniskin Islands, and to a lesser extent, off of Ursus Head. Small numbers also were seen consistently near the rocky Gull Island, at the mouth of Chinitna Bay. During fall, nearly all observations occurred along the outer coastlines, with a few small flocks occurring along rocky shorelines just inside the bay mouths (Figure 44-53). In mid-winter and late winter-spring, Harlequin Ducks mostly remained along exposed coastlines outside bays, but some also moved to scattered patches of rocky shorelines within bays (Figures 44-54 and 44-55).

Although most birds combined occurred within bays, Harlequin Ducks occurred more often outside Iliamna and Iniskin bays. For all Harlequin Duck counts combined, 91 percent of the birds occurred outside bays, rather than inside those bays (Figure 44-56). A seasonal pattern was evident, with 96 percent occurring outside bays in fall but only 90 percent occurring within bays in mid-winter and in late winter and spring. Across all birds combined, mean group size averaged $9.1 \pm \text{SE } 0.7$ birds (Figure 44-57). Although mean group sizes tended to decrease from fall to late winter and spring, mean group size did not differ significantly among seasons ($F = 1.203$; $df = 2$; $P = 0.301$).

44.7.2 Mammals

44.7.2.1 Survey Results

Boat-based Surveys

During the nearshore surveys, at least five species of mammals were recorded, plus one species was seen only off-transect (Appendices 44B and 44C). During the offshore surveys, five species of mammals were recorded, and none were seen only off-transect (Appendices 44D and 44E). In the first year of the survey (2004/2005), researchers counted 1,124 mammals during nearshore surveys and 71 mammals during offshore surveys. In the second year of the survey (2005/2006), researchers counted 1,171 mammals during nearshore surveys and 61 mammals during offshore surveys.

During nearshore surveys, only one species of mammal (harbor seal) was seen on all eight surveys and another species (sea otter) was recorded on seven of the eight surveys. In contrast, one of the five species was rare (Dall's porpoise), being recorded on only one of the eight surveys, and one other species (gray whale) was recorded only off-transect (Appendices 44B and 44C). The other two species were seen on three (Steller's sea lion) or five (harbor porpoise) of the surveys.

During offshore surveys, no mammal species was seen on more than six of the eight surveys, and only one species (sea otter) was recorded on six surveys. In contrast, one of the six species was rare (Dall's porpoise), being recorded on only one of the eight surveys. No species were recorded only off-transect (Appendices 44D and 44E). The other three species were seen on two (Steller's sea lion), four (harbor seal), or five (harbor porpoise) of the surveys).

Helicopter-based Surveys

At least five species of mammals were recorded in the Iliamna-Iniskin bays area, and three species of mammals were recorded in the Chinitna Bay area, for a total of at least five species on helicopter-based surveys (Table 44-3, Appendices 44A and 44H through 44L). The primary species of mammal that was recorded during the helicopter-based surveys was sea otter, which was one of the focal species for these surveys. Altogether, researchers counted a maximum of 10,140 mammals during 26 survey periods in the vicinity of Iliamna and Iniskin bays and a maximum of 1,242 mammals during 17 survey periods in Chinitna Bay. The maximal number counted on an individual survey in Iliamna and Iniskin bays ranged from eight mammals in mid-October 2006 to 1,501 mammals in late January 2008. The maximal number counted on an individual survey in Chinitna Bay ranged from zero mammals on four dates to 322 mammals in mid-December 2007. Therefore, it appeared that seasonal changes in numbers of mammals in each location did not parallel each other.

In the vicinity of Iliamna and Iniskin bays, one species (sea otter) was recorded on 25 of the 26 surveys, one (harbor seal) was recorded on 21 surveys, and three (Steller's sea lion, beluga, and harbor porpoise) were recorded on fewer than 10 surveys (Appendices 44H through 44J). In Chinitna Bay, one species (harbor seal) was recorded on 14 of the 17 surveys, and two species (sea otter, harbor porpoise) were recorded on fewer than five surveys (Appendices 44K and 44L).

44.7.2.2 Patterns of Distribution and Abundance

Seasonal Patterns

Boat-based Surveys. During nearshore surveys, densities of mammals in the study area were highest in the summer and were lower but highly variable during the other seasons (Figure 44-58). Densities in the summer, which averaged 20 mammals/km² in 2004 and 25 mammals/km² in 2005, consisted almost entirely of harbor seals (Appendices 44B and 44C). Densities in early winter averaged five and 14 mammals/km² in 2004 and 2005, respectively, and were dominated numerically by sea otters that had moved into the area to winter and by harbor seals, some of which appear to be resident. Densities in late winter were variable, averaging eight and three mammals/km² in 2005 and 2006, respectively. Lower densities in late winter 2006 were probably because of the extensive ice cover in the bays in the study area at that time; sea otters still were present, although in considerably lower numbers than in 2005, but harbor seals essentially had abandoned the study area (Appendices 44B and 44C). Densities in spring 2005 (seven mammals/km²) were lower than those in late winter 2005, but densities in spring 2006 (eight mammals/km²) were higher than those in late winter 2006. In both years, however, densities were considerably lower in the spring than in the summer. During the spring surveys, sea otters had abandoned the area for the summer, and harbor seals were moving back into the area.

During offshore surveys, densities of mammals in the study area were highest in early and late winter and were considerably lower in the spring and summer; densities also were at least an order of magnitude lower than those during nearshore surveys (Figure 44-58). Densities in early winter averaged 2.0 mammals/km² in 2004 and 1.8 mammals/km² in 2005 and consisted almost entirely of sea otters (Appendices 44D and 44E). Densities in late winter averaged 2.9 and 1.5 mammals/km² in 2005 and 2006, respectively, again consisting almost entirely of sea otters. Densities in the spring averaged 0.4 and 0.5 mammals/km² in 2005 and 2006, respectively, and consisted of a mixture of Steller's sea lions, harbor seals, harbor porpoises, and late-leaving sea otters. Densities in the summer averaged 0.1 and 0.6 mammals/km² in 2005 and 2006, respectively, and consisted almost entirely of harbor seals.

Helicopter-based Surveys. Numbers of mammals in and near Iliamna and Iniskin bays exhibited substantial variability among surveys in 2006 through 2008 (Figure 44-59, Table 44-3, Appendices 44H through 44J). Because the focal species for these surveys was the sea otter, variations in the numbers of that species had the greatest effect on total numbers, with harbor seals having the second-greatest effect. In 2006, overall numbers decreased from February through April and increased from October through December. In 2007, overall numbers increased from January to late March before declining abruptly in April, were high in August and early September (primarily seals) before declining from then through late October, and increased again in November and December as otters entered the area. In 2008, overall numbers peaked in January, then generally declined until the final survey in mid-April; numbers again were low in March, because of cold weather that forced most animals from the area. The most marine mammals recorded on a single survey in and near Iliamna and Iniskin bays (1,501 animals) were seen in late January 2008. Numbers seemed more stable from October to December but seemed more variable from January to April, presumably because of irregularly inclement weather that forced animals from the study area in the latter period.

Numbers of mammals in Chinitna Bay in 2007 and 2008 also exhibited substantial variability among surveys; however, no surveys were conducted in 2006 (Figure 44-60, Table 44-3, Appendices 44K and 44L). In 2007, numbers of mammals were low from January through May, and mammals were recorded

on only three of the six surveys conducted during that period; however, numbers increased by an order of magnitude from August through December. In 2008, numbers were extremely low in February and early March, peaked in late March and April, and then declined dramatically in late April; further, mammals were extremely rare on the early-March survey, similar to the extremely low number seen in Iliamna and Iniskin bays at the same time (Figure 44-59) The most marine mammals recorded during a single survey in Chinitna Bay (322 mammals) were seen in mid-December 2007.

Interannual Patterns

Boat-based Surveys. During nearshore surveys, both numbers and densities of mammals varied interannually, although the patterns were not consistent and the differences were not statistically significant (Figure 44-58, Appendices 44B and 44C). In three of the four seasons (all except late winter), mean densities were lower in 2004/2005 than in 2005/2006. In all cases, however, standard errors overlapped, indicating no statistical difference in estimated densities.

During offshore surveys, both numbers and densities of mammals again varied interannually, although the patterns again were not consistent (Figure 44-58, Appendices 44D and 44E). Mean densities in early winter and late winter were higher in 2004/2005 than in 2005/2006, whereas mean densities in spring and summer were higher in 2005/2006 than in 2004/2005. In most cases, however, standard errors overlapped, indicating no statistical difference in estimated densities.

Helicopter-based Surveys. During the helicopter-based surveys in Iliamna and Iniskin bays, numbers of mammals were higher on one survey conducted in April 2006 than on a survey that occurred on a similar date in 2007 but were higher in 2007 than 2006 on two surveys in the fall; numbers also were higher in 2007 than 2008 on two of four surveys but were lower in 2007 than 2008 on the other two (Figure 44-59). Therefore, no clear, consistent pattern in interannual abundance was evident.

During the helicopter-based surveys in Chinitna Bay, interannual comparisons are possible only for the period February through April (Figure 44-60). Numbers of mammals were higher in 2007 than 2008 on two of four surveys and higher in 2008 on the other two. Therefore, no clear, consistent pattern in interannual abundance was evident.

Taxonomic Patterns

Boat-based Surveys. Five mammal species were recorded during nearshore boat-based surveys in both 2004/2005 and 2005/2006, plus one gray whale was seen off-transect in summer 2004 (Appendices 44B and 44C); during offshore surveys, five species were recorded in 2004/2005, and four species were recorded in 2005/2006 (Appendices 44D and 44E). The total number of mammal species seen was small, and species richness varied seasonally (Figure 44-61). During nearshore surveys, species richness was highest in spring, with up to five species recorded each year. Richness was lowest in summer (one to two species), then increased slightly in early winter (three species) and late winter (two to three species). During offshore surveys, more variability occurred among seasons and years, with the highest number of species, four, seen in spring 2005, but only two species seen in spring 2006; richness generally was lowest in summer (two species), but was more variable in the winter surveys (one to three species each for both early and late winter). In general, no consistent interannual patterns in richness were seen for either the nearshore or offshore surveys.

Species composition varied substantially among seasons and between survey areas and years, although the mammalian fauna consisted primarily of two species: harbor seals and sea otters (Figure 44-62). During nearshore surveys, harbor seals dominated numerically during all spring and summer surveys (86 to 100 percent of all mammals), whereas their importance declined during the four winter surveys (3 to 62 percent of all mammals) as sea otters (36 to 97 percent of all mammals) entered the area to overwinter and as many of the seals left the area. All other species combined composed a minor percentage of the total mammals. During offshore surveys, a diversity of mammal species was seen during the four spring and summer surveys, whereas the four winter surveys found primarily or entirely sea otters (54 to 100 percent of all mammals) and a small percentage of other species, primarily harbor seals (0 to 41 percent of all mammals). All five species (sea otters, Steller's sea lions, harbor seals, and harbor and Dall's porpoises) were recorded during both seasons, but the lower number of all marine mammals recorded in the summer made species dominance seem more even, whereas the numerical predominance of sea otters in the winter reduced the relative proportions of the other species.

Helicopter-based Surveys. Species richness of mammals seen during helicopter-based surveys in Iliamna and Iniskin bays was similar among seasons and between years (Figure 44-63). Between one and four species of marine mammal were recorded on each survey, with peak numbers of species occurring in early April 2008. Because the focal species for these surveys was the sea otter, that species composed 75 percent of all marine mammals for all surveys combined (Figure 44-64). Harbor seals were abundant in Iliamna and Iniskin bays, composing 25 percent of all marine mammals. In contrast, Steller's sea lions, belugas, and harbor porpoises were recorded in trace numbers.

Species richness of marine mammals in Chinitna Bay (Figure 44-65) was lower than in Iliamna and Iniskin bays (Figure 44-63), with a total of three species recorded and a maximum of two species seen on any individual survey. Harbor seals were the most abundant species, composing more than 98 percent of all marine mammals for all surveys combined (Figure 44-66); apparently, this area is too far north, too icy, and/or too cold for many sea otters to visit in winter. Sea otters were seen in April, May, October, and November and composed less than 2 percent of all mammals. In addition, two harbor porpoises were recorded on the December survey.

Spatial Patterns

Boat-based Surveys. Mean densities of mammals exhibited distinct spatial patterns during each season. In the spring, most mammals were concentrated in the nearshore zone, especially on and near islands near the mouths of the bays; few were recorded during offshore surveys (Figure 44-67; note that in the map-based figures showing spatial distribution during boat-based surveys, the data for both years and for nearshore and offshore surveys are pooled for each season to show an average spatial pattern). This springtime spatial pattern reflects primarily harbor seals, which concentrated on and near the islands near and off the mouths of Iliamna and Iniskin bays. The survey was too early for pupping to have occurred, however (Pitcher and Calkins, 1983). Steller's sea lions also hauled out on these islands, and some seals also hauled out on the mudflats in Iniskin Bay.

In the summer, most mammals were again concentrated in the nearshore zone, with very few recorded in the offshore zone (Figure 44-68). Densities were high on the islands near the mouths of the bays, and to a lesser extent, along the outer coasts and on the mudflats in Iniskin Bay. A substantial number of the seals hauled out on the islands off the mouths of the bays were caring for pups, although it was impossible to determine exact percentages from boats.

In early winter, most mammals were concentrated in the nearshore zone near the mouths of the bays; however, small but regular numbers of mammals (primarily sea otters) also were seen throughout most of the offshore zone (Figure 44-69). The highest concentration of mammals occurred near White Gull Island, which lies near the mouth of Iliamna Bay.

In late winter, most mammals again were concentrated in the nearshore zone near the mouths of the bays; however, small but regular numbers of mammals (primarily sea otters) also were seen throughout most of the offshore zone (Figure 44-70), similar to the pattern seen for early winter. Numbers within the bays tended to be small, primarily because of the extensive ice cover at the time. The highest densities occurred on the Iniskin Islands.

Helicopter-based Surveys. Maps showing the overall distribution and abundance of all mammals combined are not shown or discussed here for two main reasons. First, the primary mammal species seen on these surveys were the sea otter and harbor seal, which are discussed separately below. Second, the other species are rare enough to be discussed separately below, and maps of their distribution and abundance accompany the pertinent text.

44.7.2.3 Species of Conservation Concern

Five of the eight species of mammals that either were recorded during the surveys or almost certainly occur in this area are classified as being of conservation concern (Table 44-6). One of the five species is a mustelid (sea otter), two are pinnipeds (Steller's sea lion, harbor seal), and two are cetaceans (gray whale, beluga). Some of these species are listed as threatened or endangered under the ESA (see Chapter 45 for further discussion of threatened and endangered species).

Sea Otter

Sea otters were one of the two most common mammal species observed in the study area. They were recorded during both boat-based and helicopter-based surveys. During boat-based surveys, they occurred in the study area primarily in the winter (Figure 44-71), with only scattered animals seen in spring and summer. During nearshore surveys, mean densities were only 0 to 0.15 mammals/km² in spring and summer. With the influx of otters into the study area to overwinter, mean densities increased to .4 to 9.8 mammals/km² in early winter. Sea otters apparently began moving out of the study area by March, as indicated by the decline in densities to 2.6 to 3.2 mammals/km² during late winter; alternatively, they may have temporarily left the area because the bays became frozen. A similar pattern was seen during offshore surveys, with almost no otters present in the summer and higher densities in the winter. Average densities were only 0 to 0.1 mammals/km² in spring and summer. Again, densities increased dramatically in early winter, when mean densities of 1.4 to 2.0 mammals/km² were recorded. Surprisingly, however, densities were higher in late winter 2005 (2.9 mammals/km²) but were much lower in late winter 2006 (0.8 mammals/km²), with the latter decline probably reflecting the presence of extensive sea ice in the bays.

The boat-based surveys also indicated that sea otters exhibited pronounced spatial patterns throughout the annual cycle as well (Figures 44-72 through 44-74). These patterns reflected a variety of factors, including habitat differences within the study area (rocky shorelines and foraging substrates along the outer coastlines and just inside the bay mouths, and muddy shorelines and foraging substrates farther inside the bays), seasonal patterns of movement, and perhaps weather-related effects (otters may enter bay mouths to escape severe weather). In the spring and summer, sea otters occurred primarily as scattered

individual animals, both during nearshore and offshore surveys; the one exception was around White Gull Island and Black Reef, where several otters congregated in both seasons (Figure 44-72). In early winter, otters had moved into the area to overwinter. They were widely distributed along the outer coasts and in offshore areas, with the highest densities again occurring near White Gull Island and Black Reef. Otters were scarce within Iniskin Bay, although a few were recorded in Iliamna Bay (Figure 44-73). In late winter, otters were found along the outer coasts or just inside the bays, occurred widely in offshore waters, and occurred in the highest densities near the Iniskin Islands (Figure 44-74).

Seasonal patterns of sea otter abundance were similar between helicopter-based surveys and boat-based surveys. Sea otters occurred in Iliamna and Iniskin bays from the fall to the spring but occurred there primarily in the winter (Figure 44-75, Appendices 44H through 44J). During helicopter-based surveys, counts were only 0 to 50 otters from May through October. With the influx of otters into the study area to overwinter starting in November, counts increased to a high of 1,433 otters in late January 2008. They apparently began moving out of the study area by late March, although they remained in the area in numbers (more than 100 animals) until mid-April in 2 of the 3 years. Numbers of sea otters were so variable that no interannual trends were apparent, and cold snaps in March often caused otters to leave the area for short periods. Chinitna Bay, which is marginally used by sea otters at all times, had a maximum of 12 otters in November 2007 but no otters most of the time (Appendices 44K and 44L).

A similar pattern of overwinter distribution is shown in the locations of individual observations of sea otters seen during helicopter-based surveys in 2006 and 2007 (Figures 44-76 through 44-78). In fall, otters concentrated near the Iniskin Islands, with almost none recorded within the bays; a few otters also were seen in Chinitna Bay (Figure 44-76). In mid-winter (November through February), otters increased in overall abundance (Figure 44-75) and were distributed in the Iniskin Islands in particular and throughout Iliamna and Iniskin bays, with additional concentrations in and near Right Arm of Iniskin Bay and in and near White Gull Island of Iliamna Bay (Figure 44-77). Only a few were seen in Chinitna Bay, and only in November, suggesting that heavy ice and/or cold temperatures in December-April prevented otters from overwintering there. In late winter and spring, otters again concentrated along the outer coasts—especially near the Iniskin Islands and, to a lesser extent, near White Gull Island—and there was a suggestion of a southward movement off Ursus Head; one small concentration also occurred in the upper end of Iniskin Bay in late winter, and a few late-departing otters also were seen in Chinitna Bay in April and May (Figure 44-78).

As might be expected from the previous discussion, most sea otters occurred outside of Iliamna and Iniskin bays, rather than inside them, at all times, with 14 percent occurring within bays and 84 percent occurring outside them (Figure 44-79). The proportion occurring within bays increased from fall (16 percent) to mid-winter (19 percent), presumably as the weather in open Kamishak Bay deteriorated, then dropped to only 9 percent in late winter-spring, as otters began moving southward in Kamishak Bay to summer there. The overall mean group size of sea otters was $17.4 \pm \text{SE } 1.9$ otters, although mean group sizes showed a pronounced seasonal pattern: mean group sizes were small (1.7 ± 0.3 otters) in the fall, as animals drifted into the area, increased dramatically as they concentrated in the area in mid-winter (21.4 ± 3.0 otters), and then dropped slightly (15.0 ± 2.6 otters) in late winter-spring (Figure 44-80). The ANOVA indicated that there was a significant difference in mean group size ($F = 4.310$; $df = 2$; $P = 0.014$), with fall significantly smaller than mid-winter but with no other seasonal comparisons being different.

A fairly similar pattern is seen in data recorded by Larned (2006a) during aerial surveys (Appendices 44N through 44P). His surveys extended farther offshore than the helicopter-based surveys did, and his locations were of groups directly on his survey line, causing the apparent linear pattern of distribution. Otters clearly concentrated in and near the Iniskin Islands and extended far offshore, beyond the area covered by the helicopter-based surveys. Surprisingly, however, Larned recorded fewer large groups than the helicopter surveys did, and the concentration of otters within bays in mid-winter recorded by Larned was not as pronounced as that seen in the helicopter surveys.

The ADF&G late-winter and spring (April-early June) surveys for spawning herring in and near Iliamna and Iniskin bays also recorded sea otters (Appendix 44Q); however, those surveys did not extend to Chinitna Bay. At that time of the year, few otters were recorded in the study area, and those that were present were concentrated in the Iniskin Islands. Surprisingly, ADF&G researchers also saw many otters in Oil Bay, east of the study area; however, casual examination of this bay during several helicopter-based surveys for the Pebble Project suggested little use of the area.

The sea otter is a threatened species under the ESA and is a depleted stock under MMPA; management of this species falls under the USFWS. This species occurs on three of the five lists, primarily because of population declines in the Southwestern Alaska Population Segment.

Steller's Sea Lion

During boat-based surveys, Steller's sea lions were rare within the study area, with only a few animals being recorded from spring to fall (Appendices 44B through 44E). During nearshore boat-based surveys, mean densities were 0.48 and 0.05 mammals/km² in spring 2005 and 2006, respectively (Figure 44-81); however, no Steller's sea lions were recorded during any other nearshore surveys. During offshore boat-based surveys, Steller's sea lions were recorded in spring 2005 (mean density of 0.15 mammals/km²) and summer 2005 (mean density of 0.07 mammals/km²); no Steller's sea lions were recorded during any other offshore surveys. During helicopter-based surveys, Steller's sea lions were recorded in November, January, March, and April of 2007 and 2008 (Table 44-3, Appendices 44H through 44L). Across the boat-based and helicopter-based data combined, most sea lions were recorded in March (7 animals), April (37 animals), and May (8 animals), with smaller numbers recorded in June (2+, including an off-transect record), November (3 animals), and January (1 animal). The concentration of sea lions from March to May, especially in April, suggests that they congregate in this area in the spring to eat Pacific herring (*Clupea harengus*) that sometimes spawn here in large numbers.

The few records of Steller's sea lions show few pronounced spatial patterns other than that they consistently occurred in the Iniskin Islands (Figure 44-82). In offshore waters, Steller's sea lions occurred in the open bight between Iliamna and Iniskin bays. Historical data from ADF&G aerial herring surveys in the spring suggest a long-standing preference for the Iniskin Islands by sea lions, with smaller numbers of animals scattered elsewhere throughout the study area (Appendix 44R).

The Steller's sea lion is protected as endangered species under the ESA and is a depleted stock under the MMPA; management of this species falls under the NMFS. This species occurred on three of the five lists, primarily because of population declines in the Western Population.

Harbor Seal

Harbor seals were the most common marine mammal species in the study area. They are a species of concern because of population declines in some parts of the Gulf of Alaska and because they are extremely sensitive to disturbance when they haul out on shorelines (e.g., during pupping, the molt). However, populations have not declined enough for them to be classified as having a depleted population to be protected under the ESA.

They were recorded during boat-based, fixed-wing, and helicopter-based surveys. During helicopter-based surveys, researchers recorded them but avoided them to minimize disturbance; therefore, those counts are incomplete at best. Similar to the patterns seen on boat-based surveys and fixed-wing surveys, historical data from ADF&G suggest that harbor seals concentrate in the Iniskin Islands and White Gull Island and on the mudflats in upper Iniskin Bay (Appendix 44S), in areas where they still concentrate today.

Boat-based Surveys. During boat-based surveys, harbor seals occurred primarily in nearshore waters, where mean densities were more than an order of magnitude greater than they were in offshore waters (Figure 44-83). During nearshore surveys, they were present primarily in the summer (mean densities of 20 to 25 mammals/km²), occurred in lower densities in the spring (five to six mammals/km²), and occurred in much lower densities in both early winter (one to four mammals/km²) and late winter (fewer than one to five mammals/km²). The near absence of this species during nearshore surveys in late winter 2006 probably reflected the presence of abundant ice in the bays. During offshore surveys, harbor seals occurred during spring surveys in both years (mean densities of 0.1 to 0.2 mammals/km²) but occurred during only 2005/2006 surveys for summer (0.5 mammals/km²), early winter (0.1 mammals/km²), and late winter (0.6 mammals/km²).

Harbor seals also exhibited pronounced spatial patterns throughout the annual cycle (Figures 44-84 through 44-87). These patterns reflect a variety of factors, including habitat differences within the study area (rocky shorelines along the outer coastlines and just inside the bay mouths, and muddy shorelines farther inside the bays), seasonal patterns of movement, and perhaps weather-related effects on haulout behavior. In spring, harbor seals occurred almost entirely in nearshore waters, with only one recorded in offshore waters (Figure 44-84); they occurred throughout the entire bay system (primarily in the water), but hauled out primarily in the Iniskin Islands. The only other place where seals commonly hauled out was on the mudflats in upper Iniskin Bay. In the summer, seals hauled out primarily on the islands near the mouths of the bays and secondarily on the mudflats in upper Iniskin Bay. Other seals seen in the bays were in the water, and few seals were seen in offshore waters (Figure 44-85). In early winter, few seals were seen during offshore surveys, and those seals that were seen during nearshore surveys were concentrated within the bays, especially on mudflats in upper Iniskin Bay (Figure 44-86). In late winter, few seals were seen during offshore surveys, and the few seals that were seen during nearshore surveys were mostly concentrated on the Iniskin Islands (Figure 44-87). Few seals were seen within the bays, probably because of the ice that was common at that time.

Fixed-wing Surveys. Counts of harbor seals from complete surveys in 2005 varied from 249 to 1,161 animals (Table 44-7). The highest counts occurred between July 21 and August 11; more than 1,000 harbor seals were counted during all four surveys conducted during that time. During 2007, counts varied from 225 to 1,410 animals (Table 44-7), with counts of more than 1,000 on all four surveys between July 27 and August 16. During 2008, counts ranged from 876 to 1,281 animals, with three counts of more

than 1,000 animals occurring on three successive days during pupping in June and more than 1,100 animals during all three complete surveys in August. The maximal count of seals on any survey was 1,410 on August 16, 2007 (Table 44-7).

Most seals were recorded on the Iniskin Islands, but there was some seasonal variation among strata, especially with respect to the increased numbers hauled out on Gull Island in Chinitna Bay in fall 2005 and 2007 (Figures 44-88 through 44-90, Table 44-7). Little seasonal variation was identified in the specific haulout locations that were used, although seals tended to be more dispersed during pupping and a few small haulouts were not used later in the year (Figures 44-91 through 44-93). Although there was variation among individual surveys, most haulout locations were used in similar proportions in all seasons.

The number of pups observed during three pupping surveys conducted June 19 through 21, 2008, ranged from 221 to 245, and the pup ratio ranged from 24.5 to 28.0 pups to 100 adults (Table 44-8). The highest number of pups occurred in the Iniskin Islands, whereas the highest pup ratio was in Iliamna Bay, and the lowest pup ratio was in the Iniskin Islands, indicating that the latter haulouts were used by a large proportion of non-maternal animals.

For the molting-season counts conducted in July and August of the 3 years, the best model explaining the survey results (based on AIC_c) included only Time from Midday ($w_i = 0.43$); the model with Time from Midday and Tide Height was the second-best model ($w_i = 0.18$); and the third-best model was the Intercept Only model ($w_i = 0.14$; Table 44-9). The model with Time from Midday and Relative Tide Height was the fourth-best model ($w_i = 0.12$). All other models had low levels of support ($w_i \leq 0.04$). The sum of Akaike Weights indicates that chances of being the best model were 77 percent for Time from Midday, 27 percent for Tide Height, and 20 percent for Relative Tide Height.

When the observed counts for July and August were adjusted only for the effects of Time from Midday (adjusted to solar midday) but not for Julian date, the estimated numbers of seals hauled out were 832 to 1,176 seals in 2005, 422 to 1,487 seals in 2007, and 998 to 1,382 seals in 2008 (Table 44-10). The highest adjusted counts in each year occurred on July 26, 2005, August 16, 2007, and August 4, 2008. The analysis of total observed count and date (Figure 44-94) provided estimates for peak haulout dates of July 29, August 11, and August 10 for 2005, 2007, and 2008, respectively.

The peak observed count of harbor seals in all 3 years was 1,410 animals on August 16, 2007. This survey was conducted 5 days after the estimated peak date in 2007 (August 11) and 2.6 hours before solar midday. After correcting for Julian date and time of day, an estimated $1,515 \pm SE 63$ harbor seals would have been hauled out under ideal conditions (just after midday on August 11). After applying the correction factor and associated variance for the number of seals not hauled out, the estimated total number present was $1,841 \pm 96$ seals, with a 95 percent CI of 1,652 to 2,029 seals.

In contrast to some other studies of harbor seal haulouts (e.g., Frost et al., 1999; Boveng et al., 2003), the Pebble marine wildlife surveys were conducted throughout much of the year (excluding winter). The number of seals hauling out varied substantially throughout the year, with seasonal peaks occurring during pupping in spring and during the molt in late summer. This seasonal effect of date was by far the largest source of variation in study counts, similar to the findings of MMS-sponsored studies of the distribution and movements of harbor seals in Cook Inlet. In those studies, Boveng et al. (2007) reported that the number of seals using haulouts in October and April were only about 35 percent of the number

using haulouts in June and August; satellite-tagged seals spent much less time ashore in fall and winter than in summer.

Peak numbers of harbor seals hauled out in the study area occurred between about July 29 and August 11 in the 3 years of study. This range of dates is consistent with that estimated by other studies in southcentral Alaska. Frost et al. (1999) estimated that peak haulout numbers in Prince William Sound occurred before the start of their surveys on August 15, and Frost et al. (2001) found that the amount of time harbor seals spent out of the water decreased more than 30 percent between July and September, implying that seals were spending less time out of the water after July. Boveng et al. (2003) estimated that harbor seal numbers at haulouts in lower Cook Inlet had peaked slightly earlier than the start of their surveys on August 12. Small et al. (2003) estimated that haulout numbers peaked prior to mid-August surveys in Kodiak and Sitka, peaked around August 22 in Ketchikan, and were nearly constant from August 13 to 28 in Bristol Bay. In contrast, the number of harbor seals hauled out near the Bering Glacier peaked in September, probably having been delayed to coincide with local salmon spawning (Savarese, 2004). Bennett (1996) found that the number of harbor seals hauled out near Lake Clark National Park and Preserve (including Chinitna Bay) peaked in July; he reported that the number in Chinitna Bay was fairly consistent from May through September and that the highest survey count (90) occurred in September. Boveng et al. (2003) also found an effect of time of day on seal numbers but estimated that the peak extended from about 10:00 to 15:00 local time. Jemison et al. (2006) also found that haulout numbers peaked near midday for harbor seals on Tugidak Island, in the Gulf of Alaska, and on Nanvak Island, in Bristol Bay. Cunningham et al. (2009) found a strong increase in the probability of hauling-out near midday in May through July for harbor seals in Scotland, but no data were available for August.

Unlike in some other studies, the effects of tide-related variables on the Pebble survey counts were not strong. This lack of tidal effects may result from the fact that seasonal patterns (date) overwhelmed all other sources of variation in these data. The models included Julian date as a quadratic term to remove this source of variation, but this approach was only an approximate solution, and much unexplained variation remained. Surveys were conducted near low tide to reduce the effect of tide on the counts because most previous studies had demonstrated the importance of this variable; therefore, it was difficult to detect changes in number caused by relative tide height.

Although population estimates based on covariate-adjusted counts include a large amount of uncertainty, the survey conducted on August 16, 2007, during which the maximal observed count was recorded, was conducted during good conditions (at low tide near the period of peak haulout and 2.6 hours before midday). This survey count of 1,410 harbor seals provides a minimal count for the number of harbor seals using the survey area at any one time. Although the number of seals observed at haulouts varied throughout the year, even after adjusting for time of day, it is not possible without radio-telemetry to determine how much of the change in numbers is due to changes in total numbers in the area and how much is due to changing proportions hauling out. Lowry et al. (2001) found that 27 (55 percent) of 49 harbor seals in Prince William Sound stayed near their tagging location, but juveniles had less fidelity to a specific site than adults did. Bennett (1996) observed no harbor seals hauled out in Lake Clark National Park and Preserve during the winter, suggesting that harbor seals are not present in that area during the winter, and the Pebble marine wildlife study recorded them during helicopters surveys only as early as the first half of March, also suggesting little use of the area in winter. Boveng et al. (2005b, 2007) found that some satellite-tagged seals in their study moved from western Cook Inlet into Shelikof Strait and the Gulf

of Alaska (around the Kodiak Archipelago) between June 2003 and October 2006, whereas others remained near their capture locations.

Bennett (1996) counted a maximum of 90 harbor seals hauled out along tidal channels in inner Chinitna Bay during aerial surveys conducted from 1994 through 1996. In contrast, 400 harbor seals were hauled out on Gull Island in Chinitna Bay in 1976 (Calkins, 1979). Bennett (1996) reported that two long-time Chinitna Bay residents felt that there had been a major decline in harbor seals in Chinitna Bay. In the Pebble marine wildlife study, peak counts on Gull Island were 400 seals in 2005, 421 in 2007, and 218 in 2008 (no September surveys were conducted in 2008), and the average for all surveys was 105, suggesting that the evidence for a population decline there was equivocal. It is not clear, however, whether Bennett (1996) included Gull Island in his surveys.

Population trends of harbor seals in the northern Gulf of Alaska have varied among locations. Small et al. (2003) found that harbor seal populations increased between 1993 and 2001 in Kodiak but were stable or declined in Bristol Bay from 1998 to 2001. Frost et al. (1999) reported that the harbor seal population in Prince William Sound declined between 1990 and 1997. Jemison et al. (2006) reported that harbor seal populations at Tugidak Island, near Kodiak Island, declined between 1976 and the 1980s but increased between 1994 and 2000. The total population estimate from the Pebble marine wildlife study was lowest in 2005 and highest in 2007, suggesting that the local population was either stable or increasing during the period 2005 through 2008. Boveng et al. (2003) estimated a total population of $5,268 \pm \text{SE } 456$ harbor seals along the west coast of Cook Inlet during August 25 to September 2, 1996. The maximal count of 1,410 harbor seals in the Pebble study area represented approximately 27 percent of that total, whereas the total adjusted peak estimate, after correcting for both Julian date and time of day (1,840 seals), represents approximately 35 percent of that total. Harbor seals occurred on three of the five lists (Table 44-6).

Beluga

Belugas were recorded in the study area only rarely. Belugas were recorded during helicopter-based and fixed-wing surveys in fall 2007, when groups of up to 12 whales were seen in Iliamna, Iniskin, and Chinitna bays and near the Iniskin Islands (Figure 44-95). This species was recorded at least three times in the study area in 2007 by other observers. In September 2007, ADF&G personnel recorded 25 to 30 belugas (including young animals) in inner Chinitna Bay (Baird, pers. comm., 2007), and 12 belugas were seen in upper Iniskin Bay (Faulkner, pers. comm., 2007). In addition, Jon Houghton (pers. comm., 2008) of Pentec Environmental recorded two belugas along the eastern shore of Iliamna Bay in October 2008. The species should be considered rare in this area, however, because it was recorded on only two out of eight boat-based surveys, 20 fixed-wing bird surveys, 45 fixed-wing seal surveys, and 28 helicopter-based surveys over five years of data collection in this study.

Three other studies have recorded belugas in the area of Iniskin and Iliamna bays, which confirms its suitability as habitat for belugas. First, during the annual NMFS survey for belugas in Cook Inlet, a small group of two belugas was seen in Iniskin Bay on June 4, 1994 (Rugh et al., 2000a). Second, Loren Buck (pers. comm., 2005), a marine ecologist from Kodiak, recorded 12 to 15 belugas off the mouth of Iniskin Bay while he was flying herring surveys in lower Cook Inlet on March 26 through April 1, 1997. He did not see them enter the bay, and he did not see any belugas in the vicinity of Iniskin or Iliamna bays during aerial surveys in the same area in 1992. Finally, sporadic observations of belugas were reported during the ADF&G herring surveys conducted from 1978 through 2002 (Appendix 44T). Those data suggest that belugas historically occurred primarily in Iniskin Bay, with only a few individuals seen in Iliamna Bay;

no data were collected in Chinitna Bay. The nine records of belugas on those surveys occurred in 1983 (one record), 1986 (two), 1987 (one), 1994 (three), and 1996 (two).

A recent analysis of habitat use by belugas in Cook Inlet (Goetz et al., 2007) examined the importance of three environmental variables—bathymetry, mudflats, and flow accumulation values from rivers and streams—on the distribution and abundance of belugas, based on observed use by the existing small population. The researchers used that information to map suitable habitats in the entire inlet. In the study area, Iniskin Bay may offer the most suitable habitats for belugas because of the combination of large mudflats and higher flow-accumulation rates. Not all suitable habitats in Cook Inlet are being used now, especially in the lower inlet, since the population has declined (see Section 44.4.2.4); hence, the study area may be occupied more frequently if the population recovers to former levels.

The beluga is protected as an endangered species under the ESA and is a depleted stock under the MMPA; management of this species falls under the NMFS. This species occurred on three of the five lists, primarily because of population declines, and lack of recovery after protection of the Cook Inlet Population.

Gray Whale

A single gray whale was seen near the mouth of Iniskin Bay on June 23, 2004, during the marine wildlife surveys. This species formerly was classified as an endangered species, but its population has since recovered completely. Therefore, it is now classified as a delisted species under the ESA, although it remains protected under the MMPA; management falls under the NMFS. This species occurred on three of the five lists, primarily because of the former ESA listing and because some organizations consider it vulnerable and in need of conservation efforts

44.7.2.4 Other Species of Interest

There were two records of Dall's porpoises during boat-based surveys and more than 20 records of harbor porpoises during boat-based, fixed-wing, and helicopter-based surveys combined. Similar to the concentration of sea lion records in the late winter and spring, most harbor porpoises were recorded during the same period (Figure 44-96). Porpoises were seen in all three bays in the study area as well as offshore, but they were most common near the mouths of Iliamna and Iniskin bays. The fourth species was a common minke whale recorded near the mouth of Iliamna Bay in the summer of 2006 by researchers conducting another Pebble study (Houghton, pers. comm., 2006); the species was not recorded on any marine wildlife surveys that are the subject of this chapter.

44.8 Summary

At least 69 species of birds occur within the Cook Inlet marine study area. The greatest species richness occurs in spring, when large numbers of birds, especially shorebirds, are migrating through the area. Species richness then declines and is at its lowest in mid- or late winter. In general, the avifauna of this area is dominated numerically by waterfowl, seabirds, and (in spring) shorebirds. The greatest density of birds occurs in spring, with large numbers of waterfowl migrating through the area in both spring and fall. There also is a substantial community of wintering birds that consists primarily of seaducks. In general, the highest densities of birds in spring and summer occur in nearshore waters and near the mouths of the bays, whereas the highest densities in the winter occur within the bays and especially in offshore waters

within bays. Fixed-wing surveys also indicated that large numbers of shorebirds stage in Chinitna Bay in spring. Approximately 10 species of birds other than raptors nested in the study area; however, numbers of nesting birds, especially Tufted Puffins, clearly have declined since the 1970s. Nineteen species of birds that are classified as being of conservation concern were recorded during the marine wildlife surveys or occur in this area. One (Steller's Eider) is protected as a threatened species under the federal ESA. In addition, one species (Kittlitz's Murrelet) not recorded in these studies, but possibly occurring in this area due to suitable habitat and general species distribution, is classified as a candidate species under the ESA. Steller's Eiders concentrated in winter primarily in outer Iniskin Bay, although large flocks also occurred in the center of Iliamna Bay at times.

At least eight species of mammals occur within the Cook Inlet marine study area. The greatest species richness occurs in the spring, when the mammalian community is changing from a wintering community to a summering one. Species richness then declines to lower, but variable, numbers of species in late winter. The mammalian fauna is dominated by two species, harbor seals, which dominate numerically in spring and summer, and sea otters, which dominate numerically in winter. Densities of mammals during nearshore surveys were highest in summer and lower but highly variable during other seasons, whereas densities during offshore surveys were highest in winter. In summer, most mammals concentrated in the nearshore zone, with densities being high on the islands near the mouths of the bays, and to a lesser extent, along the outer coasts and on the mudflats in Iniskin Bay. The animals that numerically dominated in the area in the summer were primarily harbor seals, especially for pupping and molting. In winter, most mammals concentrated in the nearshore zone near the mouths of the bays, with small, but regular, numbers (of primarily sea otters) also seen throughout the offshore zone; sea otters also concentrated within the bays at times, especially in mid- and late winter. Five of the mammal species recorded in the study area are classified as being of conservation concern. Of these species, two (Steller's sea lion and beluga) are protected as an endangered species under the ESA, one (sea otter) is protected as a threatened species under the ESA, one (gray whale) is classified as a delisted species under the ESA, and one (harbor seal) is of conservation concern because of population declines in some parts of the Gulf of Alaska. The maximal count of harbor seals at haulouts during fixed-wing surveys showed that at least 1,410 seals occurred in the study area; after adjusting for both Julian date and time of day, an estimated 1,840 seals occurred in the study area. These numbers are approximately 27 to 35 percent of the total number of harbor seals estimated by NMFS to occur in western Cook Inlet. Belugas were recorded during surveys for this study in only one of five years (only 3 of more than 100 surveys) and were seen once by other observers in 2008.

44.9 References

- Agler, B.A., S.J. Kendall, P.E. Seiser, and D.B. Irons. 1995. Estimates of marine bird and sea otter abundance in Lower Cook Inlet, Alaska, during summer 1993 and winter 1994. Final Report. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. Outer Continental Shelf Study MMS 94-0063.
- Alaska Department of Fish and Game (ADF&G). 1998. State of Alaska species of special concern (November 27, 1998). http://www.adfg.state.ak.us/special/esa/species_concern.php (accessed May 17, 2010).

- . 2006. Our wealth maintained: a strategy for conserving Alaska's diverse wildlife and fish resources. Juneau, AK. <http://www.sf.adfg.state.ak.us/statewide/ngplan/> (accessed May 17, 2010).
- . 2010. State of Alaska endangered species list. http://www.adfg.state.ak.us/special/esa/esa_home.php (accessed October 29, 2010).
- Alaska Natural Heritage Program (AKNHP). 2008. Vertebrate species tracking list for 2008. The Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. http://aknhp.uaa.alaska.edu/zoology/Zoology_Tracking.htm (accessed May 17, 2010).
- Alaska Shorebird Group (ASG). 2008. Alaska Shorebird Conservation Plan. Version II. Anchorage, AK. <http://alaska.fws.gov/mbsp/mbm/shorebirds/plans.htm> (accessed October 11, 2010).
- American Ornithologists' Union. 2008. Check-list of North American Birds. <http://www.aou.org/checklist/north/full.php> (accessed April 14, 2010).
- Angliss, R.P., and B.M. Allen. 2009. Alaska marine mammal stock assessments, 2008. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-193.
- Angliss, R.P., D.P. DeMaster, and A.L. Lopez. 2001. Alaska marine mammal stock assessments, 2001. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-124.
- Angliss, R.P., and K.L. Lodge. 2003. Alaska marine mammal stock assessments, 2003. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-144.
- . 2002. Alaska marine mammal stock assessments, 2002. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-133.
- Angliss, R.P., and R.B. Outlaw. 2005. Alaska marine mammal stock assessments, 2005. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-161.
- Arneson, P.D. 1981. "Identification, documentation, and delineation of coastal migratory bird habitat in Alaska." Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators. Vol. 15. pp. 1-363. U.S. Departments of Interior and Commerce, Bureau of Land Management/National Oceanic and Atmospheric Administration, Boulder, CO.
- Baird, S. 2007. Kachemak Bay Research Reserve, Homer, AK. Personal communication to Dave Rugh of National Marine Mammal Laboratory.
- Bennett, A.J. 1996. Physical and biological resource inventory of the Lake Clark National Park-Cook Inlet coastline, 1994-1996. Unpublished report. U.S. Department of Interior, National Park Service, Lake Clark National Park and Preserve, Kenai, AK.

- Boveng, P.L. 2006. U.S. Department of Commerce, National Marine Mammal Laboratory, Seattle, WA. Personal communication.
- Boveng, P.L., J.L. Bengtson, and M.A. Simpkins. 2005a. Distribution and abundance of harbor seals in Cook Inlet: seasonal variability in relation to key life-history events. Presentation summary from 10th Information Transfer Meeting, March 14-16, 2005, Anchorage, AK. Alaska Outer Continental Shelf Region, Minerals Management Service.
- . 2005b. Movements and habitat use of harbor seals in Cook Inlet. Presentation summary from 10th Information Transfer Meeting, March 14-16, 2005, Anchorage, AK. Alaska Outer Continental Shelf Region, Minerals Management Service.
- Boveng, P.L., J.L. Bengtson, D.E. Withrow, J.C. Cesarone, M.A. Simpkins, K.J. Frost, and J.J. Burns. 2003. "The abundance of harbor seals in the Gulf of Alaska." *Marine Mammal Science*. Vol. 19. pp. 111-127.
- Boveng, P., J. London, J. Ver Hoef, and R. Montgomery. 2007. "Strong seasonal dynamics of harbor seals in Cook Inlet, Alaska." Poster presented at 17th Biennial Conference on the Biology of Marine Mammals, December 2007, Cape Town, South Africa. Society for Marine Mammalogy.
- Buck, L. 2005. Institute of Marine Sciences, University of Alaska, Kodiak, AK. Personal communication (letter).
- Bureau of Land Management (BLM). 2005. Special status species list for Alaska. Instruction Memorandum No. AK 2006-03, U.S. Department of the Interior, Anchorage, AK. <http://www.blm.gov/nhp/efoia/ak/2006im/im06-003.pdf> (accessed November 13, 2007).
- Burn, Douglas M. 2009. U.S. Fish and Wildlife, Marine Mammals Management Office. Personal communication. October 8.
- Burn, D.M., and A.M. Doroff. 2005. "Decline in sea otter (*Enhydra lutris*) populations along the Alaska Peninsula, 1986-2001." *Fishery Bulletin*. Vol. 103. pp. 270-279.
- Burnham, K.P., and D.R. Anderson. 2002. *Model Selection and Inference: an Information-theoretic Approach*. 2nd ed. Springer-Verlag: Berlin, Germany.
- Cahalane, V.H. 1959. "A biological survey of Katmai National Monument." *Smithsonian Miscellaneous Collections*. Vol. 138, No. 5. pp. 1-246.
- Calkins, D.G. 1979. "Marine mammals of lower Cook Inlet and the potential for impact from outer continental shelf oil and gas exploration, development and transport." *Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators*. 1983. Vol. 20. pp. 171-263. U.S. Department of Commerce, Bureau of Land Management/National Oceanic and Atmospheric Administration, Boulder, CO.
- Cunningham, L., J.M. Baxter, I.L. Boyd, C.D. Duck, M. Lonergan, S.E. Moss, and B. McConnell. 2009. "Harbour seal movements and haul-out patterns: implications for monitoring and management." *Aquatic Conservation: Marine and Freshwater Ecosystems*. Vol. 19. pp. 398-407.

- Day, R.H. 2006. "Seabirds in the northern Gulf of Alaska and adjacent waters, October to May." *Western Birds*. Vol. 37. pp. 190-214.
- Day, R.H., A.K. Prichard, and D.A. Nigro. 2003. "Ecological specialization and overlap of *Brachyramphus* murrelets in glaciated fjords of Prince William Sound, Alaska." *Auk*. Vol. 120. pp. 680-699.
- Day, R.H., K.J. Kuletz, and D.A. Nigro. 1999. "Kittlitz's Murrelet (*Brachyramphus brevirostris*)." In A. Poole and F. Gill, eds. *The Birds of North America*. No. 435. Birds of North America, Inc., Philadelphia, PA.
- Erikson, D. 2005. URS Corporation, Fritz Creek, AK, formerly of Alaska Department of Fish and Game. Personal communication.
- . 1977. "Distribution, abundance, migration, and breeding locations of marine birds, Lower Cook Inlet, Alaska, 1976." Vol. VIII in L.L. Trasky, L.B. Flagg, and D.C. Burbank, eds., *Environmental Studies of Kachemak Bay and Lower Cook Inlet, Alaska*. Department of Fish and Game, Marine/Coastal Habitat Management, Anchorage, AK.
- Estes, J.A., M.T. Tinker, A.M. Doroff, and D.M. Burn. 2005. "Continuing sea otter population declines in the Aleutian Archipelago." *Marine Mammal Science*. Vol. 21. pp. 169-172.
- Faulkner, B. 2007. Commercial fisherman, Homer, AK. Personal communication to Ted Otis of Alaska Department of Fish and Game.
- Ferrero, R.C., D.P. DeMaster, P.S. Hill, M.M. Muto, and A.L. Lopez. 2000. Alaska marine mammal stock assessments, 2000. U.S. Department of Commerce, National Marine Fisheries Service, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-AFSC-119.
- Ferrero, R.C., and L.W. Fritz. 2002. Steller sea lion research and coordination: a brief history and summary of recent progress. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Technical Memorandum NMFS-AFSC-129.
- Frost, K.J., M.A. Simpkins, and L.F. Lowry. 2001. "Diving behavior of subadult and adult harbor seals in Prince William Sound, Alaska." *Marine Mammal Science*. Vol. 17. pp. 813-834.
- Frost, K.J., L.F. Lowry, and J.M. Ver Hoef. 1999. "Monitoring the trend of harbor seals in Prince William Sound, Alaska." *Marine Mammal Science*. Vol. 15. pp. 494-506.
- Gibson, D.D., and B. Kessel. 1989. "Geographic variation in the Marbled Godwit and description of an Alaska subspecies." *Condor*. Vol. 91. pp. 436-443.
- Gill, R.E., Jr., and T.L. Tibbitts. 1999. Seasonal shorebird use of intertidal habitats in Cook Inlet, Alaska. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region. Contract Report OCS Study MMS 99-0012.
- Gill, V.A., S.A. Hatch, and R.B. Lanctot. 2004. "Colonization, population growth, and nesting success of Black Oystercatchers following a seismic uplift." *Condor*. Vol. 106. pp. 791-800.

- Goetz, K.T., D.J. Rugh, A.J. Read, and R.C. Hobbs. 2007. "Habitat use in a marine ecosystem: beluga whales *Delphinapterus leucas* in Cook Inlet, Alaska." Marine Ecology Progress Series. Vol. 330. pp. 247-256.
- Goldstein, M.I., D. Martin, and M.C. Stensvold. 2009. U.S. Forest Service 2009 Alaska Region sensitive species list: assessment and proposed revisions to the 2002 list. Juneau, AK.
http://www.fs.fed.us/r10/ro/policy-reports/documents/2009_revised_r10_ss_report.pdf (accessed October 11, 2010).
- Goodman, L.A. 1960. "On the exact variance of products." Journal of the American Statistical Association. Vol. 55. pp. 708-713.
- Hicks, S.D. 1989. Tide and current glossary. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Rockville, MD.
- Hill, P.S., and D.P. DeMaster. 1999. Alaska marine mammal stock assessments, 1999. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Seattle, WA.
- . 1998. Alaska marine mammal stock assessments, 1998. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Seattle, WA.
- Hobart, W.L., ed. 2000. Belugas. Marine Fisheries Review, special edition. U.S. Department of Commerce, National Marine Fisheries Service. Vol. 62, No. 3.
<http://spo.nwr.noaa.gov/mfr623/mfr623.htm> (accessed April 15, 2000).
- Hobbs, R.C., K.L. Laidre, D.J. Vos, B.A. Mahoney, and M. Eagleton. 2005. "Movements and area use of belugas, *Delphinapterus leucas*, in a subarctic Alaskan estuary." Arctic. Vol. 58. pp. 331-340.
- Houghton, J.P. 2008. Pentec Environmental, Edmonds, WA. Personal communication (in letter).
- . 2006. Pentec Environmental, Edmonds, WA. Personal communication.
- Hurvich, C.M, and C.L. Tsai. 1989. Regression and time series model selection in small samples. Biometrika. Vol. 76. pp. 297-307.
- Isleib, M.E., and B. Kessel. 1973. "Birds of the North Gulf Coast-Prince William Sound region, Alaska." Biological Papers of the University of Alaska. No. 14.
- Jemison, L.A., G.W. Pendleton, C.A. Wilson, and R.J. Small. 2006. "Long-term trends in harbor seal numbers at Tugidak Island and Nanvak Bay, Alaska." Marine Mammal Science. Vol. 22, pp. 339-360.
- Kirchhoff, M., and V. Padula. 2010. The Audubon Alaska WatchList 2010. Anchorage, AK.
http://ak.audubon.org/files/Audubon%20Alaska/documents/ANNOTATED_WATCHLIST_FIN_AL_WEB_7-22-10.pdf (accessed October 11, 2010).

- Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J.E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan. Version I. Washington, DC.
- Larned, W.W. 2006a. Distribution and abundance of selected waterbirds and sea otters in Cook Inlet, Alaska, winters 2004-2005. Unpublished report prepared by U.S. Fish and Wildlife Service, Anchorage, AK. (appendix to Larned, 2006b).
- . 2006b. Winter distribution and abundance of Steller's Eiders (*Polysticta stelleri*) in Cook Inlet, Alaska, 2004-2005. U.S. Fish and Wildlife Service, Waterfowl Management Branch, Anchorage, AK. Outer Continental Shelf Study MMS 2006-066.
- . 2005. Aerial survey of lower Cook Inlet to locate molting flocks of Steller's Eiders and mergansers, 14 September 2005. Unpublished report by U.S. Fish and Wildlife Service, Soldotna, AK.
- Lewis, Steve. 2009. NOAA Fisheries, Alaska Region. Personal communication. December 18.
- London, J.M., P.L. Boveng, J.M. Ver Hoef, J.K. Jansen, K.M. Yano, and L. Santos. 2009. A comprehensive approach for estimating harbor seal abundance in Alaska. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, January.
- Lowry, L.F., K.J. Frost, J.M. Ver Hoef, and R.A. Delong. 2001. "Movements of satellite-tagged subadult and adult harbor seals in Prince William Sound, Alaska." *Marine Mammal Science*. Vol. 17. pp. 835-861.
- MacDonald, S.O., and J.A. Cook. 2009. *Recent Mammals of Alaska*. University of Alaska Press: Fairbanks, AK.
- Merrick, R.L., T.R. Loughlin, and D.G. Calkins. 1987. "Decline in abundance of northern sea lions, *Eumetopias jubatus*, in Alaska, 1956-86." *Fishery Bulletin*. Vol. 85. pp. 351-365.
- Montgomery, R.A., J.M. Ver Hoef, and P.L. Boveng. 2007. "Spatial modeling of haul-out site use by harbor seals in Cook Inlet, Alaska." *Marine Ecology Progress Series*. Vol. 341. pp. 257-264.
- Moore, S.E., and D.P. DeMaster. 2000. "Cook Inlet belugas, *Delphinapterus leucas*: status and overview." *Marine Fisheries Review*. Vol. 62. pp. 1-5.
- Moore, S.E., K.E.W. Sheldon, L.K. Litzky, B.A. Mahoney, and D.J. Rugh. 2000. "Beluga, *Delphinapterus leucas*, habitat associations in Cook Inlet, Alaska." *Marine Fisheries Review*. Vol. 62, No. 3. pp. 60-80.
- North American Waterbird Conservation Plan (NAWCPC). 2006. North American Waterbird Conservation Plan. Version II. Washington, DC.
<http://ak.audubon.org/files/Audubon%20Alaska/documents/WatchList2005.pdf> (accessed April 20, 2010).

- NMFS (National Marine Fisheries Service). 2009. NOAA Reports Latest Cook Inlet Beluga Population Estimate. News release. October 6.
- . 2008a. Recovery plan for the Steller sea lion eastern and western distinct population segments (*Eumetopias jubatus*). Revision. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Office of Protected Resources, Silver Spring, MD.
- . 2008b. Cook Inlet beluga whale subsistence harvest — final supplemental environmental impact statement. National Oceanic and Atmospheric Administration, NMFS, Alaska Region, Juneau, AK.
- . 2008c. Conservation plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Oceanic and Atmospheric Administration, NMFS, Office of Protected Resources, Juneau, AK.
- . 2007a. Marine Mammal Species Under the Endangered Species Act. <http://www.nmfs.noaa.gov/pr/species/esa/mammals.htm> (accessed June 21, 2007).
- . 2007b. Proactive Conservation Program: Species of Concern and Candidate Species. <http://www.nmfs.noaa.gov/pr/species/mammals/> (accessed June 21, 2007).
- . 2003. Subsistence harvest management of Cook Inlet beluga whales — final environmental impact statement. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Alaska Region, Juneau, AK.
- . 1992. Final recovery plan for Steller sea lions *Eumetopias jubatus*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Office of Protected Resources. Silver Spring, MD.
- NOAA Fisheries. n.d. Species under the Endangered Species Act. Office of Protected Resources, <http://www.nmfs.noaa.gov/pr/species/esa.htm> (accessed April 20, 2010).
- O’Corry-Crowe, G.M., R.S. Suydam, A. Rosenberg, K.J. Frost, and A.E. Dizon. 1997. “Phylogeography, population structure, and dispersal patterns of the beluga whale *Delphinapterus leucas* in the western Nearctic revealed by mitochondrial DNA.” *Molecular Ecology*. Vol. 6. pp. 955-970.
- Osgood, W.H. 1904. “A biological reconnaissance of the base of the Alaska Peninsula.” U.S. Fish and Wildlife Service, North American Fauna. No. 24.
- . 1901. “Natural history of the Cook Inlet region, Alaska.” U.S. Fish and Wildlife Service, North American Fauna. No. 21. pp. 51-81.
- Piatt, J. (ed.). 2002. Response of seabirds to fluctuations in forage fish density. *Exxon Valdez Oil Spill Restoration Project Final Report*, Restoration Project 01163M, and Minerals Management Service, Alaska Outer Continental Shelf Region, OCS Study MMS 2002-068.
- Pitcher, K.W. 1990. “Major decline in number of harbor seals, *Phoca vitulina richardsi*, on Tugidak Island, Gulf of Alaska.” *Marine Mammal Science*. Vol. 6. pp. 121-134.

- Pitcher, K.W., and D.G. Calkins, 1983. "Biology of the harbor seal, *Phoca vitulina richardsi*, in the Gulf of Alaska." Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators, 1983. Vol. 19. pp. 231-310. U.S. Department of Commerce, Bureau of Land Management/National Oceanic and Atmospheric Administration, Boulder, CO.
- Ritchie, R.J. 2006. ABR, Inc.—Environmental Research & Services, Fairbanks, AK. Personal communication.
- Rothe, T.C. 2006. Alaska Department of Fish and Game, Anchorage, AK. Personal communication (letter).
- Rugh, D.J., K.T. Goetz, J.A. Mocklin, B.A. Mahoney, and B.K. Smith. 2007. Aerial surveys of belugas in Cook Inlet, Alaska, June 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., K.T. Goetz, and C.L. Sims. 2006a. Aerial surveys of belugas in Cook Inlet, Alaska, May 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA.
- Rugh, D.J., K.T. Goetz, C.L. Sims, K.W. Sheldon, O.V. Shpak, B.A. Mahoney, and B.K. Smith. 2006b. Aerial surveys of belugas in Cook Inlet, Alaska, June 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.; Russian Academy of Science, Moscow, Russia.
- Rugh, D.J., K.T. Goetz, and B.A. Mahoney. 2005a. Aerial surveys of belugas in Cook Inlet, Alaska, August 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., K.T. Goetz, B.A. Mahoney, B.K. Smith, and T.A. Ruszkowski. 2005b. Aerial surveys of belugas in Cook Inlet, Alaska, June 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK, and Fort Richardson, AK.
- Rugh, D.J., K.E.W. Sheldon, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. Litzky, and R.C. Hobbs. 2005c. Aerial surveys of belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-149.
- Rugh, D.J., B.A. Mahoney, and B.K. Smith. 2004a. Aerial surveys of beluga whales in Cook Inlet, Alaska, between June 2001 and June 2002. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Technical Memorandum NMFS-AFSC-103.

- Rugh, D.J., K.E.W. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, and R.C. Hobbs. 2004b. Aerial surveys of belugas in Cook Inlet, Alaska, June 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., B.A. Mahoney, C.L. Sims, B.K. Smith, and R.C. Hobbs. 2003. Aerial surveys of belugas in Cook Inlet, Alaska, June 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., B.A. Mahoney, L.K. Litzky, and B. Smith. 2002. Aerial surveys of beluga in Cook Inlet, Alaska, June 2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., K.E.W. Shelden, B.A. Mahoney, and L.K. Litzky. 2001. Aerial surveys of beluga in Cook Inlet, Alaska, June 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Rugh, D.J., K.E.W. Shelden, and B.A. Mahoney. 2000a. "Distribution of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska, during June/July 1993-2000." *Marine Fisheries Review*. Vol. 62. pp. 6-21.
- Rugh, D.J., K.E.W. Shelden, B.A. Mahoney, and L.K. Litzky. 2000b. Aerial surveys of beluga in Cook Inlet, Alaska, June 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.
- Savarese, D.M. 2004. Seasonal trends in harbor seal abundance at the terminus of the Bering Glacier in southcentral Alaska. M.S. thesis. University of Alaska Anchorage.
- Schneider, K.B. 1977. "Assessment of the distribution and abundance of sea otters along the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago." *Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators, 1986*. Vol. 37. pp. 529-626. U.S. Department of Commerce, Bureau of Land Management/National Oceanic and Atmospheric Administration, Boulder, CO.
- Shelden, K.E.W., D.J. Rugh, K.T. Goetz, C.L. Sims, L. Vate Brattstrom, and R.C. Hobbs. 2009. Aerial surveys of belugas in Cook Inlet, Alaska, June 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA.
- Shelden, K.E.W., D.J. Rugh, K.T. Goetz, L. Vate Brattstrom, and B.A. Mahoney. 2008. Aerial surveys of belugas in Cook Inlet, Alaska, June 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and Alaska Regional Office, Anchorage, AK.

- Simpkins, M.A., D.E. Withrow, J.C. Cesarone, and P.L. Boveng. 2003. "Stability in the proportion of harbor seals hauled out under locally ideal conditions." *Marine Mammal Science*. Vol. 19. pp. 791-805.
- Small, R.J., P.L. Boveng, G.V. Byrd, and D.E. Withrow. 2008. "Harbor seal population decline in the Aleutian Archipelago." *Marine Mammal Science*. Vol. 24. pp. 845-863.
- Small, R.J., G.W. Pendleton, and K.W. Pitcher. 2003. "Trends in abundance of Alaska harbor seals, 1983-2001." *Marine Mammal Science*. Vol. 19. pp. 344-362.
- Speckmann, S.G., and J.F. Piatt. 2000. "Historic and current use of lower Cook Inlet, Alaska, by belugas, *Delphinapterus leucas*." *Marine Fisheries Review*. Vol. 62, No. 3. pp. 22-26.
- Trites, A.W., and P.A. Larkin. 1996. "Changes in the abundance of Steller sea lions (*Eumetopias jubatus*) in Alaska from 1956 to 1992: how many were there?" *Aquatic Mammals*. Vol. 22. pp. 153-156.
- U.S. Fish and Wildlife Service (USFWS). 2010a. Endangered, threatened, proposed, candidate, and delisted species in Alaska, January 2010. Anchorage, AK.
- . 2010b. Southwest Alaska Distinct Population Segment of the northern sea otter (*Enhydra lutris kenyoni*)—Draft Recovery Plan. U.S. Fish and Wildlife Service, Anchorage, AK. 171 pp.
- . 2008. Birds of conservation concern, 2008. Arlington, VA.
<http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf> (accessed 11 November 2010).
- . 2005. Recovery outline for the southwest Alaska distinct population segment of the northern sea otter (*Enhydra lutris kenyoni*). Anchorage, AK.
- . 2002a. Steller's Eider recovery plan. U.S. Fish and Wildlife Service, Fairbanks, AK. 27 pp.
- . 2002b. Stock assessment for sea otters (*Enhydra lutris*): southwest Alaska stock.
- . n.d.[a]. Endangered Species Listing Program: How many listed species currently occur in and are listed in Alaska? http://ecos.fws.gov/tess_public/pub/stateOccurrenceIndividual.jsp?state=AK (accessed April 20, 2010).
- . n.d.[b]. Catalog of North Pacific Seabird Colonies. Anchorage, AK.
<http://alaska.fws.gov/mbsp/mbm/northpacificseabirds/colonies/default.htm> (accessed May 20, 2010).
- Williamson, F.S.L., and L.J. Peyton. 1962. Faunal relationships of birds in the Iliamna Lake area, Alaska. *Biological Papers of the University of Alaska*. No. 5.
- Withrow, D.E. 2006. U.S. Department of Commerce, National Marine Mammal Laboratory, Seattle, WA. Personal communication.

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TABLES

TABLE 44-1
 Numbers of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2004

SPECIES-GROUP/ Subgroup	SEASON									Total
	Spring				Fall					
	Apr 21	May 3	May 13	May 22	Sep 3	Sep 14	Sep24	Oct 6	Oct 21 ^a	
WATERFOWL										
Geese	0	5	0	0	0	0	0	0	0	5
Swans	0	0	0	0	0	0	0	0	0	0
Ducks	378	1,273	230	203	2,023	1,291	478	356	0	6,232
WATERBIRDS										
Grebes	0	11	0	0	2	0	0	0	0	13
SHOREBIRDS										
Shorebirds	0	40	0	0	5	4	0	0	0	49
SEABIRDS										
Cormorants	25	43	38	33	49	61	11	0	0	260
Larids	204	233	824	303	851	1,209	1,179	274	41	5,118
Alcids	0	10	0	0	0	0	0	0	0	10
TOTAL	607	1,615	1,092	539	2,930	2,565	1,668	630	41	11,687

Notes:

- a. Only a partial survey was flown because of turbulent conditions.

TABLE 44-2
Numbers of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2005

SPECIES- GROUP/ Subgroup	SEASON											Total
	Spring				Fall							
	Apr 24	May 3	May 15 ^a	May 21	Aug 18	Aug 30	Sep 7	Sep 13	Sep 29	Oct 6	Oct 11	
WATERFOWL												
Geese	1	35	0	0	0	0	0	0	0	0	0	36
Swans	0	0	0	2	1	6	0	9	0	0	0	18
Ducks	1,136	1,783	1,953	1,536	6,389	8,642	6,302	3,695	1,317	1,437	2,238	36,428
WATERBIRDS												
Loons	0	1	1	2	0	2	0	0	0	0	0	6
Grebes	0	0	2	0	0	0	0	0	0	9	14	25
SHOREBIRDS												
Shorebirds	0	5,216	8	103	0	0	0	0	0	4	0	5,331
SEABIRDS												
Cormorants	30	102	115	76	212	111	30	61	5	4	19	765
Larids	788	759	452	684	1,425	3,990	4,103	1,890	1,155	1,026	1,164	17,436
Alcids	0	0	27	34	0	0	0	0	0	0	0	61
TOTAL	1,955	7,896	2,558^a	2,437	8,027	12,751	10,435	5,655	2,477	2,480	3,435	60,106

Notes:

a. Iniskin Bay survey data were lost because of a tape-recorder malfunction.

TABLE 44-3

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

SPECIES-GROUP/ Species	ILIAMNA AND INISKIN BAYS				CHINITNA BAY			TOTAL
	2006	2007	2008	Total	2007	2008	Total	
<u>BIRDS</u>								
WATERFOWL								
Greater White-fronted Goose	0	206	0	206	0	0	0	206
Cackling/Canada Goose	0	0	0	0	160	0	160	160
American Wigeon	0	28	0	28	0	0	0	28
Mallard	339	591	47	977	1,445	27	1,472	2,449
Northern Shoveler	0	74	0	74	5	0	5	79
Northern Pintail	50	49	0	99	75	30	105	204
Green-winged Teal	20	256	47	323	120	232	352	675
Unidentified dabbling duck	0	5	0	5	175	0	175	180
Greater Scaup	0	59	0	59	0	0	0	59
Unidentified scaup	31	862	341	1,234	78	112	190	1,424
Steller's Eider	790	1,636	808	3,234	0	0	0	3,234
King Eider	0	1	1	2	0	0	0	2
Common Eider	0	61	2	63	53	7	60	123
Unidentified eider	0	7	0	7	0	0	0	7
Harlequin Duck	667	1,503	931	3,101	224	37	261	3,362
Surf Scoter	175	3,060	11	3,246	626	30	656	3,902
White-winged Scoter	97	1,278	136	1,511	185	447	632	2,143
American Scoter	338	2,168	980	3,486	1,535	1,140	2,675	6,161
Unidentified scoter	267	3,276	204	3,747	1,977	544	2,521	6,268
Long-tailed Duck	2,051	5,564	3,056	10,671	1,742	1,750	3,492	14,163
Bufflehead	19	64	28	111	0	0	0	111
Common Goldeneye	0	1	10	11	0	0	0	11
Barrow's Goldeneye	376	320	4	700	4	0	4	704
Unidentified goldeneye	232	579	443	1,254	404	173	577	1,831

SPECIES-GROUP/ Species	ILIAMNA AND INISKIN BAYS				CHINITNA BAY			TOTAL
	2006	2007	2008	Total	2007	2008	Total	
Common Merganser	0	34	2	36	15	10	25	61
Red-breasted Merganser	0	158	2	160	8	0	8	168
Unidentified merganser	23	465	3	491	4	2	6	497
Unidentified diving duck	0	32	1	33	22	0	22	55
Unidentified duck	5	136	75	216	64	28	92	308
Total	5,480	22,569	7,134	35,183	8,921	4,569	13,490	48,673
WATERBIRDS								
Red-throated Loon	0	4	0	4	0	0	0	4
Pacific Loon	0	0	0	0	2	0	2	2
Common Loon	0	4	1	5	0	0	0	5
Unidentified loon—large	0	1	0	1	0	0	0	1
Unidentified loon	0	10	0	10	4	0	4	14
Horned Grebe	0	2	0	2	0	0	0	2
Red-necked Grebe	0	6	0	6	0	0	0	6
Total	0	27	1	28	6	0	6	34
SEABIRDS (CORMORANTS)								
Pelagic Cormorant	1	27	16	44	11	0	11	55
Unidentified cormorant	69	645	13	727	36	4	40	767
Total	70	672	29	771	47	4	51	822
SEABIRDS (LARIDS & ALCIDS)								
Mew Gull	175	1,043	83	1,301	164	368	532	1,833
Herring Gull	1	281	0	282	23	0	23	305
Glaucous-winged Gull	1,704	1,427	1,114	4,245	907	744	1,651	5,896
Glaucous Gull	0	35	0	35	6	0	6	41
Unidentified gull—small	0	0	0	0	50	3	53	53
Unidentified gull—large	33	1,169	0	1,202	27	26	53	1,255
Unidentified gull	164	4,159	1,732	6,055	1,806	858	2,664	8,719
Pigeon Guillemot	2	12	6	20	13	0	13	33

SPECIES-GROUP/ Species	ILIAMNA AND INISKIN BAYS				CHINITNA BAY			TOTAL
	2006	2007	2008	Total	2007	2008	Total	
Horned Puffin	0	46	0	46	24	0	24	70
Tufted Puffin	0	5	0	5	17	0	17	22
Unidentified alcid	0	3	0	3	0	0	0	3
Total	2,079	8,180	2,935	13,194	3,037	1,999	5,036	18,230
RAPTORS								
Bald Eagle	25	39	9	73	8	3	11	84
Peregrine Falcon	0	0	0	0	1	0	1	1
Total	25	39	9	73	9	3	12	85
SHOREBIRDS								
Black Oystercatcher	4	79	8	91	4	0	4	95
Unidentified sandpiper—small	175	0	0	175	0	0	0	175
Rock Sandpiper	406	393	220	1,019	0	0	0	1,019
Unidentified shorebird—small	0	38	0	38	25	0	25	63
Unidentified shorebird—large	0	0	0	0	40	0	40	40
Unidentified shorebird	35	1	0	36	22	0	22	58
Total	620	511	228	1,359	91	0	91	1,450
CORVIDS								
Black-billed Magpie	0	0	0	0	1	0	1	1
Common Raven	5	4	7	16	2	2	2	18
Total	5	4	7	16	3	2	3	19
BIRDS TOTAL	8,279	32,002	10,343	50,624	12,114	6,577	18,689	69,313
<u>MAMMALS</u>								
CARNIVORES								
Sea Otter	1,450	3,949	2,188	7,587	15	2	17	7,604
Steller's Sea Lion	0	3	21	24	0	0	0	24
Harbor Seal	425	1,582	496	2,503	852	371	1,223	3,726
Total	1,875	5,534	2,705	10,114	867	373	1,240	11,354

SPECIES-GROUP/ Species	ILIAMNA AND INISKIN BAYS				CHINITNA BAY			TOTAL
	2006	2007	2008	Total	2007	2008	Total	
CETACEANS								
Beluga	0	4	0	4	0	0	0	4
Harbor Porpoise	2	10	2	14	2	0	2	16
Unidentified porpoise	0	8	0	8	0	0	0	8
Total	2	22	2	26	2	0	2	28
MAMMALS TOTAL	1,877	5,556	2,707	10,140	869	373	1,242	11,382

TABLE 44-4
Comparison of Birds Counted during Breeding-bird Surveys in 1976 and 1978 and during Boat-based Marine Surveys in Summer 2004 and 2005

Species	Breeding Birds Recorded In 1976 and 1978^a	Pebble Project Surveys 2004	Pebble Project Surveys 2005
Double-crested Cormorant	149	52	74
Red-faced Cormorant	0	20	10
Pelagic Cormorant	134	117	130
Common Eider	30	8	13
Black Oystercatcher	42	23	41
Mew Gull	0	25	74
Glaucous-winged Gull	1,498	843	1,030
Pigeon Guillemot	119	95	77
Tufted Puffin	2,060	49	84
Horned Puffin	140	32	51
Total	4,172	1,264	1,584

Notes:

- a. The 1976/1978 data are from USFWS (n.d.[b]).

TABLE 44-5
Bird Species in the Cook Inlet Marine Study Area that Are of Conservation Concern^a

Species	USFWS^b	BLM^c	USFS^d	ADFG^e	Audubon Alaska^f	AKNHP^g	Alaska Shorebird Group^h	NAWCPⁱ
Steller's Eider (Alaska breeding population)	ESA threatened species	— ^j	—	Species of special concern	Declining or depressed population	Imperiled species	—	—
Common Eider	—	—	—	Featured species for conservation	Declining or depressed population	Vulnerable species	—	—
Surf Scoter	—	Sensitive species	—	Featured species for conservation	—	—	—	—
American Scoter	—	Sensitive species	—	Featured species for conservation	Declining or depressed population	Vulnerable species	—	—
Long-tailed Duck	—	Sensitive species	—	Featured species for conservation	—	—	—	—
Red-throated Loon	Species of conservation concern	Sensitive species	—	Featured species for conservation	Declining or depressed population	—	—	Species of high concern
Horned Grebe	Species of conservation concern	—	—	Featured species for conservation	—	—	—	Species of high concern
Red-faced Cormorant	Species of conservation concern	—	—	Featured species for conservation	Declining or depressed population	Vulnerable species	—	Species of high concern
Pelagic Cormorant	Species of conservation concern	—	—	—	—	—	—	Species of high concern
Golden Eagle	—	—	—	Featured species for conservation	—	Vulnerable species	—	—

Species	USFWS ^b	BLM ^c	USFS ^d	ADFG ^e	Audubon Alaska ^f	AKNHP ^g	Alaska Shorebird Group ^h	NAWCP ⁱ
Peregrine Falcon (<i>pealei</i> subspecies)	Species of conservation concern	—	—	Featured species for conservation	—	Imperiled/vulnerable species	—	—
Black Oystercatcher	Species of conservation concern	—	Sensitive species	Featured species for conservation	Vulnerable population	Imperiled/vulnerable species	Species of high concern	—
Marbled Godwit (<i>beringiae</i> subspecies)	Species of conservation concern	Sensitive species	—	Featured species for conservation	Vulnerable population	Imperiled species	Species of high concern	—
Black Turnstone	—	—	—	—	Vulnerable population	Vulnerable species	Species of high concern	—
Surfbird	—	—	—	—	Declining or depressed population	Imperiled/vulnerable species	Species of high concern	—
Rock Sandpiper (<i>ptilocnemis</i> subspecies)	Species of conservation concern	—	—	Featured species for conservation	Declining or depressed population	Imperiled/vulnerable species	Species of high concern	—
Dunlin (<i>arcticola</i> and <i>pacifica</i> subspecies)	Species of conservation concern	—	—	—	Declining or depressed population	—	Species of high concern	—
Marbled Murrelet (Alaska population)	Species of conservation concern	Sensitive species	—	Featured species for conservation	Declining or depressed population	Vulnerable species	—	Species of high concern
Kittlitz's Murrelet	ESA candidate species	Sensitive species	Sensitive species	Featured species for conservation	Declining or depressed population	Imperiled species	—	Species of high concern

Notes:

- See Section 44.6.4 for definition of species of conservation concern. No information from Boreal Partners in Flight is shown because none of those species were recorded in the Cook Inlet marine study area.
- Sources: USFWS, 2008, 2010; species included from USFWS (2008) are listed for one or two Bird Conservation Regions (BCRs; western Alaska and northwestern interior forest) because the Cook Inlet marine study area is near the border between the two BCRs.
- Source: BLM, 2005.
- Source: Goldstein et al., 2009.

- e. Sources: ADFG, 1998, 2006, 2010; no bird species recorded in the Cook Inlet marine study area are listed as endangered by the State of Alaska (ADFG, 2010).
- f. Source: Kirchhoff and Padula, 2010.
- g. Source: AKNHP, 2008; state listings only; the highest conservation ranking for either the breeding or nonbreeding season is shown; secure and apparently secure rankings (roughly equivalent to low and moderate conservation-concern classes) are not shown.
- h. Source: ASG, 2008; species of high concern only; species of low to moderate concern are not shown.
- i. Source: Kushlan et al. 2002.
- j. Dash indicates that the species is not listed or that its conservation ranking is below the threshold for inclusion in this study (see Section 44.6.4 and notes g. and h., above).

TABLE 44-6

Threatened and Endangered Marine Mammal Species and Marine Mammal Species of Conservation Concern^a Recorded in the Cook Inlet Marine Study Area, 2004-2006, and Listing Status by Agency or Conservation Organization

Species	USFWS ^b	NMFS ^c	BLM ^d	ADF&G ^e	AKNHP ^f
Northern sea otter ^g	Threatened species, depleted stock	— ^l	—	Priority species for conservation and species of special concern	Imperiled-vulnerable
Steller's sea lion ^h	—	Endangered species, depleted stock	—	Priority species for conservation and species of special concern	Imperiled
Harbor seal ⁱ	—	Non-depleted	Sensitive species	Species of special concern	—
Gray whale ^j	—	Delisted species	—	Priority species for conservation	Vulnerable
Beluga ^k	—	Endangered species, depleted stock	—	Priority species for conservation and species of special concern	Critically Imperiled

Notes:

- a. See Section 44.6.4 for definition of species of conservation concern. Only species with low population numbers and/or known population threats are listed.
- b. Source: USFWS, 2006.
- c. Sources: NMFS, 2007a, 2007b.
- d. Source: BLM, 2005.
- e. Sources: ADFG, 1998, 2006, 2010.
- f. Source: AKNHP, 2008, state listings only; secure, apparently secure, and vulnerable/apparently secure rankings are not shown.
- g. Southwestern Alaska “distinct population segment”.
- h. Western population of Steller’s sea lion (west of 144°W longitude).
- i. Eastern Pacific subspecies.
- j. Eastern Pacific population.
- k. Cook Inlet population of beluga; although not recorded in the Cook Inlet marine study area in 2004-2006, the species was recorded there in 2007 (see text).
- l. Dash indicates that the species is not listed or that its conservation ranking is below the threshold for inclusion in this study (see Section 44.6.4).

TABLE 44-7

Number of Harbor Seals Counted during Fixed-wing Marine Surveys of Haulout Locations, Cook Inlet Marine Study Area, April through December 2005, 2007, and 2008, by Date and Count Area

Year	Date	TIME		COUNT AREA				Total
		Start	End	Iliamna Bay	Iniskin Bay	Iniskin Islands	Chinitna Bay	
2005	April 24	19:45	20:40	0	80	234	178	492
	May 3	18:00	19:15	23	0	226	0	249
	May 10	11:50	13:00	56	40	308	0	404
	May 11	11:30	13:00	92	68	675	2	837
	May 25	12:10	13:50	71	3	207	0	281
	May 26	10:45	12:30	89	165	409	2	665
	May 31	16:00	17:50	142	256	544	13	955
	June 28	12:40	14:30	49	118	228	3	398
	June 29	14:20	16:20	75	131	399	17	622
	July 21	9:30	12:00	45	0	877	128	1,050
	July 22	9:50	12:00	63	0	833	134	1,030
	July 26	14:10	15:20	49	0	1,013	99	1,161
	August 11	13:10	15:20	76	1	845	119	1,041
	August 17	7:10	9:00	36	108	419	82	645
	August 21	9:20	10:30	125	27	406	165	723
	September 8	12:00	13:30	153	105	231	37	526
	September 29	9:56	11:47	25	78	119	400	622
October 10	12:10	13:58	23	89	79	374	565	
December 13	10:50	11:45	0	NS	0	206	—	
2007	May 21	13:36	15:35	116	0	671	3	790
	June 19	13:22	15:51	144	97	544	4	789
	June 20	12:25	14:42	105	279	656	22	1,062
	July 16	12:45	14:04	4	0	362	17	383
	July 17	11:23	13:09	40	0	585	84	709

Year	Date	TIME		COUNT AREA				Total
		Start	End	Iliamna Bay	Iniskin Bay	Iniskin Islands	Chinitna Bay	
	July 26	7:34	9:21	44	0	648	60	752
	July 27	8:00	10:03	43	72	771	143	1,029
	August 14	10:27	12:31	92	93	864	116	1,165
	August 15	11:07	13:48	116	69	1,017	199	1,401
	August 16	11:09	13:33	114	60	1,029	207	1,410
	August 29	9:51	12:19	85	64	640	130	919
	August 30	9:44	11:54	123	84	420	169	796
	September 12	11:18	12:49	14	0	75	51	140
	September 13	10:07	12:13	97	30	364	421	912
	October 11	9:21	11:22	19	8	142	59	228
	October 12	9:27	11:22	21	42	111	51	225
2008	June 19	10:00	12:50	109	263	612	27	1,011
	June 20	10:00	12:52	136	308	652	27	1,123
	June 21	10:09	12:41	152	313	613	35	1,113
	July 19	9:21	11:47	8	114	734	73	929
	July 20	9:40	12:07	23	119	638	96	876
	August 4	10:24	13:09	82	42	973	184	1,281
	August 5	10:40	13:26	55	97	755	218	1,125
	August 16	9:48	10:46	83	NS	766	NS	—
	August 17	9:54	10:14	34	NS	NS	NS	—
	August 18	10:12	12:18	103	74	882	122	1,181

Notes:

NS = not surveyed: entire bay was not surveyed; therefore, the entire survey was dropped from subsequent analyses.

TABLE 44-8
Number of Adult and Young Harbor Seals Counted during Pupping Surveys, Cook Inlet Marine Study Area, June 19 through 21, 2008, by Date and Count Area

Date	Attribute	COUNT AREA				Total
		Iliamna Bay	Iniskin Bay	Iniskin Islands	Chinitna Bay	
June 19	Adults	70	191	505	24	790
	Pups	39	72	107	3	221
	Pups per 100 adults	55.7	37.7	21.2	12.5	28.0
June 20	Adults	103	236	541	22	902
	Pups	33	72	111	5	221
	Pups per 100 adults	32.0	30.5	20.5	22.7	24.5
June 21	Adults	98	245	497	28	868
	Pups	54	68	116	7	245
	Pups per 100 adults	55.1	27.8	23.3	25.0	28.2
Mean	Adults	90.3	224.0	514.3	24.7	853.3
	Pups	42.0	70.7	111.3	5.0	229.0
	Pups per 100 adults	46.5	31.5	21.6	20.3	26.8

TABLE 44-9
Comparison of Model-selection Results from Fixed-wing Marine Surveys of Harbor Seal Haulout Locations, Cook Inlet Marine Study Area, July to August 2005, 2007–2008

Model	RSS^a	K^b	AIC_c^c	Δ^d	w_i^e
Time from Midday	156,436	3	186.79	0.00	0.43
Time from Midday, Tide Height	145,394	4	188.50	1.70	0.18
Intercept Only Model	200,983	2	189.01	2.22	0.14
Time from Midday, Relative Tide Height	151,305	4	189.29	2.50	0.12
Tide Height	197,611	3	191.47	4.67	0.04
Relative Tide Height	142,690	3	191.74	4.95	0.04
Time from Midday, Relative Tide Height, Tide Height	200,735	5	191.78	4.99	0.04
Relative Tide Height, Tide Height	197,607	4	194.63	7.84	0.01

Notes:

- a. Residual sum of squares.
- b. Number of parameters (includes error term and intercept).
- c. Akaike Information Criteria corrected for small sample size.
- d. Difference between the AIC_c value for the model and the minimal AIC of all models.
- e. Akaike Weight, which is the probability that model is the best model in the candidate model set.

TABLE 44-10

Date, Tide Conditions, Number of Harbor Seals Counted, and Estimated Number of Harbor Seals after Adjusting Counts for Environmental Covariates during Fixed-wing Marine Surveys of Haulout Locations, Cook Inlet Marine Study Area, July and August 2005, 2007, and 2008

Year	Date	CLOSEST LOW TIDE ^a		Tide Height During Surveys ^b (feet)	Time to Midday ^c (hours)	Observed Count Total	ADJUSTED COUNTS		
		Time	Height (feet)				Time to Midday Only ^d	Julian Date Only	Time and Julian Date
2005	July 21	9:59	-3.8	-3.6	4.0	1,050	1,169		
	July 22	10:44	-4.3	-4.2	3.8	1,030	1,143		
	July 26	13:39	-0.4	1.0	0.5 ^e	1,161	1,176	1,177	1,192
	August 11	13:33	3.0	3.1	0.3	1,041	1,050		
	August 17	8:10	-0.9	-0.9	6.3	645	832		
	August 21	11:05	-3.5	-1.3	4.4	723	854		
	2007	July 16	11:23	-2.8	-0.1	1.3	383	422	
July 17		12:00	-2.1	-2.0	2.6	709	786		
July 26		7:49	1.8	1.8	6.3	752	939		
July 27		8:33	0.6	0.6	5.8	1,029	1,201		
August 14		10:57	-1.9	-1.9	3.4	1,165	1,266		
August 15		11:28	-1.2	-1.1	2.6	1,401	1,478		
August 16		11:59	-0.1	0.0	2.6	1,410	1,487	1,437	1,515
August 29		10:32	-2.3	-2.3	3.7	919	1,029		
August 30		11:08	-1.9	-0.9	4.0	796	915		

Year	Date	CLOSEST LOW TIDE ^a		Tide Height During Surveys ^b (feet)	Time to Midday ^c (hours)	Observed Count Total	ADJUSTED COUNTS		
		Time	Height (feet)				Time to Midday Only ^d	Julian Date Only	Time and Julian Date
2008	July 19	10:51	-1.6	-0.5	4.5	929	1,063		
	July 20	11:24	-1.6	0.0	4.1	876	998		
	August 4	11:56	-2.1	-0.8	3.4	1,281	1,382	1,306	1,407
	August 5	12:33	-0.6	1.4	3.1	1,125	1,217		
	August 18	10:55	-1.4	-1.3	3.6	1,181	1,288		



Notes:

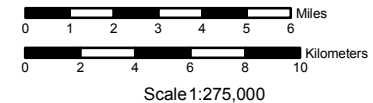
- a. The average of Iliamna Bay and Oil Bay tide stations.
- b. Based on average of Iliamna Bay and Oil Bay tide values at the time when the Iniskin Islands were surveyed.
- c. Time from solar noon at the time when the Iniskin Islands were surveyed.
- d. Adjusted to solar noon.
- e. After solar noon.

FIGURES

**Figure 44-1
Marine Wildlife Survey Area,
Cook Inlet Marine
Study Area,
2004–2008**

Legend

-  Marine Wildlife Survey Area
-  Existing Road



Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 44-01_AIMarineSA_CI_PLP_EBD_v02.mxd	Date: Nov. 13, 2010
Version: 2	Author: ABR-AZC

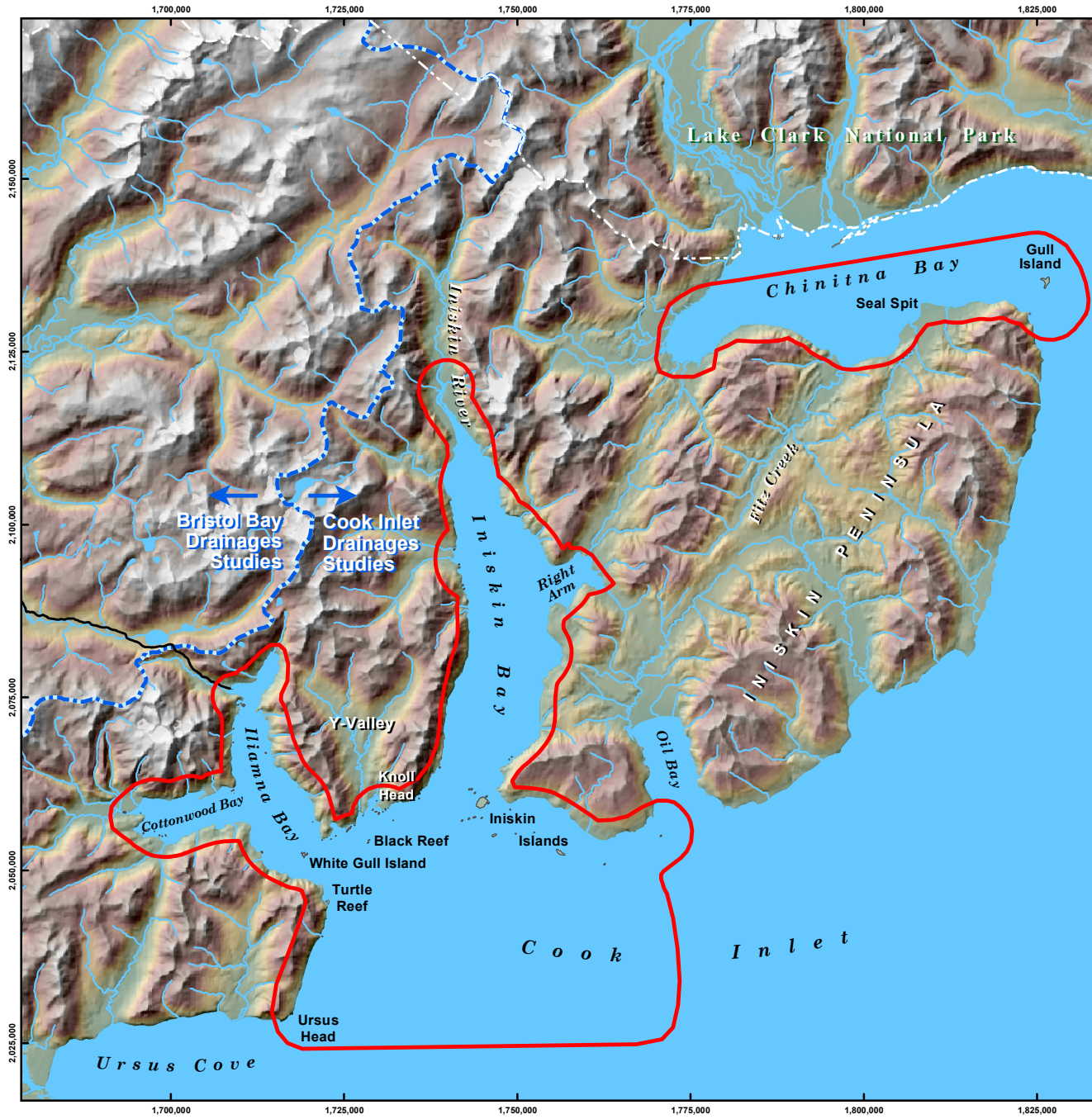







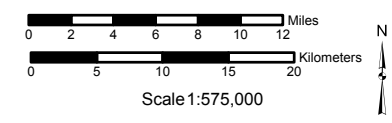
Figure 44-2
Critical Habitat Delineations
for Sea Otters and Belugas
in the Vicinity of the
Cook Inlet Marine Study Area

Legend

-  Critical Habitat for Sea Otters¹
-  Proposed Critical Habitat for Belugas²
-  Existing Road

¹Final designated critical habitat for the southwest Alaska distinct population segment of the northern sea otter (Burn, pers. comm., 2009).

²Proposed critical habitat for belugas (Lewis, pers. comm., 2009).



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File:44-02_SEOTBELU_CrHab_Ci_PLP_EBD_v02.mxd	Date: Jun. 14, 2011
Version: 2	Author: ABR-AZC



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2,075,000
2,050,000
2,025,000

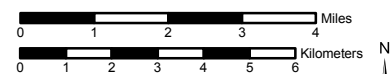
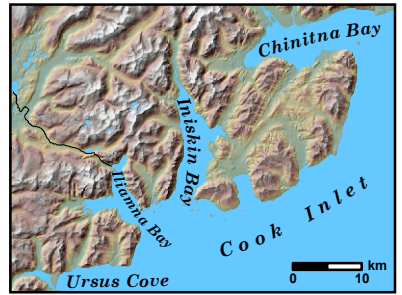
1,700,000 1,725,000 1,750,000 1,775,000



Figure 44-3
Survey Area for Boat-based
Marine Wildlife Surveys,
Cook Inlet Marine Study Area,
2004–2006

Legend

- 2004–2006 Offshore Boat Survey Transect
- 2004–2006 Offshore Transect Boundary
- 2004–2006 200-m Nearshore Survey Area for Boat Surveys
- 2004–2006 Nearshore Survey Segment Boundary
- Existing Road



Scale 1:165,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-03_BoatSA_CI_PLP_EBD_v02.mxd	Date: Nov. 16, 2010
Version: 2	Author: ABR-AZC

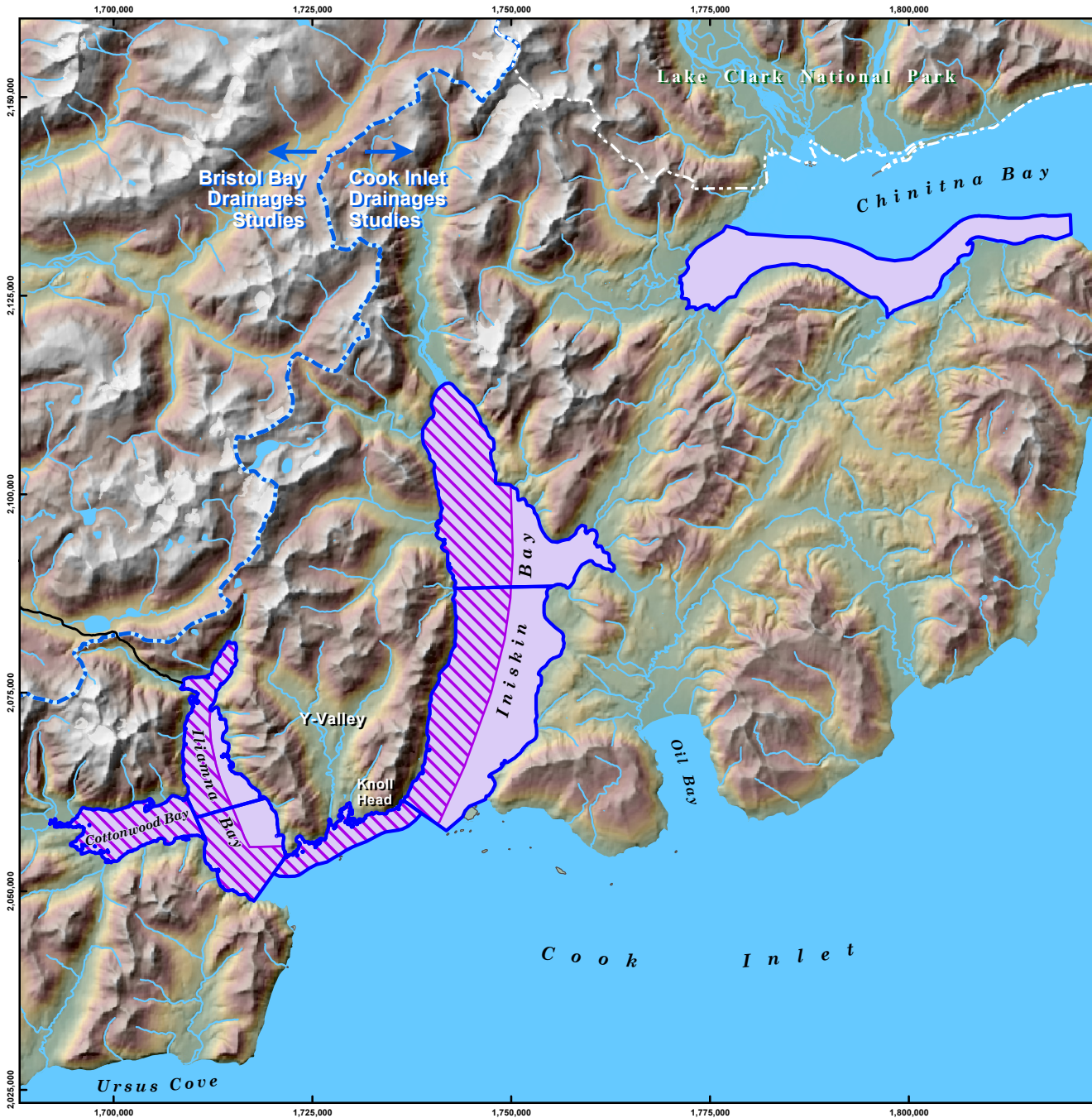




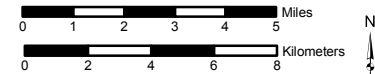


Figure 44-4
Survey Area for Fixed-wing
Marine-bird Surveys,
Cook Inlet Marine Study Area
2004–2005

Legend

-  2004 Survey Area
-  2005 Survey Area
-  Stratum Boundary
-  Existing Road

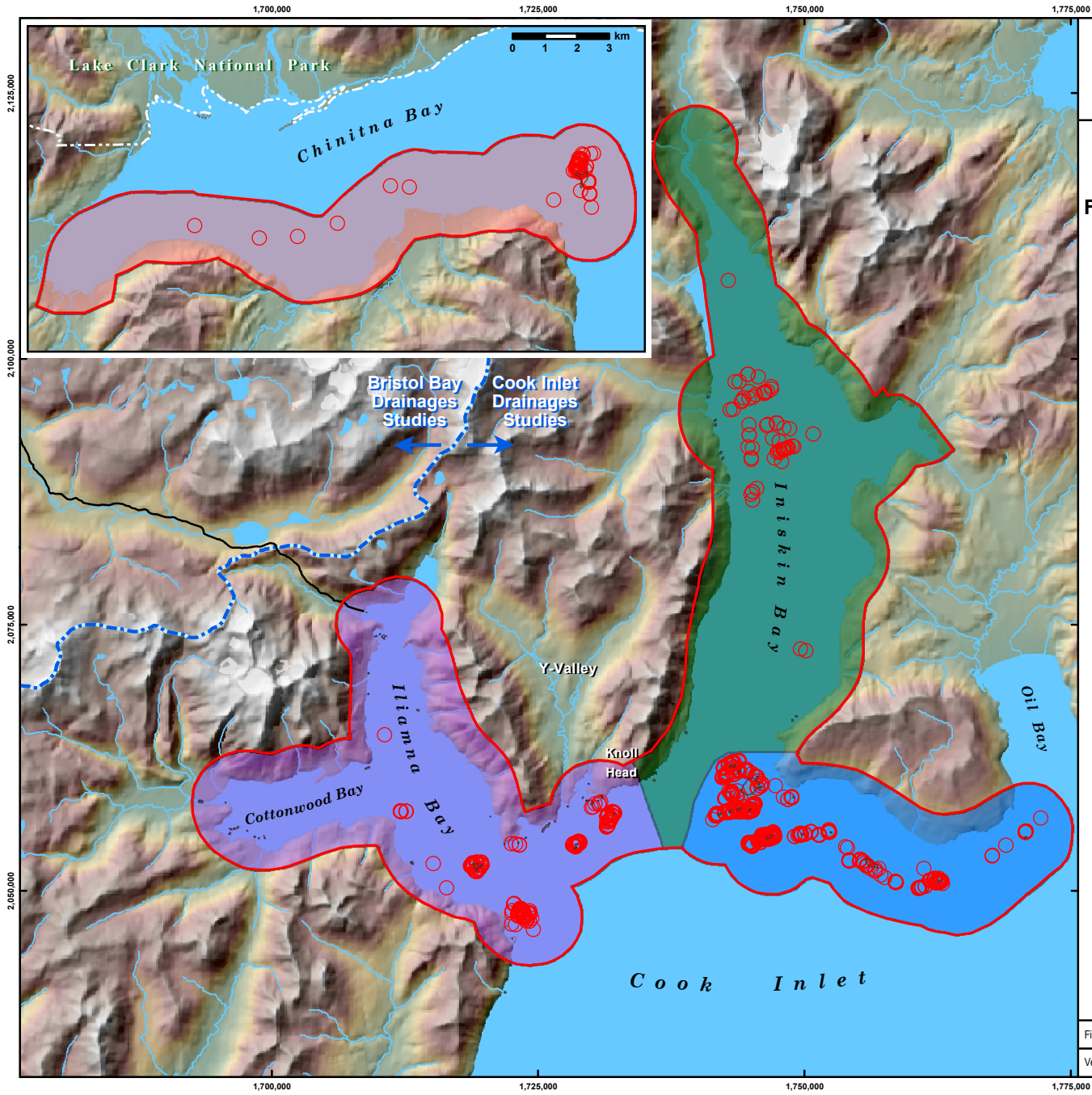


Scale 1:240,000

Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-04_WaterbirdSA_CI_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2 Author: ABR-AZC



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2,075,000
2,050,000

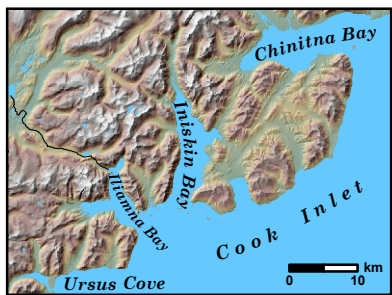
1,700,000 1,725,000 1,750,000 1,775,000



Figure 44-5
Survey Area, Count Areas, and
Haulout Locations Surveyed by
Fixed-wing Aircraft for Harbor Seals,
Cook Inlet Marine Study Area,
2005, 2007, and 2008

Legend

- Survey Area
- Chinitna Bay Count Area
- Iliamna Bay Count Area
- Iniskin Bay Count Area
- Iniskin Islands Count Area
- Harbor Seal Haulout Location
- Existing Road







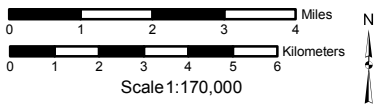
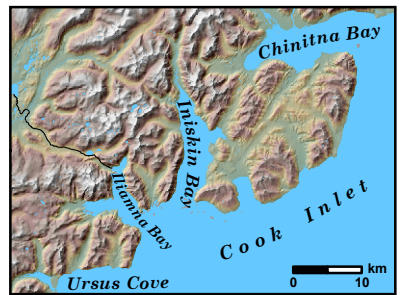
0 1 2 3 4 Miles
 0 1 2 3 4 5 6 Kilometers
 Scale 1:175,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum



Figure 44-6
Survey Area for Helicopter-based
Marine Wildlife Surveys,
Cook Inlet Marine Study Area,
2006–2008

Legend

-  2006–2008 Survey Area for Helicopter Surveys
-  Inside-/Outside-Bay Delineation
-  200-m Nearshore Survey Area
-  Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-06_HeliSA_CI_PLP_EBD_v02.mxd	Date: Nov. 16, 2010
Version: 2	Author: ABR-AZC

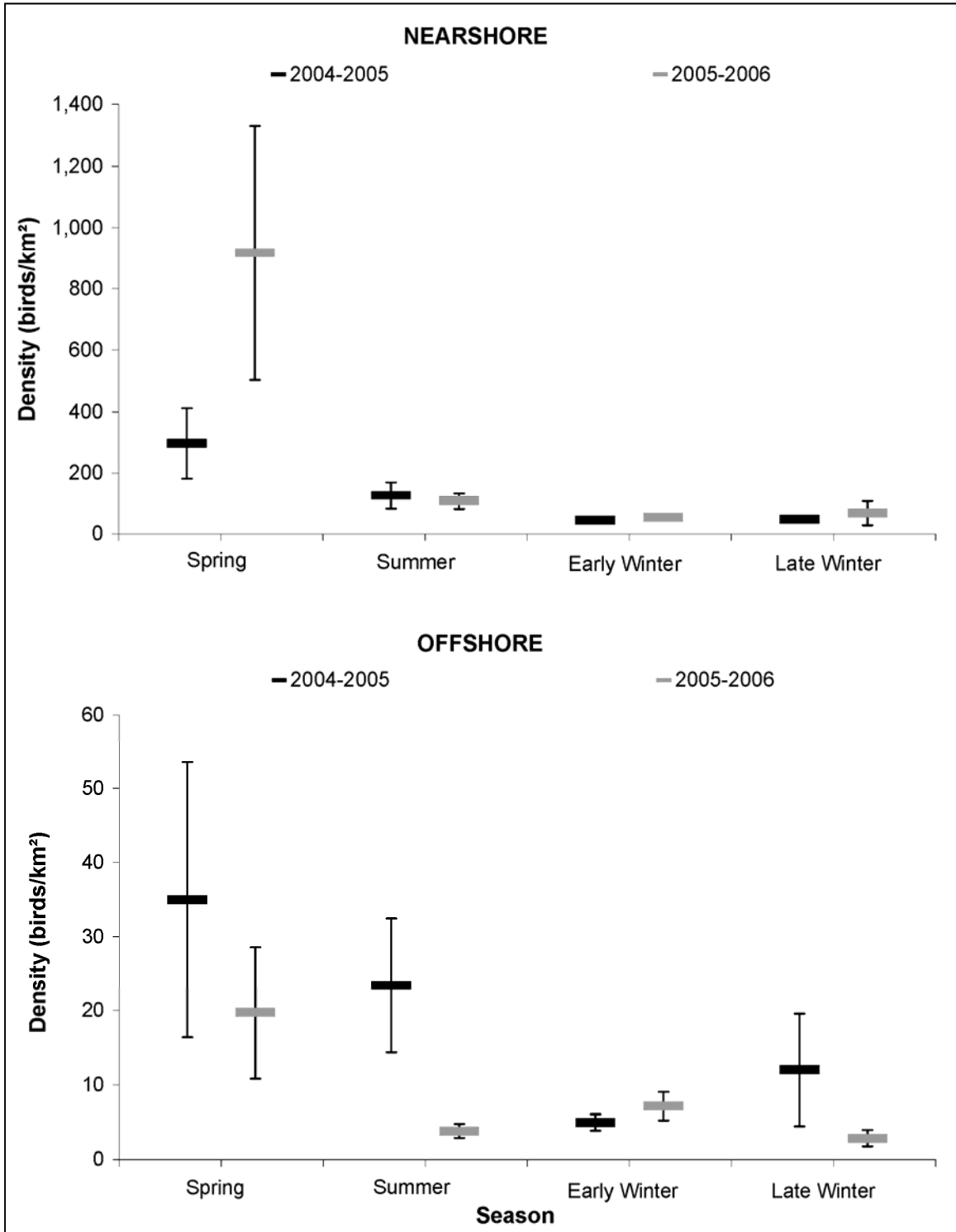


FIGURE 44-7
Mean Densities of Birds Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004-2006

Note: Data are presented as mean \pm 1 standard error.

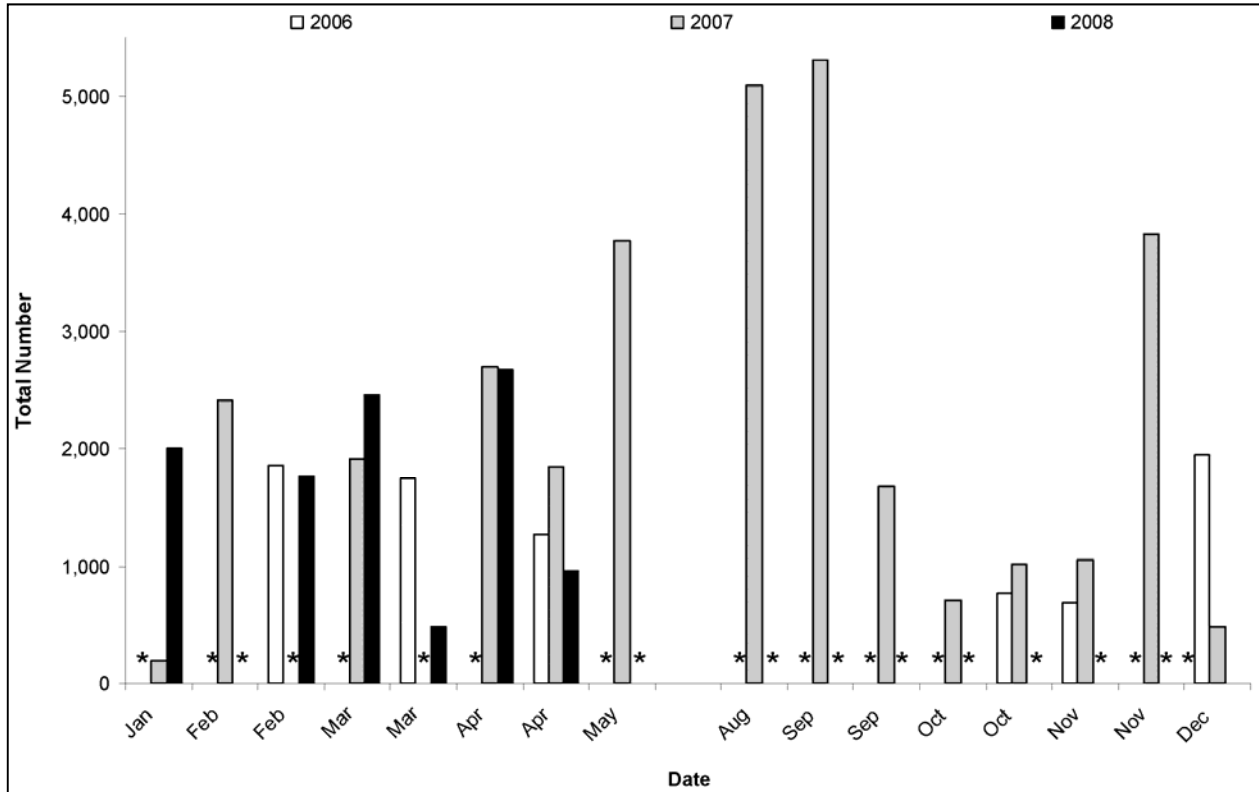


FIGURE 44-8
 Maximal Numbers of Birds Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey data in a particular year during that survey date.

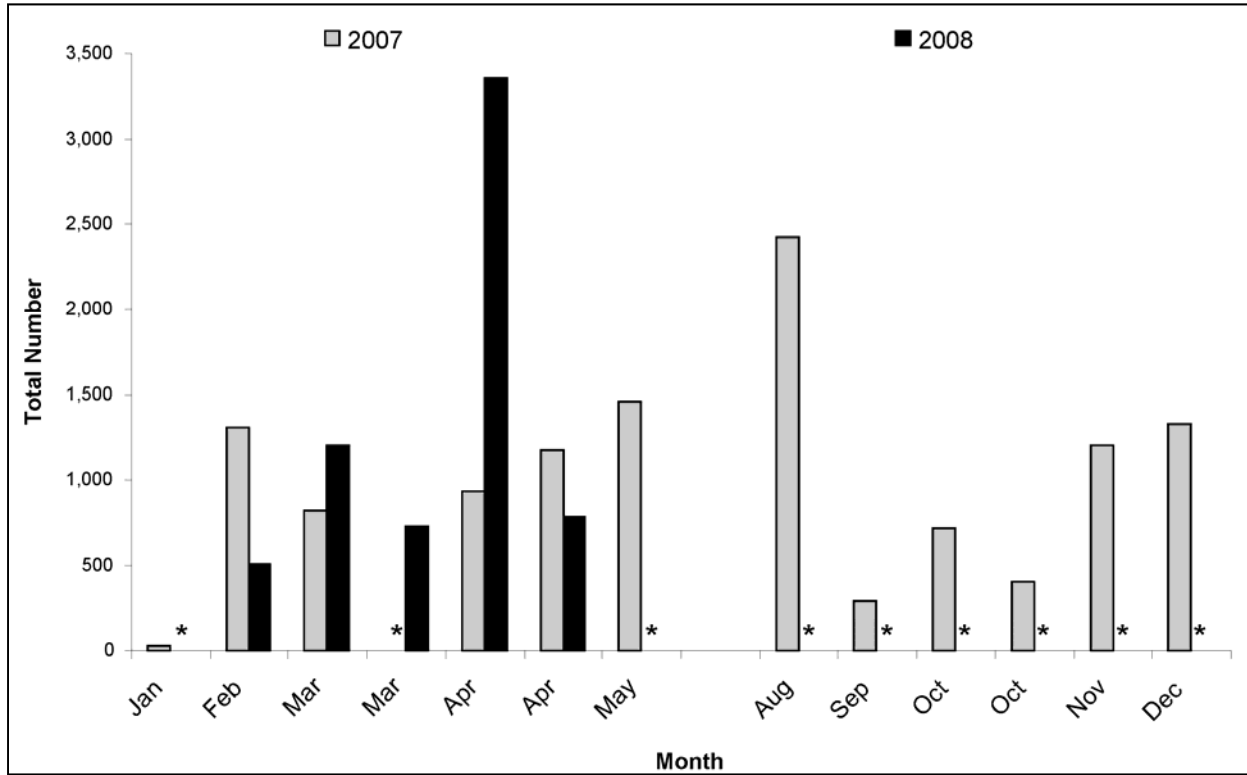


FIGURE 44-9
Maximal Numbers of Birds Counted in Chinitna Bay during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2007-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

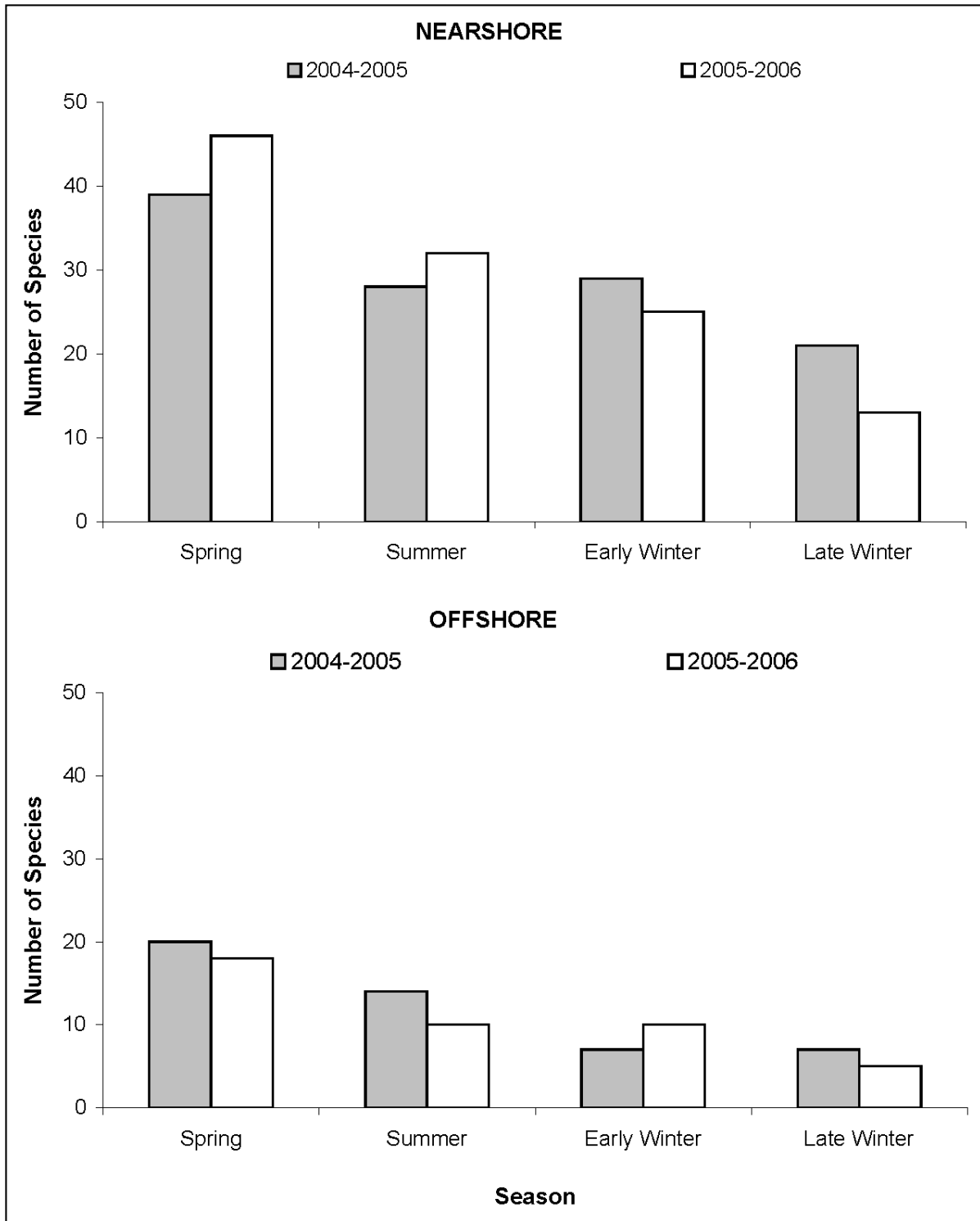


FIGURE 44-10
Species Richness of Birds Counted during Boat-based Marine Surveys, Cook Inlet Marine Study
Area, 2004–2006

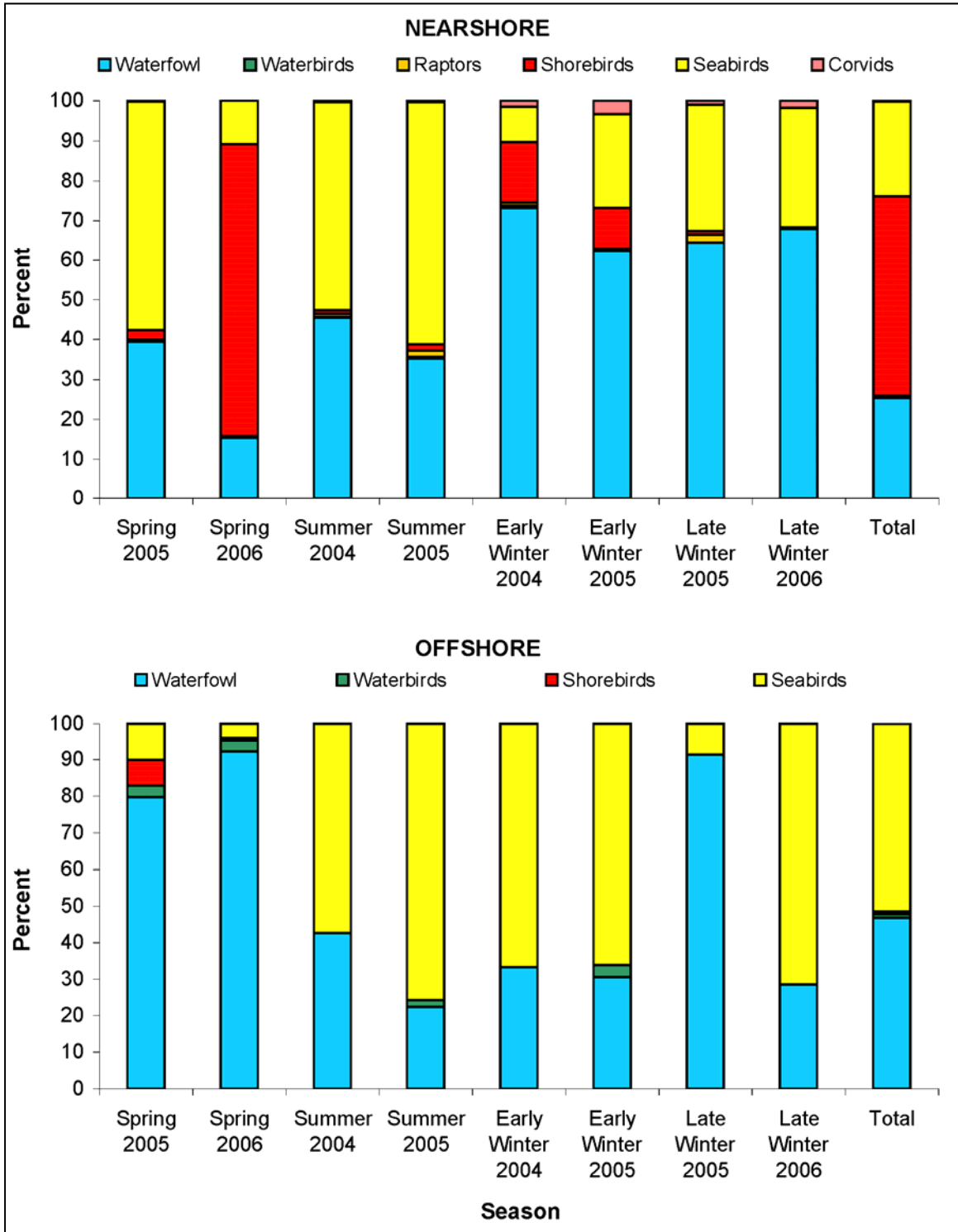


FIGURE 44-11
Species Composition of Birds Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

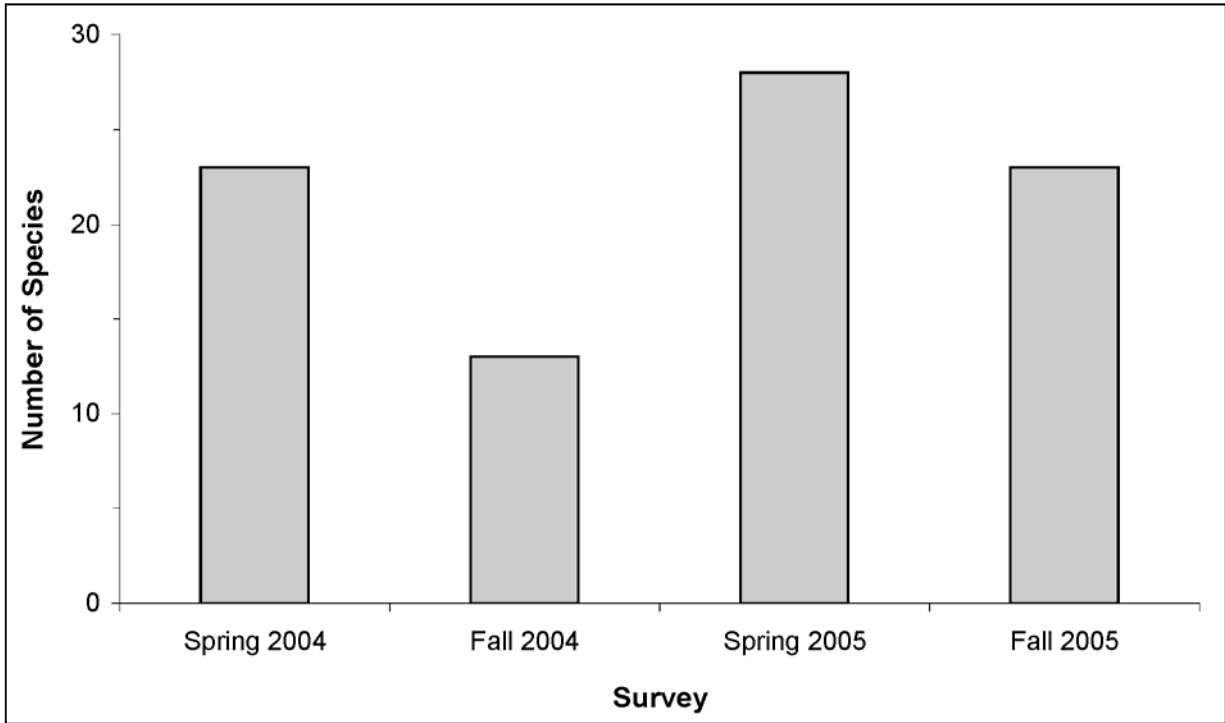


FIGURE 44-12
Species Richness of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2004–2005

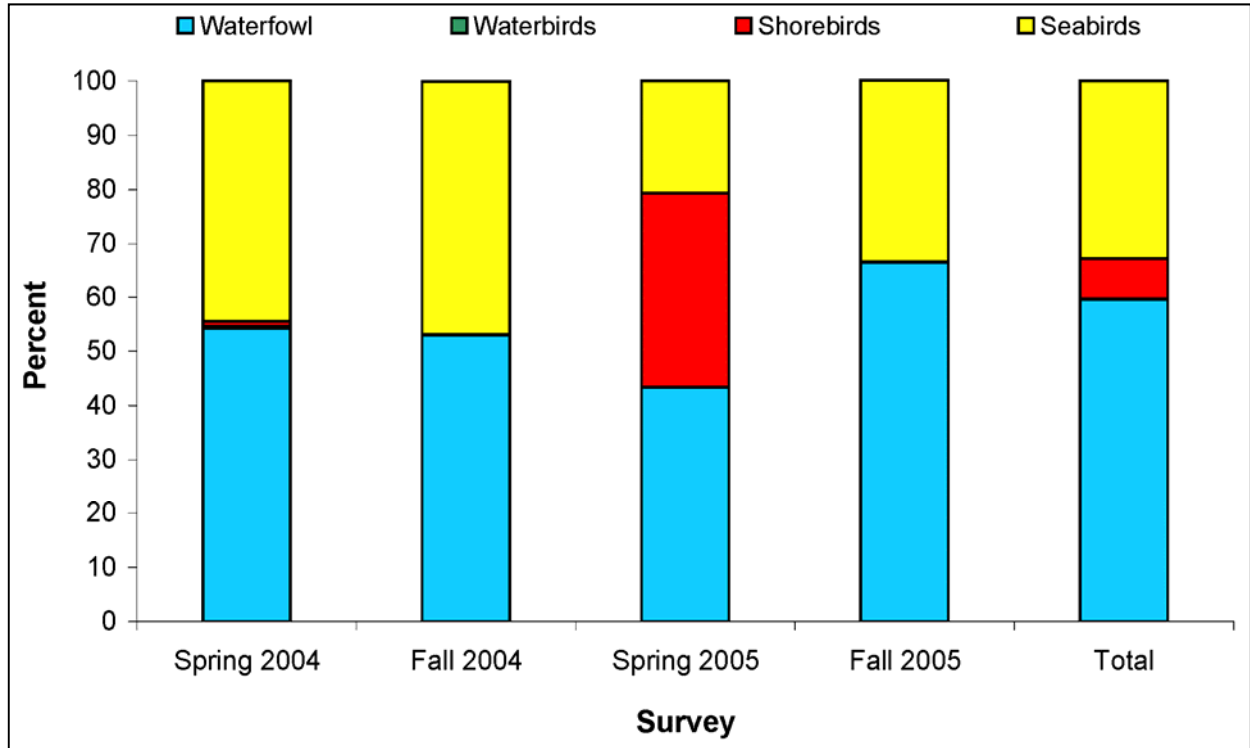


FIGURE 44-13
Species Composition of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2004–2005

Note: Only trace numbers of waterbirds were recorded

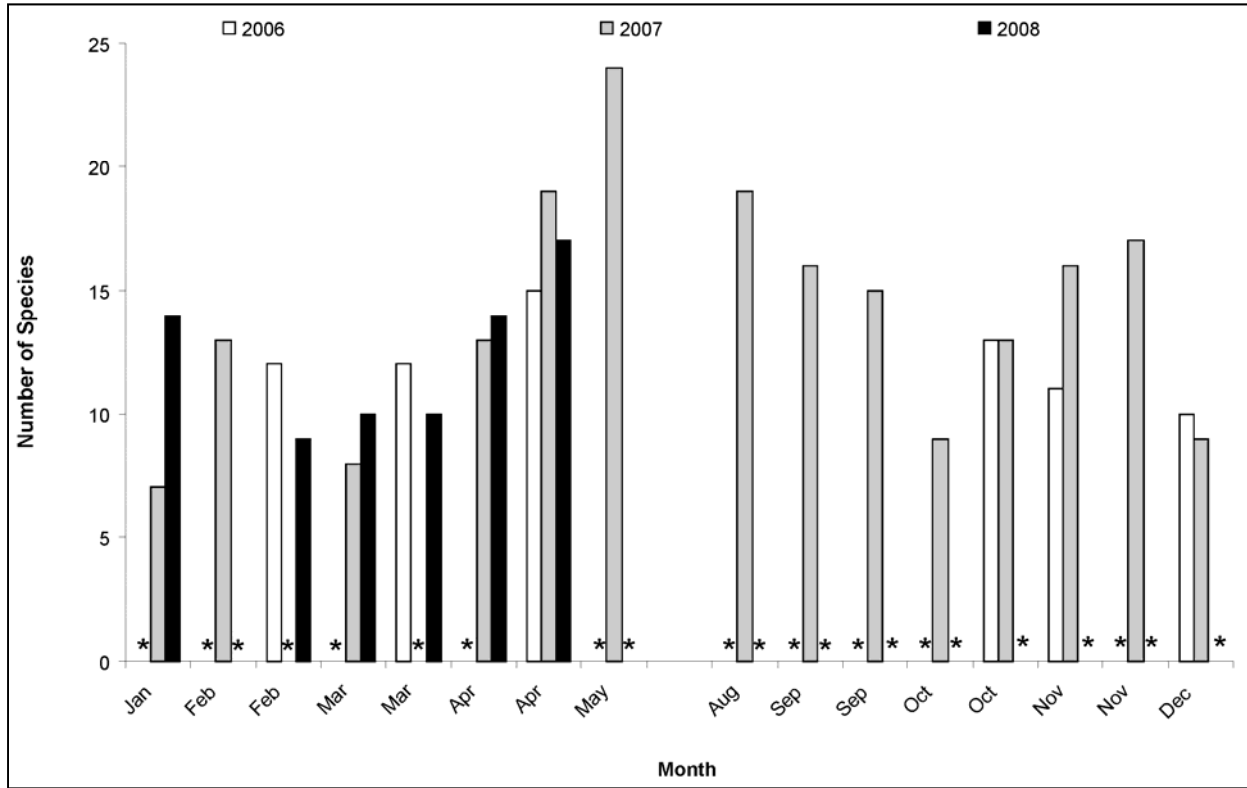


FIGURE 44-14
 Species Richness of Birds Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

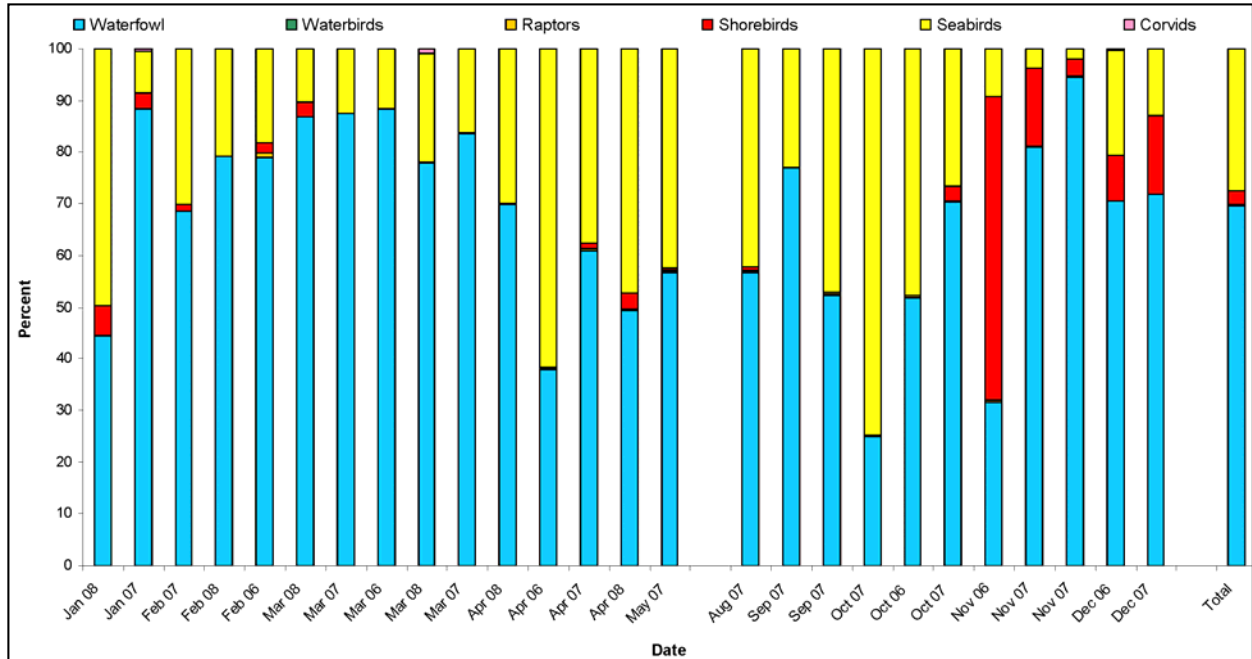


FIGURE 44-15
 Species Composition of Birds Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

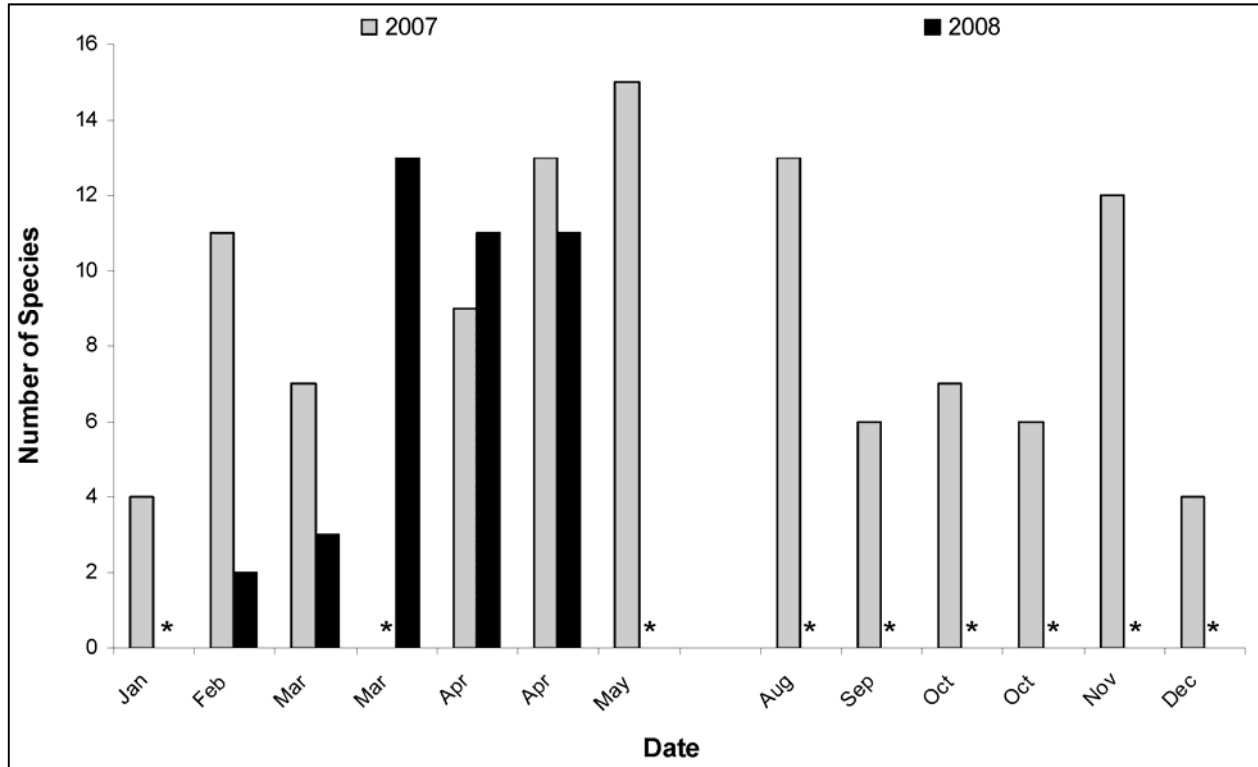


FIGURE 44-16
Species Richness of Birds Counted in Chinitna Bay during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2007-2008

Note:

Asterisks indicate no survey in a particular year during that survey date.

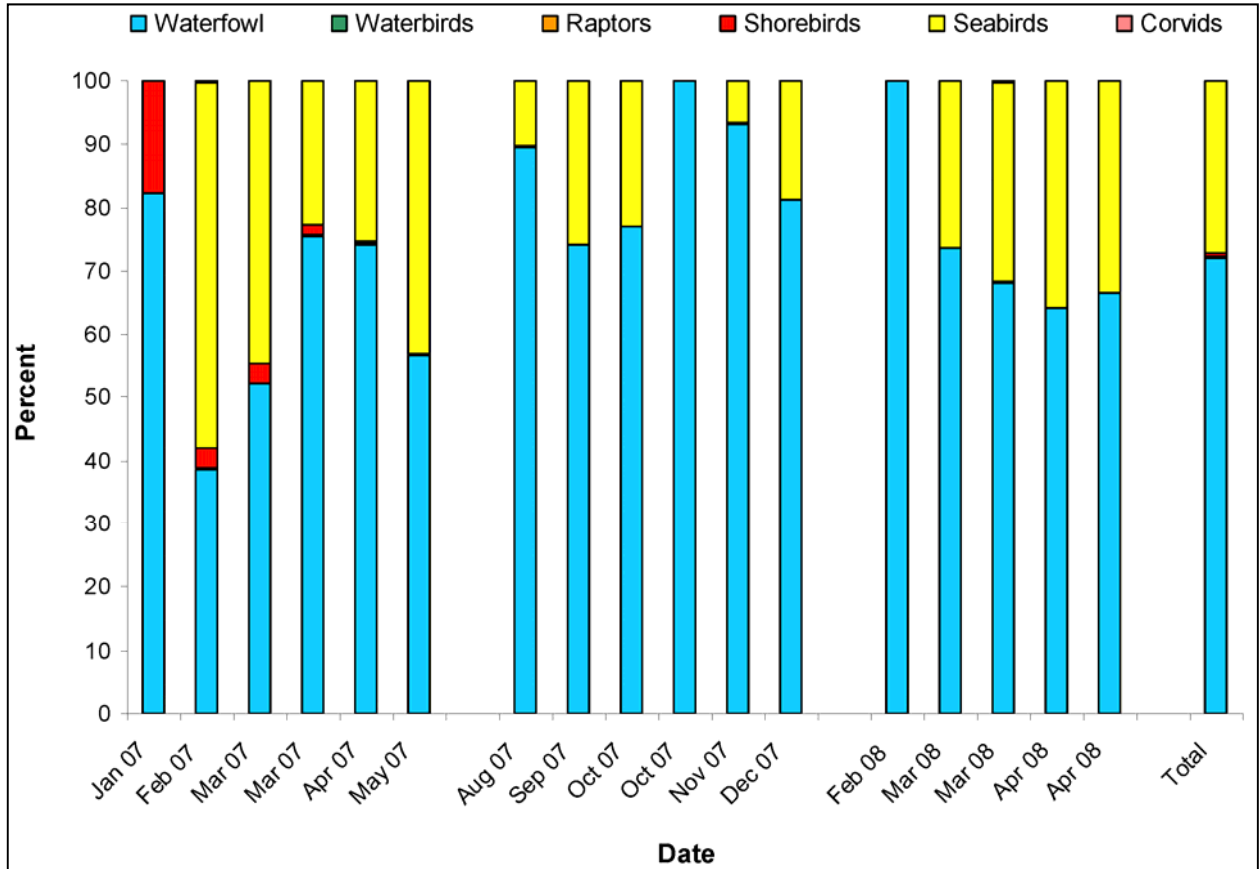


FIGURE 44-17
 Species Composition of Birds Counted in Chinitna Bay during Helicopter-based Marine Surveys,
 Cook Inlet Marine Study Area, 2007-2008

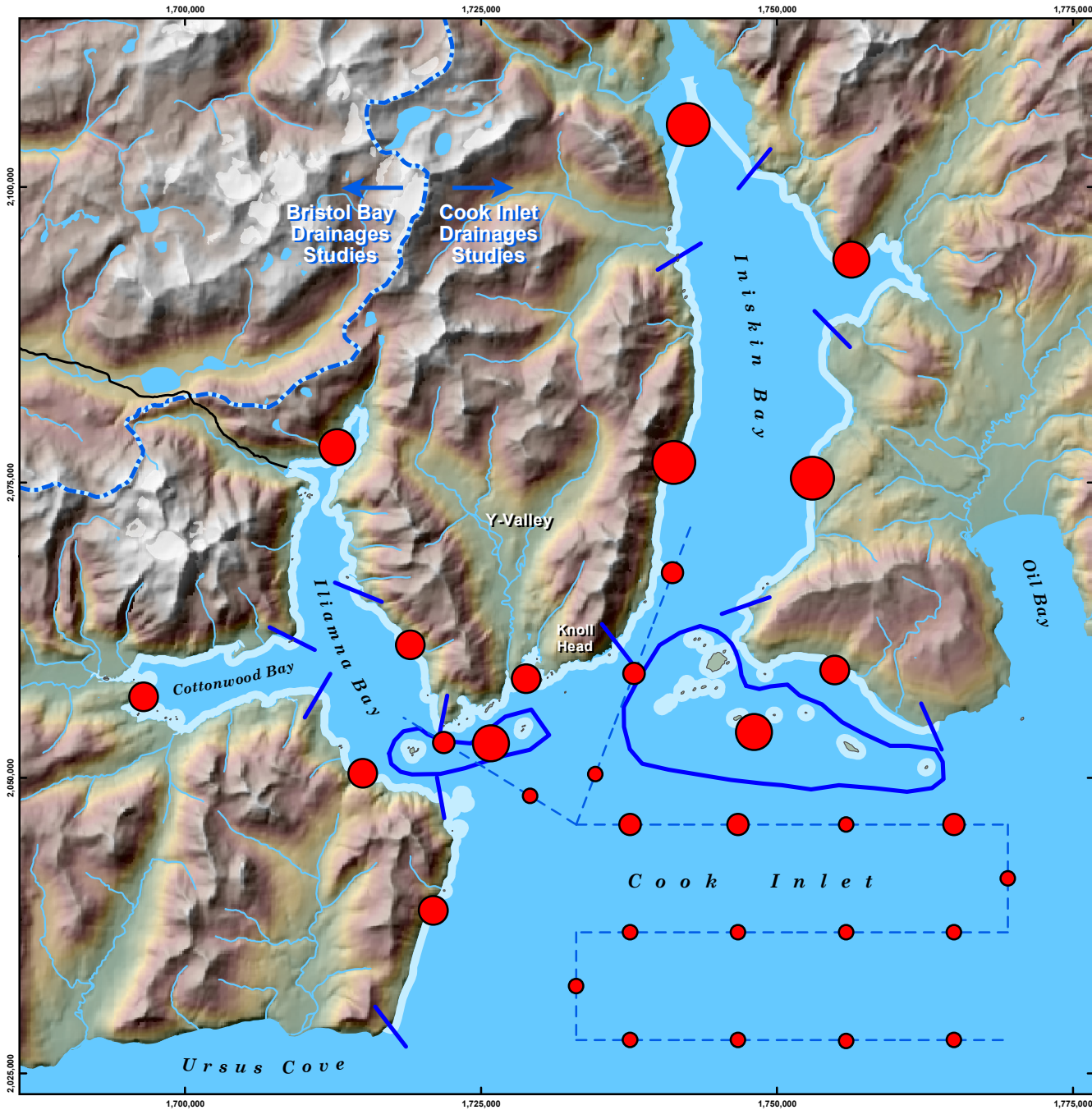


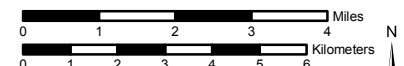
Figure 44-18
Distribution and Abundance
of Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2005 and 2006

Legend

Mean Density (birds/km²)

- 0.01 – 10.00
- 10.01 – 50.00
- 50.01 – 200.00
- 200.01 – 1,000.00
- 1,000.01 – 2,225.00

- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-18_BirdDens_Spr0506_PLP_EBD_v02.mxd Date: Nov. 13, 2010

Version: 2 Author: ABR-AZC

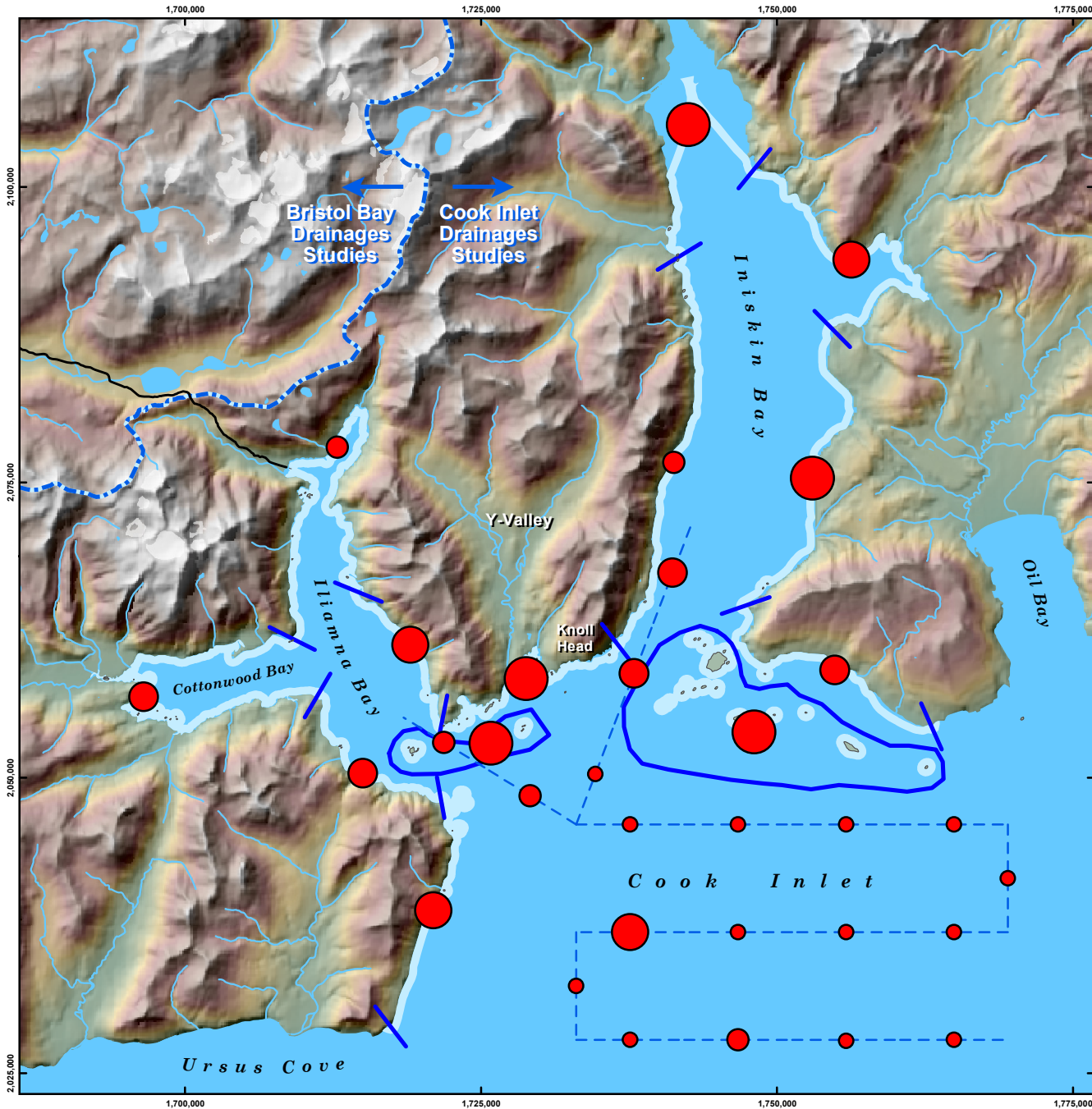
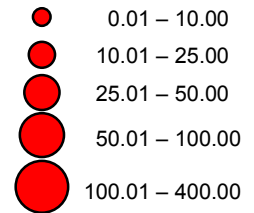


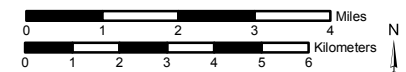
Figure 44-19
Distribution and Abundance
of Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2004 and 2005

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-19_BirdDens_Sum0405_PLP_EBD_v02.mxd Date: Nov. 14, 2010

Version: 2 Author: ABR-AZC

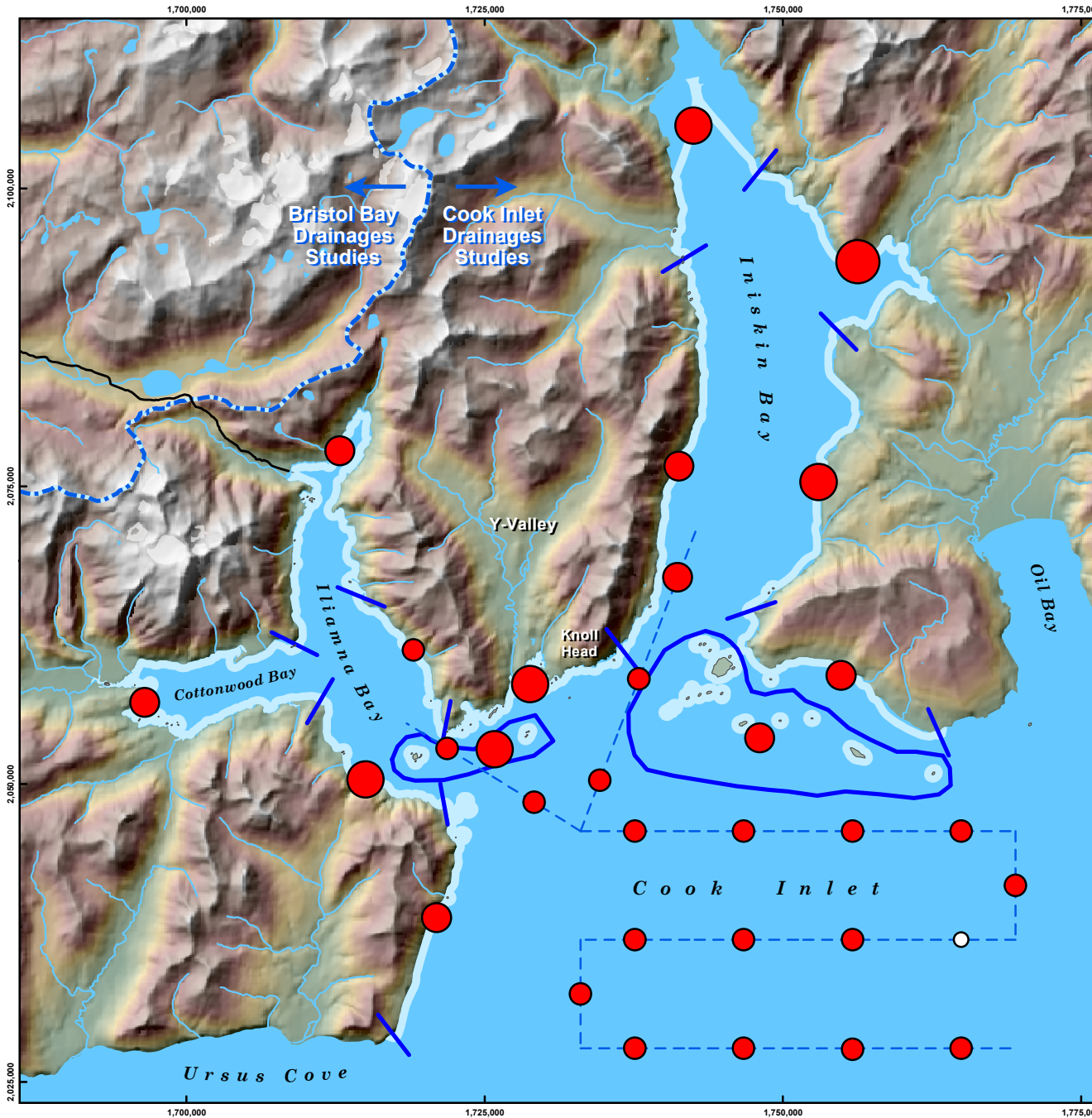
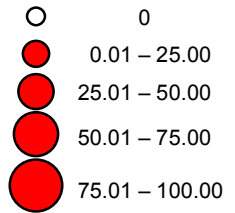


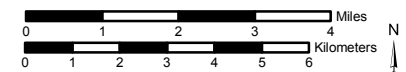
Figure 44-20
Distribution and Abundance
of Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Early Winter 2004 and 2005

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-20_BirdDens_EWin0405_PLP_EBD_v02.mxd Date: Nov. 15, 2010

Version: 2 Author: ABR-AZC

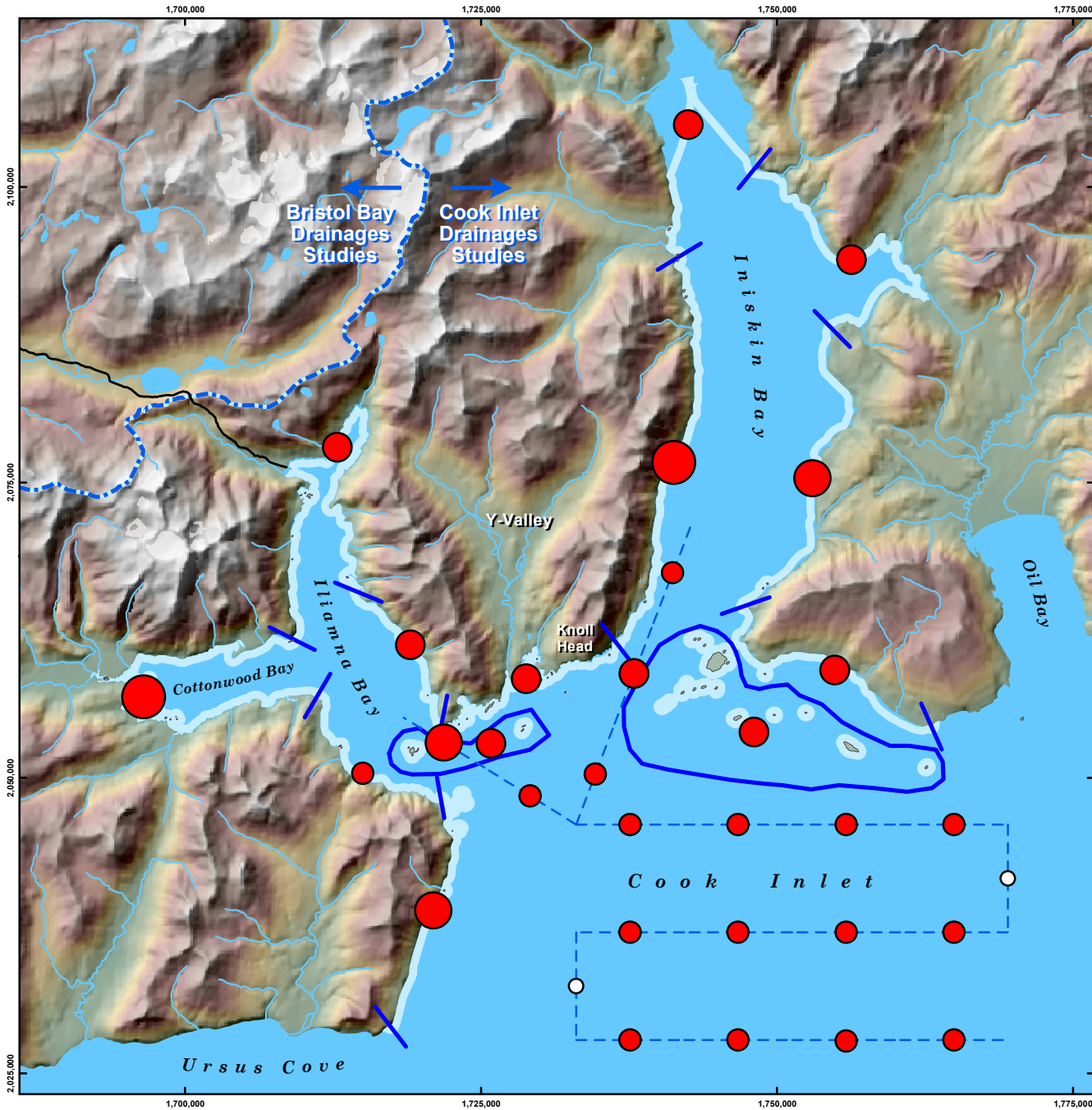
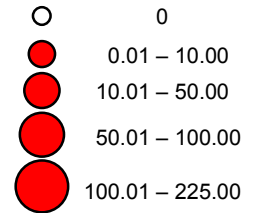


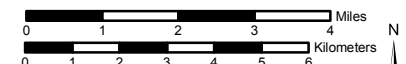
Figure 44-21
Distribution and Abundance
of Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter 2005 and 2006

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-21_BirdDens_LWin0506_PLP_EBD_v02.mxd Date: Nov. 15, 2010

Version: 2 Author: ABR-AZC



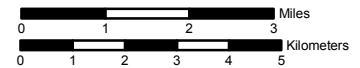
Figure 44-22
Distribution and Abundance
of Birds Counted During
Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2004

Legend

Maximal Number of Birds

- 101 – 500
- 501 – 1,000

Existing Road



Scale 1:145,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-22_WtrBrdDist_Spr04_PLP_EBD_v02.mxd Date: Nov. 15, 2010

Version: 2 Author: ABR-AZC



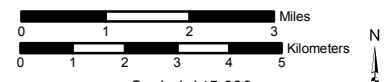
Figure 44-23
Distribution and Abundance
of Birds Counted During
Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area,
Fall 2004

Legend

Maximal Number of Birds

- 101 – 500
- 501 – 1,000
- 2,001 – 3,500

— Existing Road



Scale 1:145,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-23_WtrBrdDist_Fall04_PLP_EBD_v02.mxd	Date: Nov. 15, 2010
Version: 2	Author: ABR-AZC

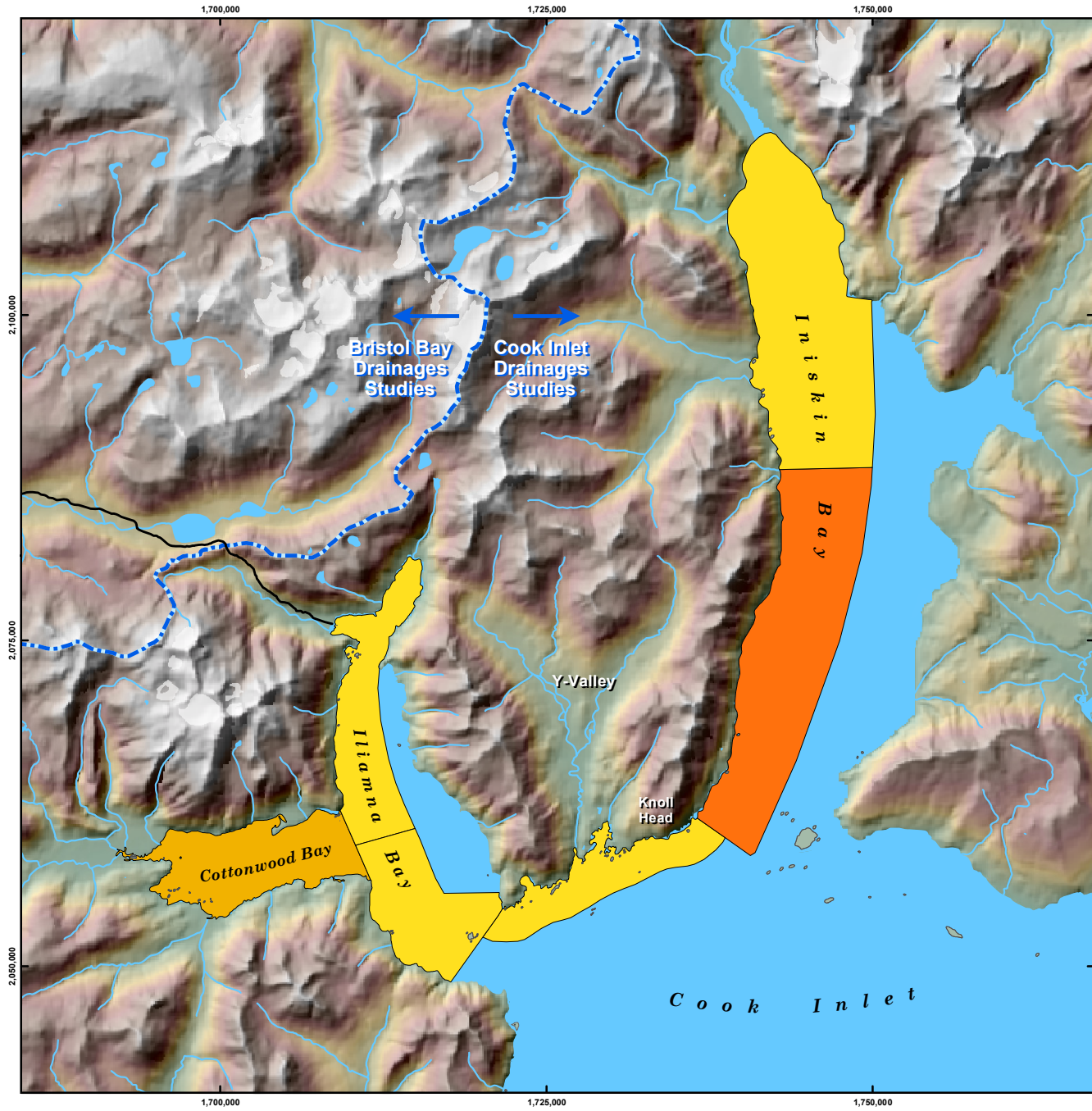
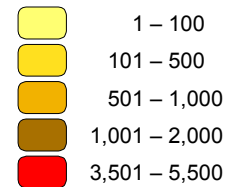




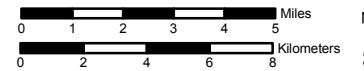
Figure 44-24
Distribution and Abundance
of Birds Counted During
Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2005

Legend

Maximal Number of Birds



Existing Road



Scale 1:240,000

Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-24_WtrBrdDist_Spr05_PLP_EBD_v02.mxd

Date: Nov. 16, 2010

Version: 2

Author: ABR-AZC

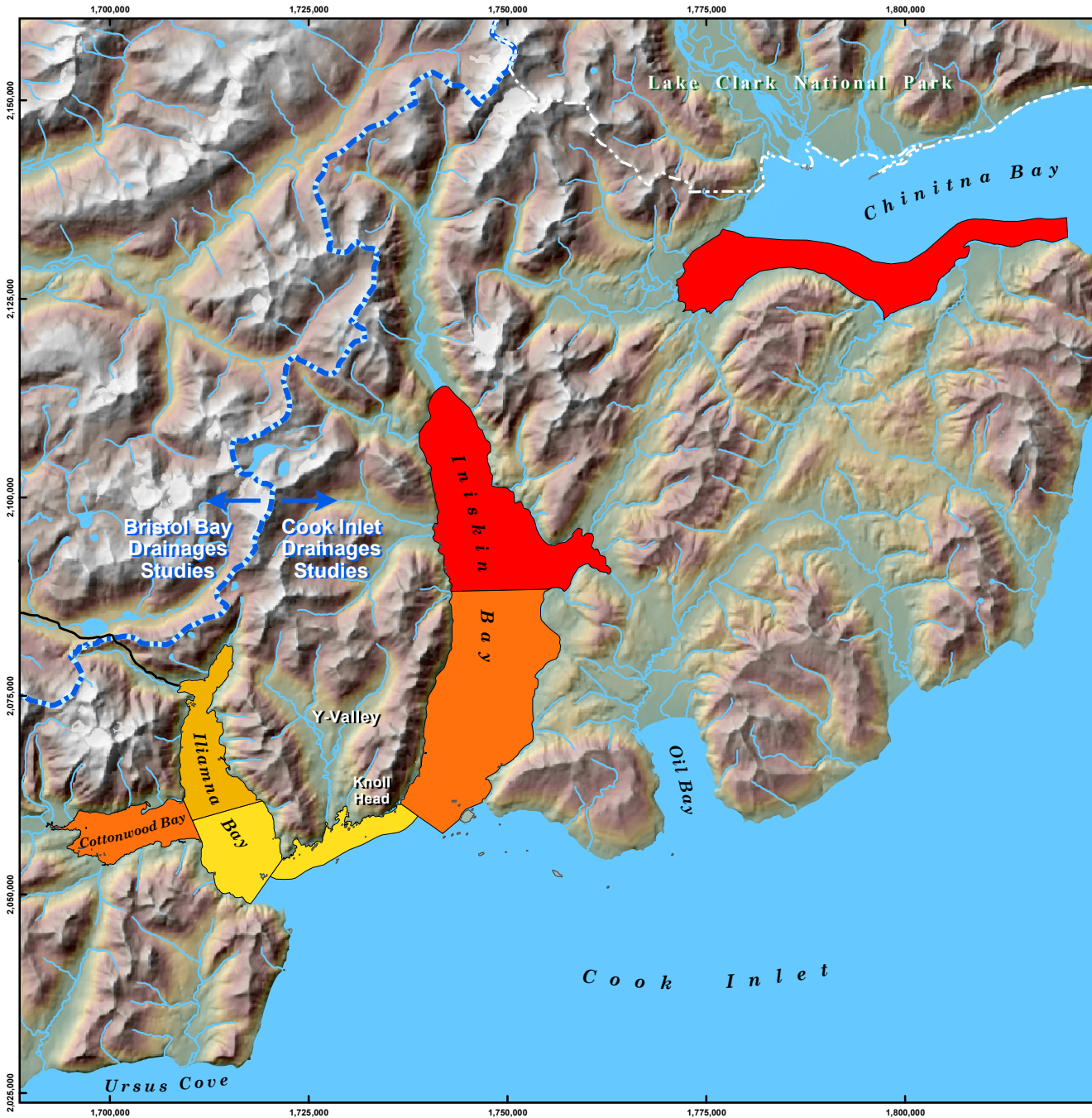


Figure 44-25
Distribution and Abundance
of Birds Counted During
Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area,
Fall 2005

Legend

Maximal Number of Birds

- 101 – 500
- 501 – 1,000
- 2,001 – 3,500
- 3,501 – 5,500

— Existing Road



Scale 1:240,000

Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-25_WtrBrdDist_Fall05_PLP_EBD_v01.mxd Date: Nov. 16, 2010

Version: 1 Author: ABR-AZC

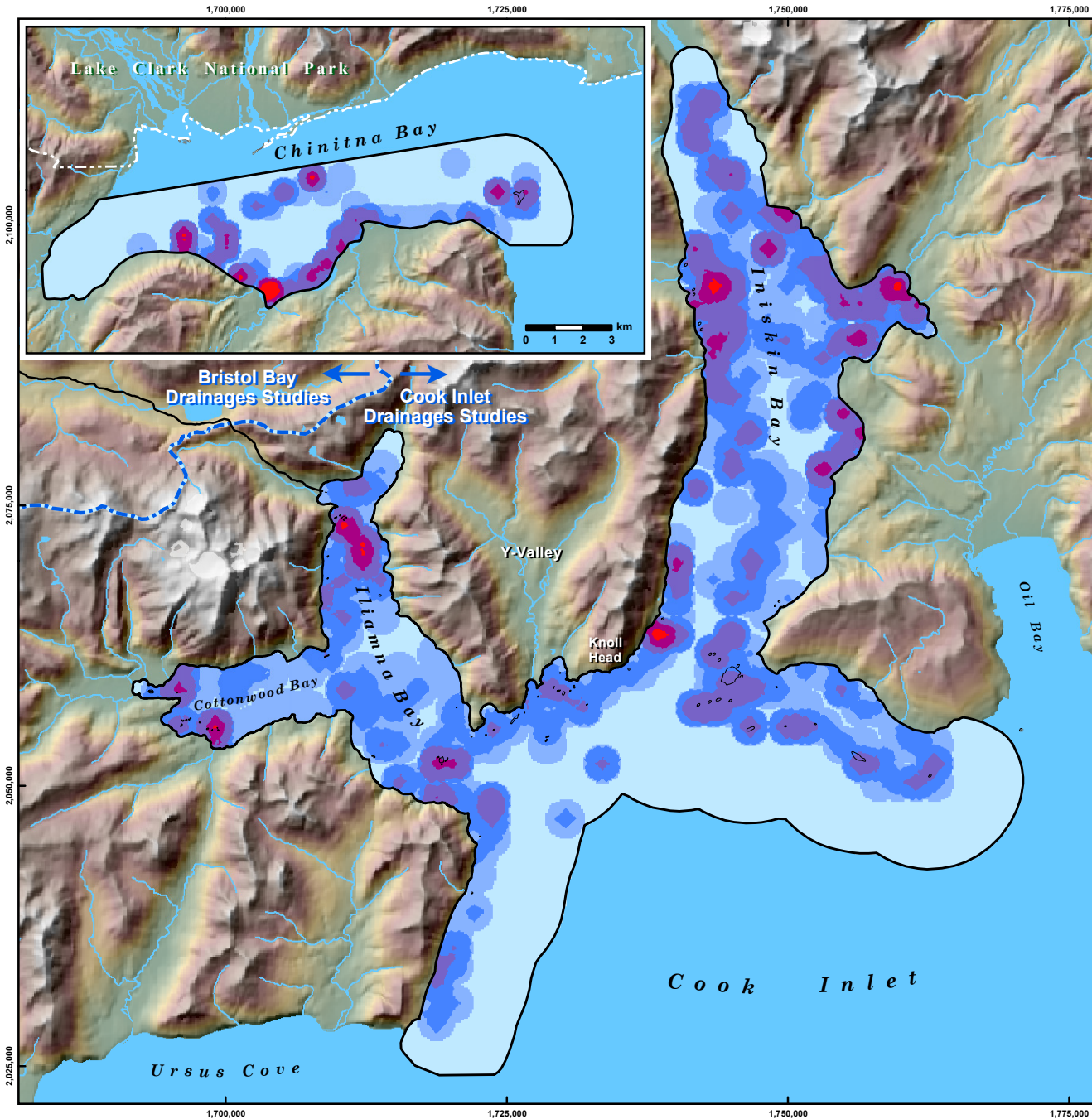
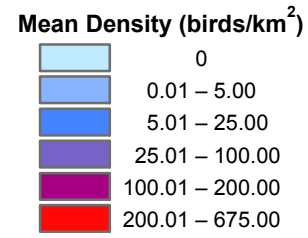


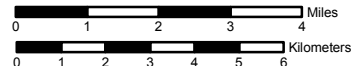
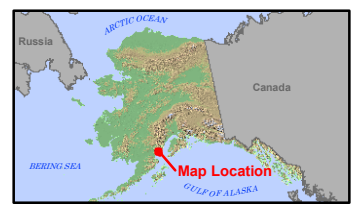
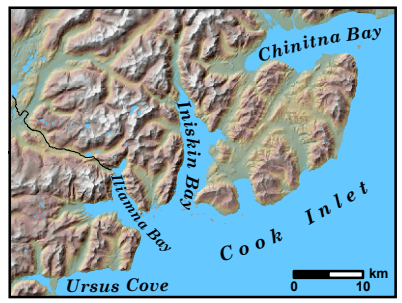
Figure 44-26
Distribution and Abundance of Birds
Counted During Helicopter-based
Marine Surveys, Cook Inlet Marine
Study Area, Fall 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-26_BirdDistHeLi_Fall0608_PLP_EBD_v02.mxd Date: Nov. 17, 2010

Version: 2 Author: ABR-AZC

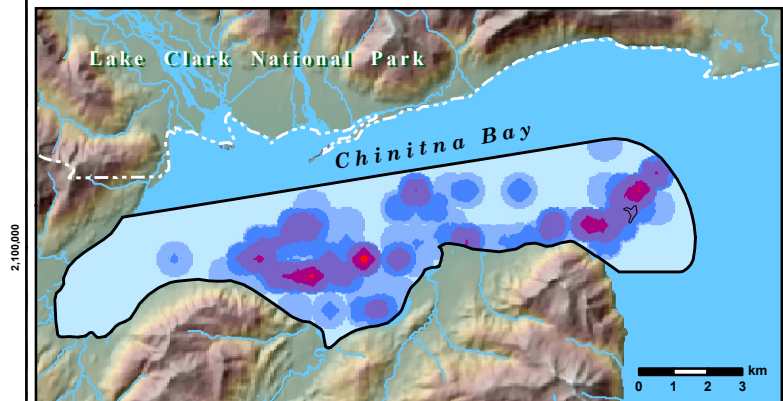
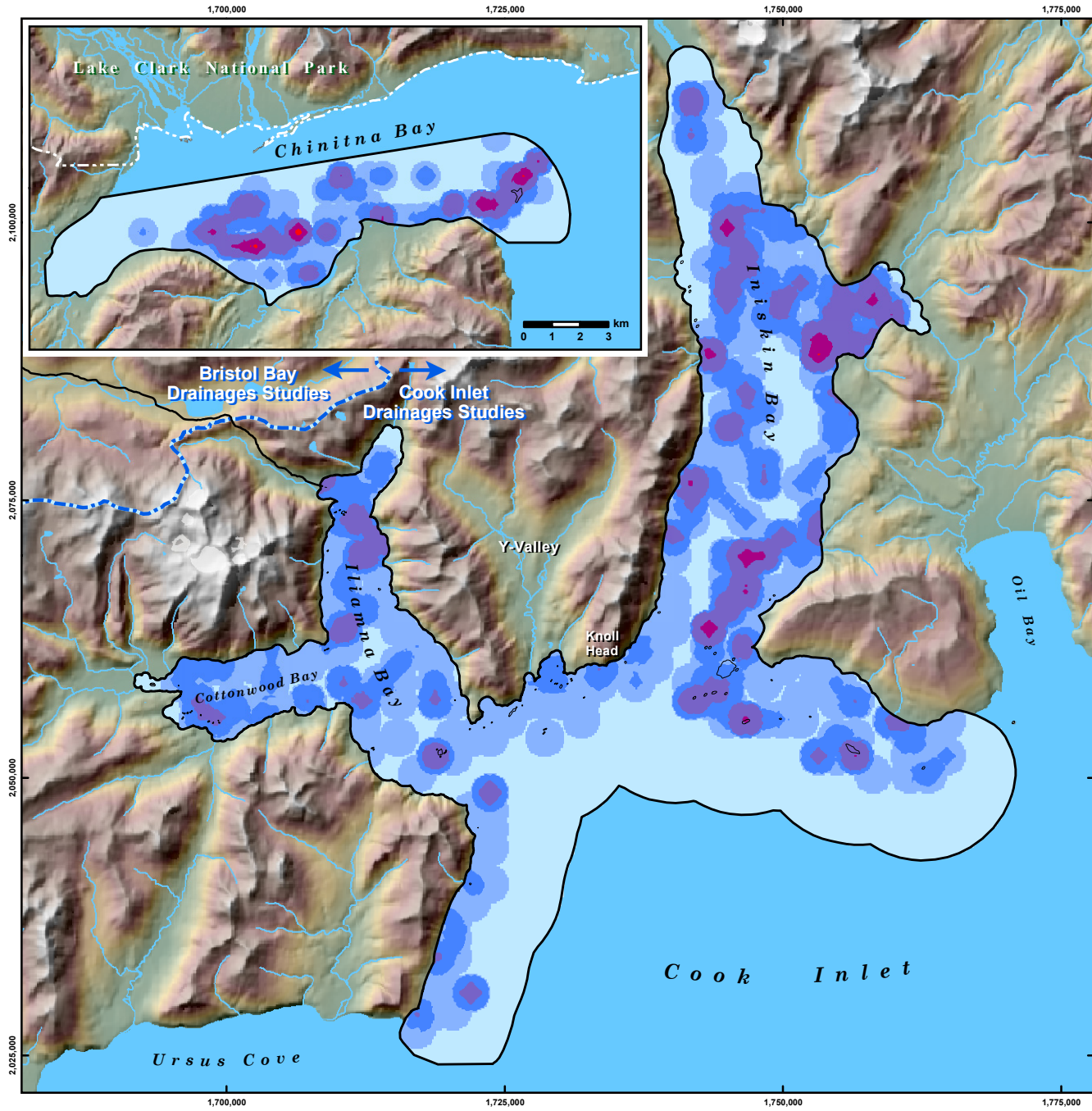
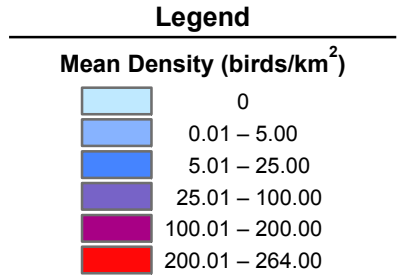
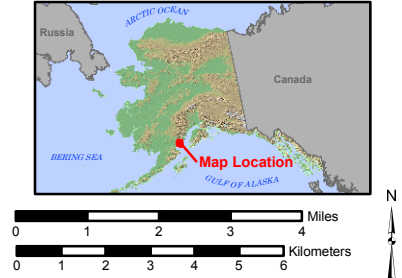
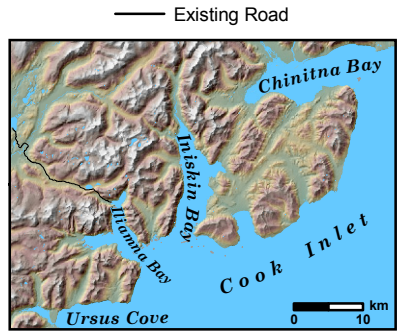


Figure 44-27
Distribution and Abundance of Birds
Counted During Helicopter-based
Marine Surveys, Cook Inlet Marine
Study Area, Mid-winter 2006–2008



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-27_BirdDistHeli_Win0608_PLP_EBD_v02.mxd Date: Nov. 17, 2010

Version: 2 Author: ABR-AZC

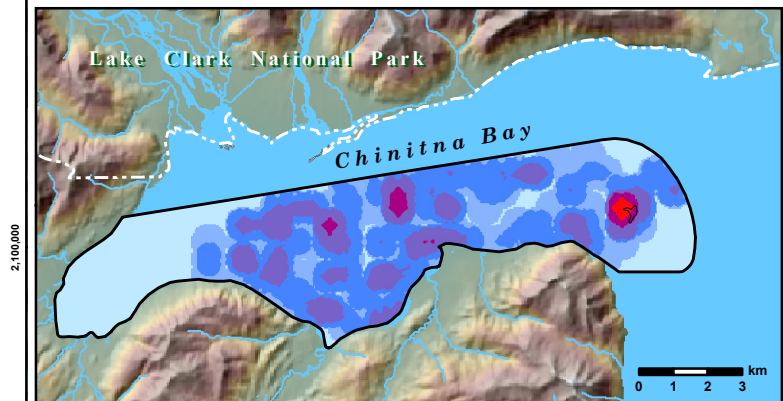
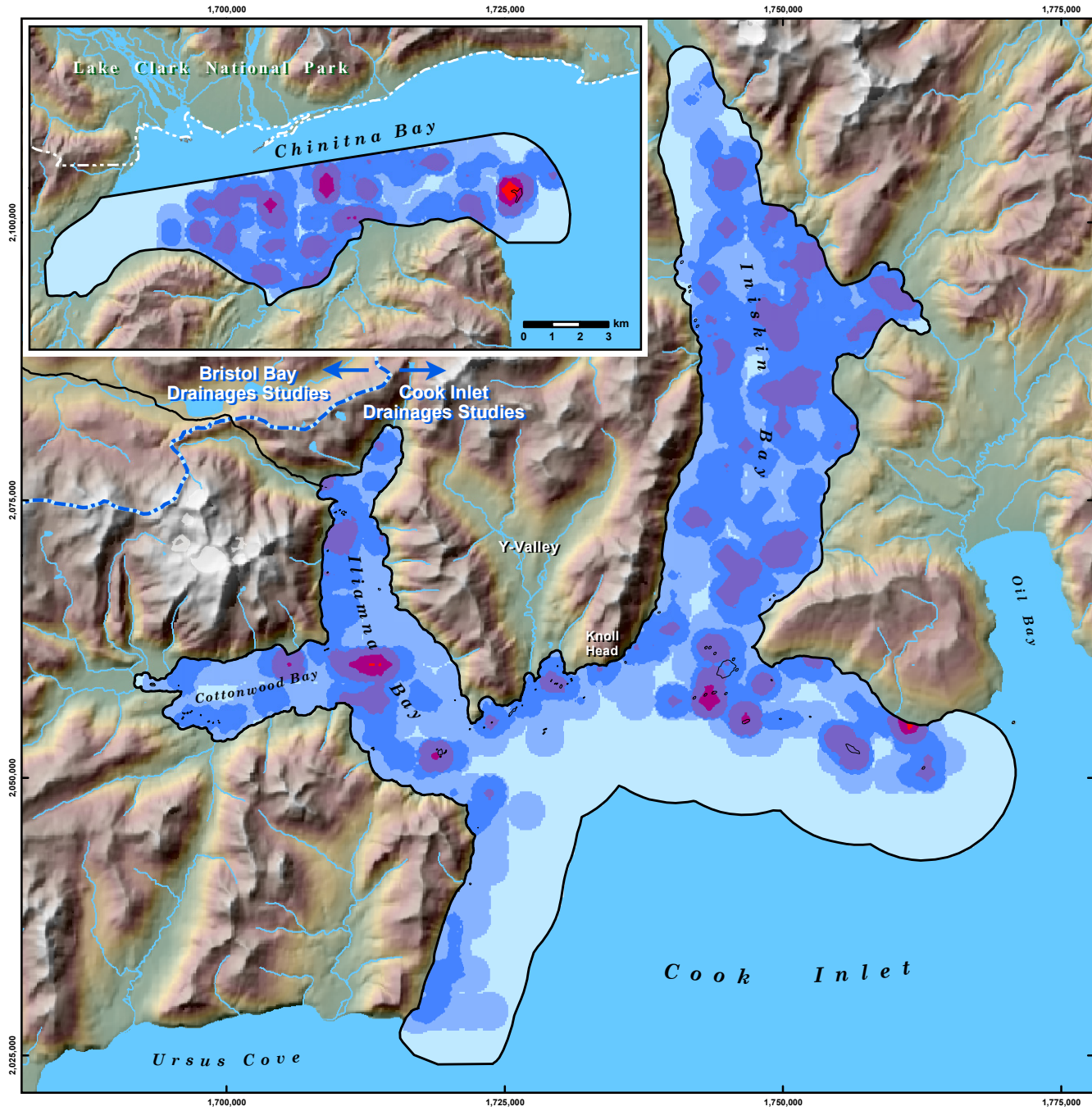
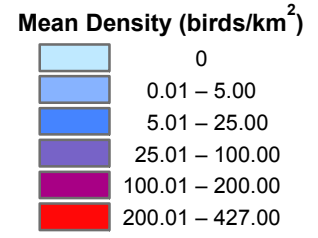


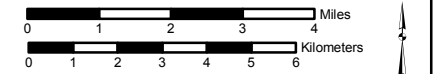
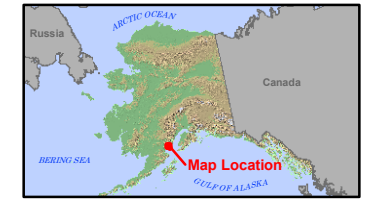
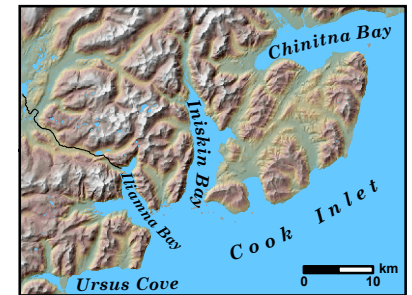
Figure 44-28
Distribution and Abundance
of Birds Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter-Spring 2006-2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:170,000

File: 44-28_BirdDistHeil_LWinSp0608_PLP_EBD_v02.mxd Date: Nov. 17, 2010

Version: 2 Author: ABR-AZC

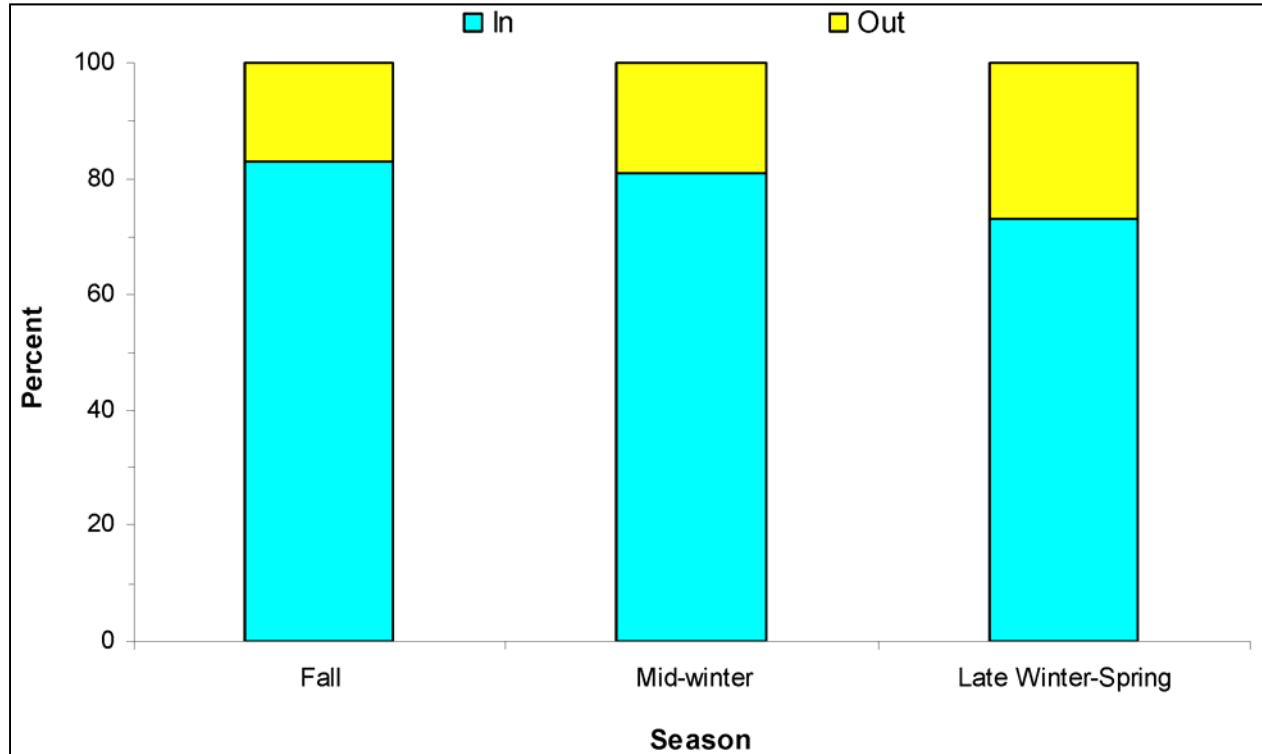


FIGURE 44-29
Inside-/outside-bay Locations of Birds Counted in and near Iliamna and Iniskin Bays during
Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

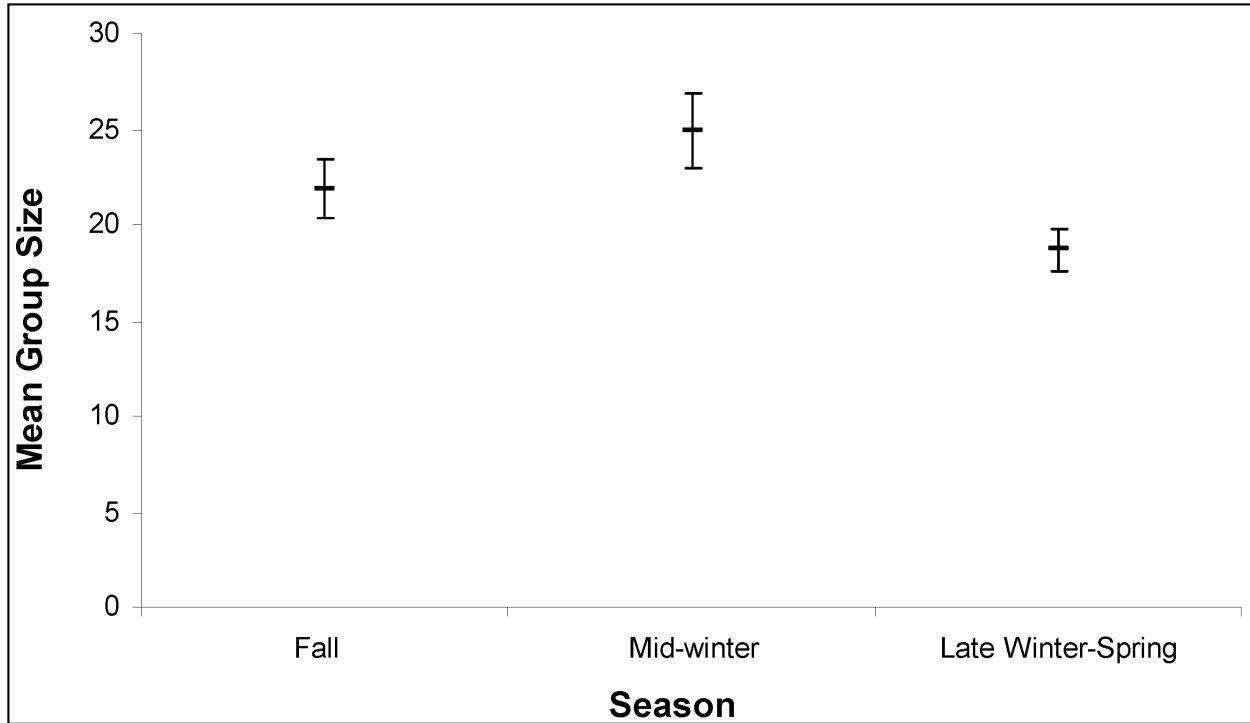


FIGURE 44-30
Mean Group Sizes of Birds Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Data are presented as mean \pm 1 standard error.

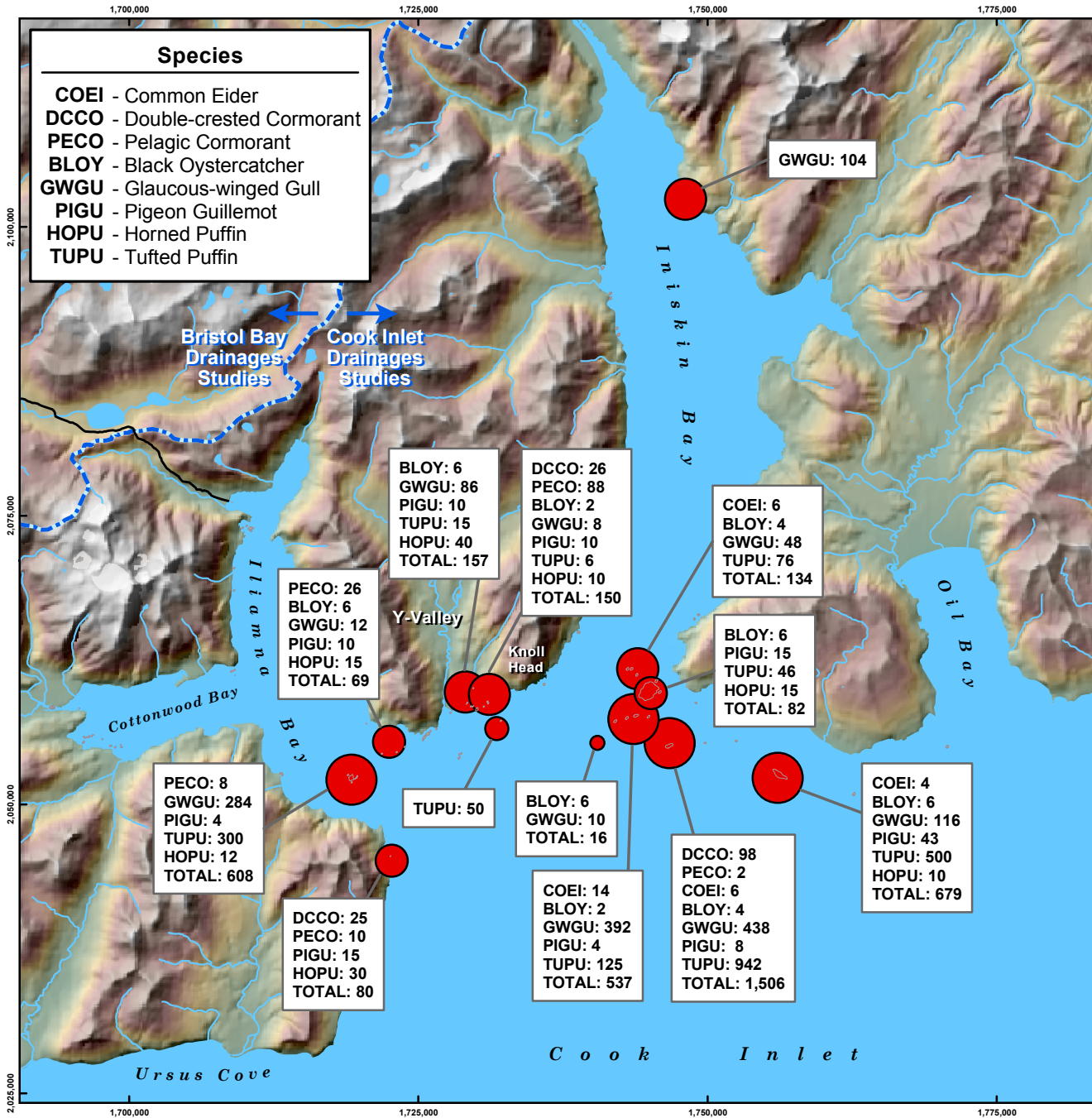


Figure 44-31
Breeding Birds Counted During
Historical Marine Surveys,
Cook Inlet Marine Study Area,
1976 and 1978

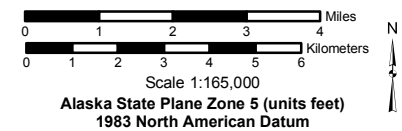
Legend

Number of Individuals¹

- 1 - 25
- 26 - 50
- 51 - 100
- 101 - 500
- >500

¹Source: USFWS, n.d.[b].

Existing Road



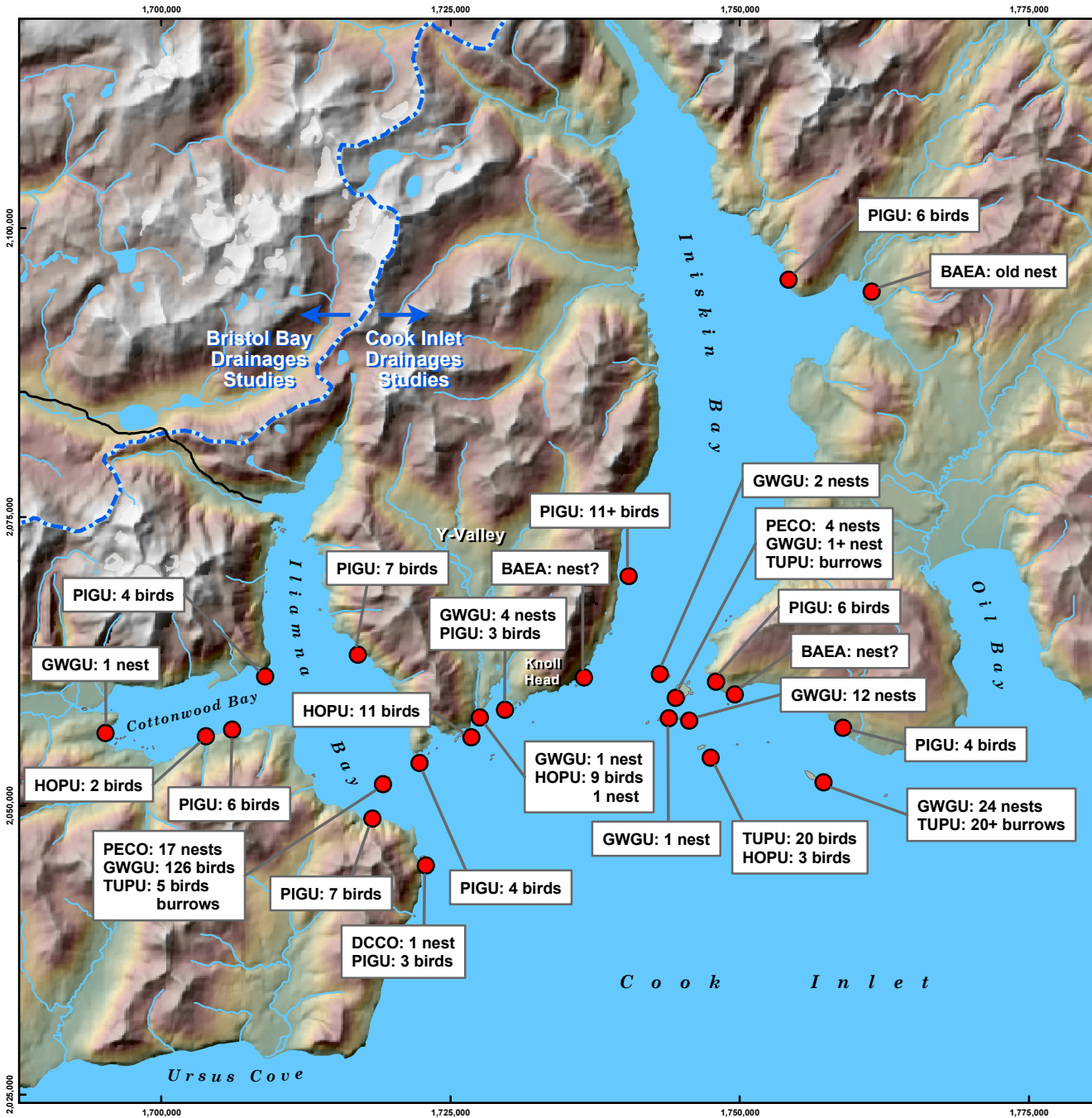
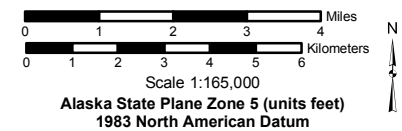


Figure 44-32
Breeding Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2004

Legend

- **Breeding Bird Location**
- DCCO - Double-crested Cormorant
- PECO - Pelagic Cormorant
- BAEA - Bald Eagle
- GWGU - Glaucous-winged Gull
- PIGU - Pigeon Guillemot
- TUPU - Tufted Puffin
- HOPU - Horned Puffin

— Existing Road



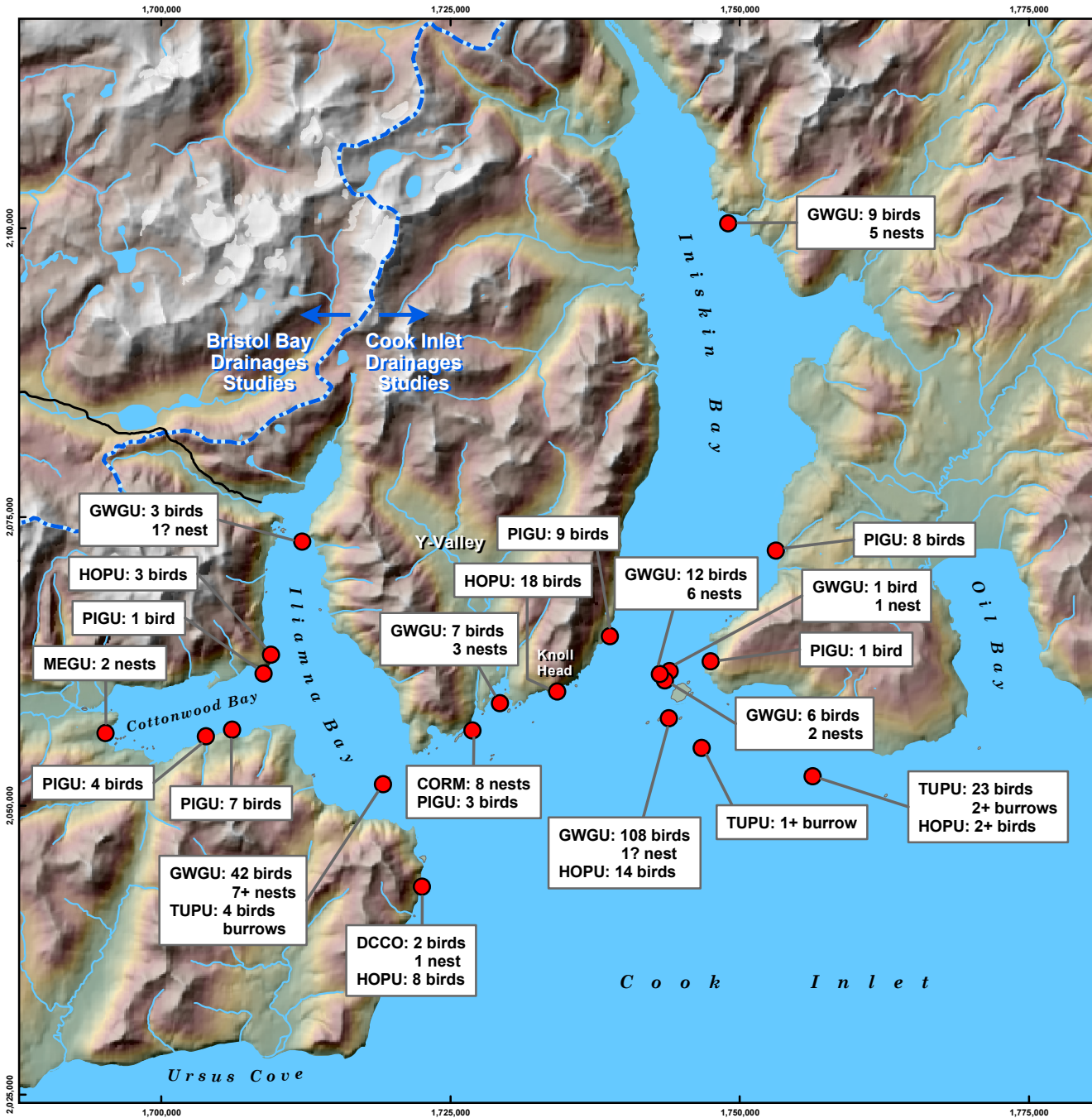
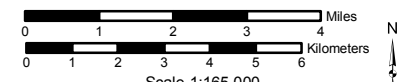


Figure 44-33
Breeding Birds Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2005

Legend

- **Breeding Bird Location**
- DCCO** - Double-crested Cormorant
- CORM** - Unidentified Cormorant
- MEGU** - Mew Gull
- GWGU** - Glaucous-winged Gull
- PIGU** - Pigeon Guillemot
- TUPU** - Tufted Puffin
- HOPU** - Horned Puffin

— Existing Road



Scale 1:165,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-33_BrdBird_BoatSum05_PLP_EBD_v02.mxd	Date: Nov. 16, 2010
Version: 2	Author: ABR-AZC

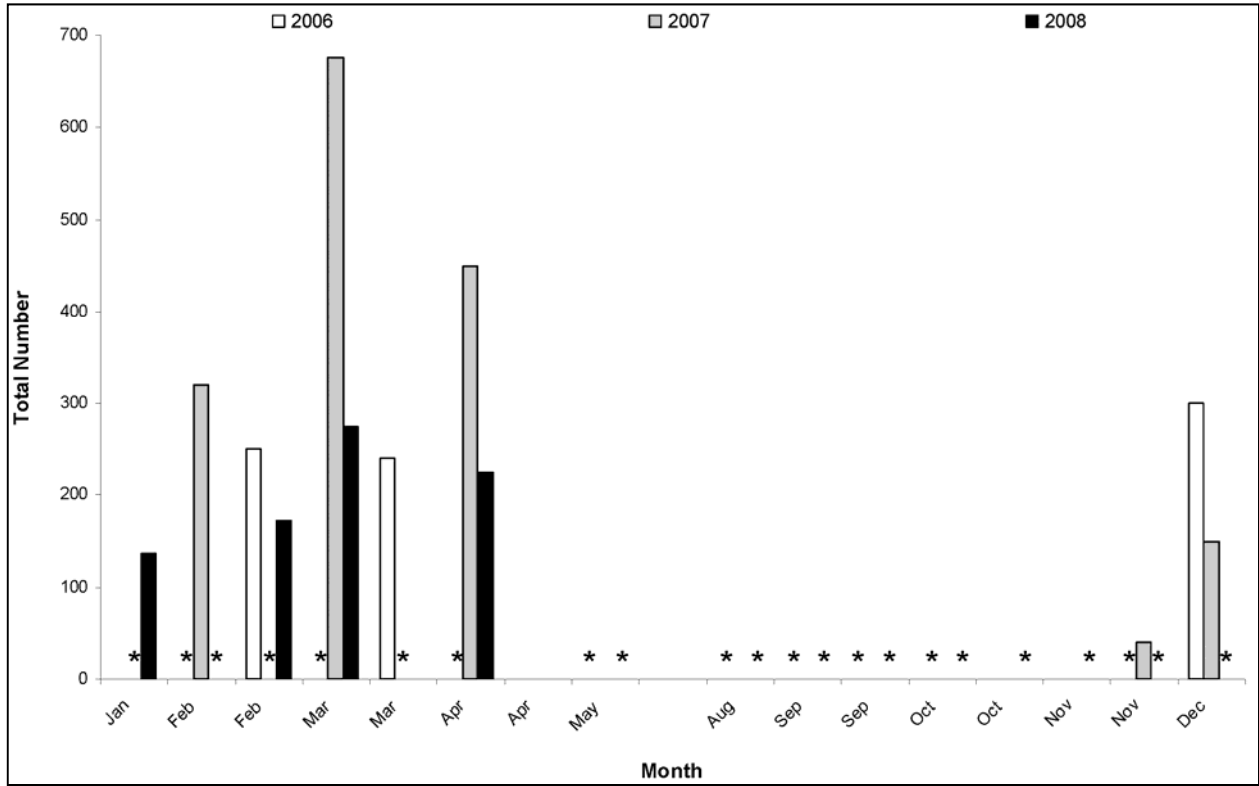


FIGURE 44-34
 Maximal Numbers of Steller's Eiders Counted during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

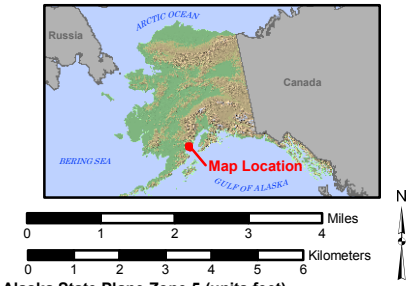
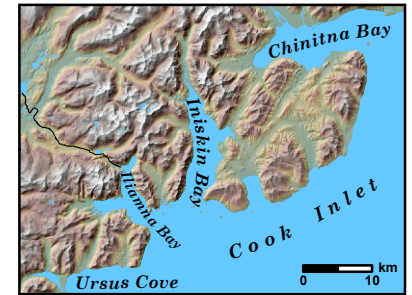


Figure 44-35
Distribution and Abundance of
Steller's Eiders Counted During
Aerial Marine Surveys, 2006–2008, and
Other Miscellaneous Records, 2004–
2006, Cook Inlet Marine Study Area

Legend

Number of Individuals	Month
○ 1 – 50	○ January
○ 51 – 150	○ February
○ 151 – 250	○ March
○ 251 – 450	○ April
○ 675	○ November
	○ December

— 200-m Nearshore Survey Area — Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-35_STEIDist_Heli0408_PLP_EBD_v02.mxd Date: Nov. 18, 2010

Version: 2 Author: ABR-AZC

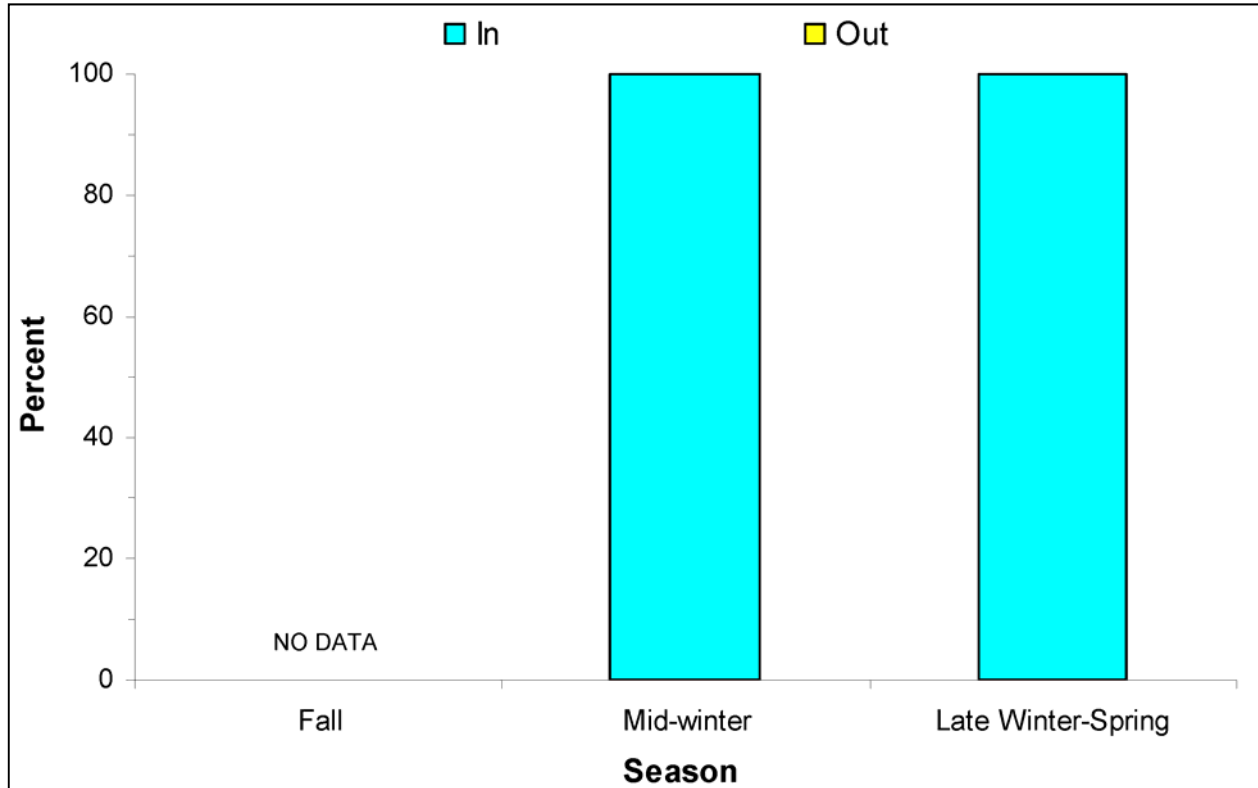


FIGURE 44-36
Inside-/outside-bay Locations of Steller's Eiders Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

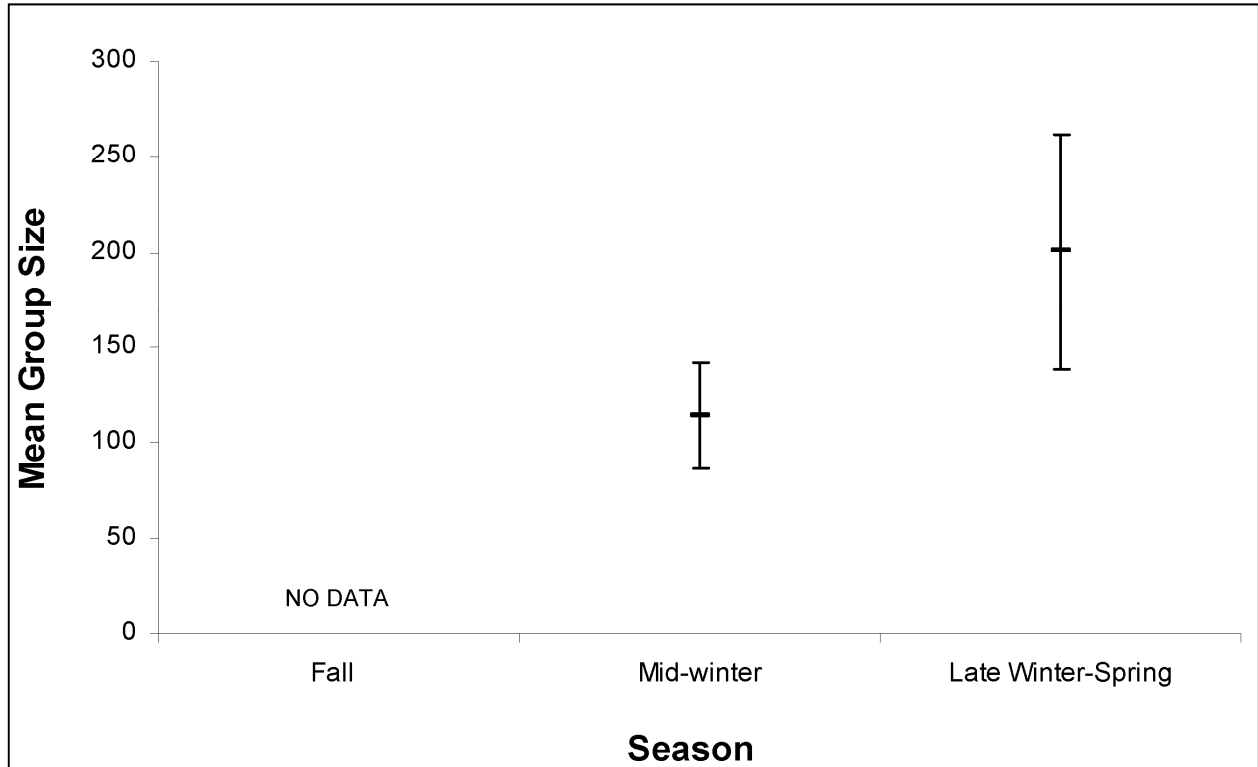


FIGURE 44-37
Mean Group Sizes of Steller's Eiders Counted in and near Iliamna and Iniskin Bays during
Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Data are presented as mean \pm 1 standard error.

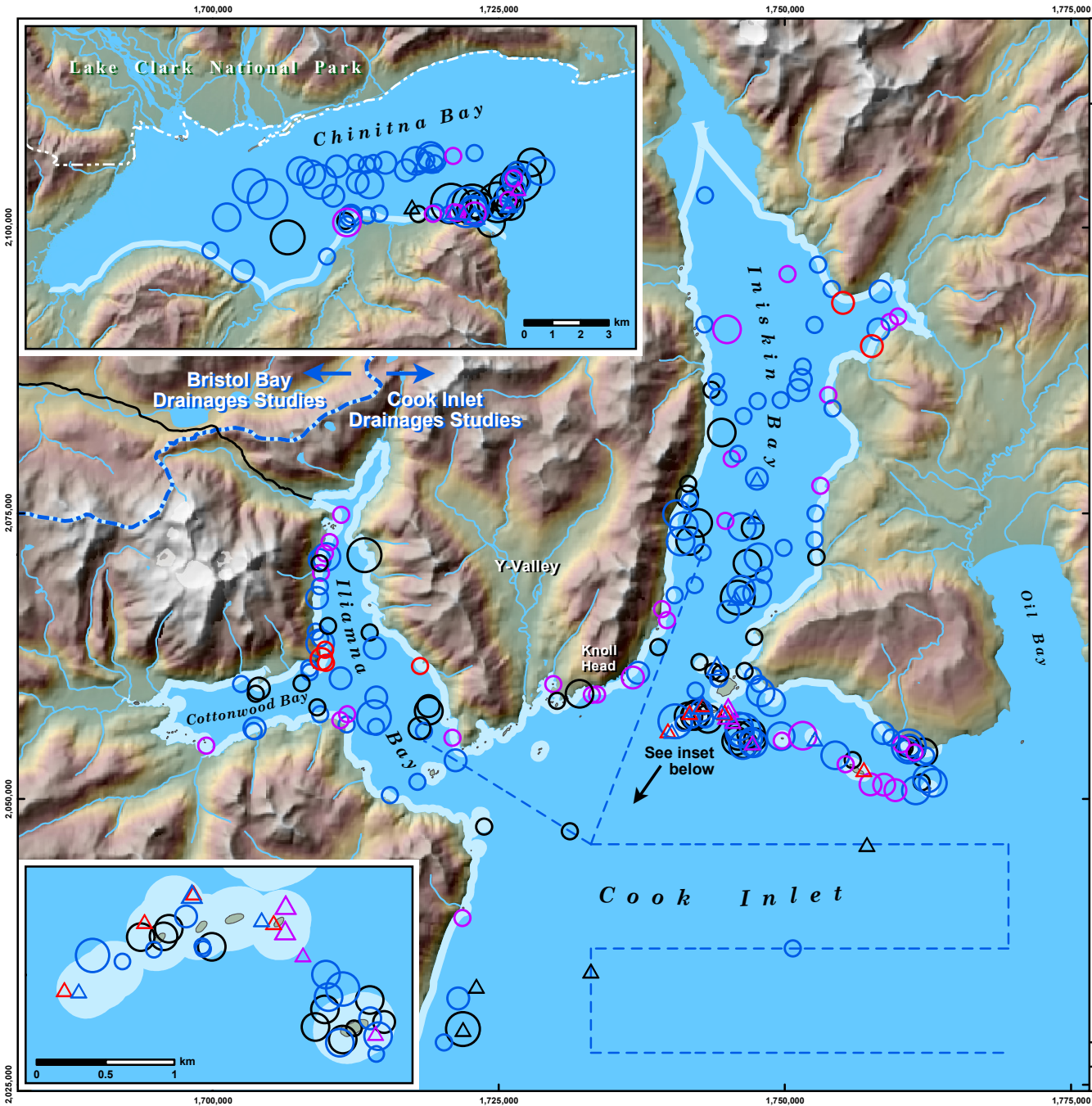
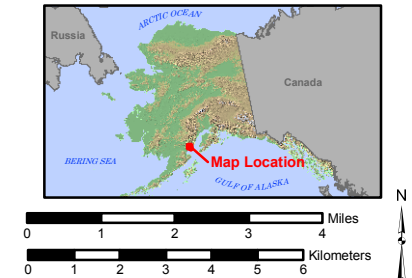
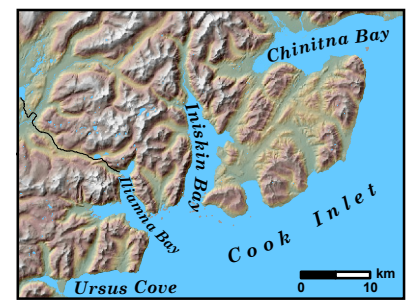


Figure 44-38
Distribution and Abundance of Common Eiders and Black Scoters Counted During Boat-based and Aerial Marine Surveys, Cook Inlet Marine Study Area, 2004–2008

Legend

Number of Individuals		Season	
1 – 10	Black Scoter (Small Circle)	Common Eider (Small Triangle)	Fall (Pink)
11 – 25	Black Scoter (Medium Circle)	Common Eider (Medium Triangle)	Mid-winter (Black)
26 – 100	Black Scoter (Large Circle)	Common Eider (Large Triangle)	Late Winter–Spring (Blue)
101 – 200	Black Scoter (Very Large Circle)	Common Eider (Very Large Triangle)	Summer (Red)
201 – 350	Black Scoter (Extremely Large Circle)	Common Eider (Extremely Large Triangle)	

- - - Offshore Survey Transect
 200-m Nearshore Survey Area
 Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-38_COEI_AMSCDist_0408_PLP_EBD_v03.mxd Date: July 18, 2011

Version: 3 Author: ABR-AZC

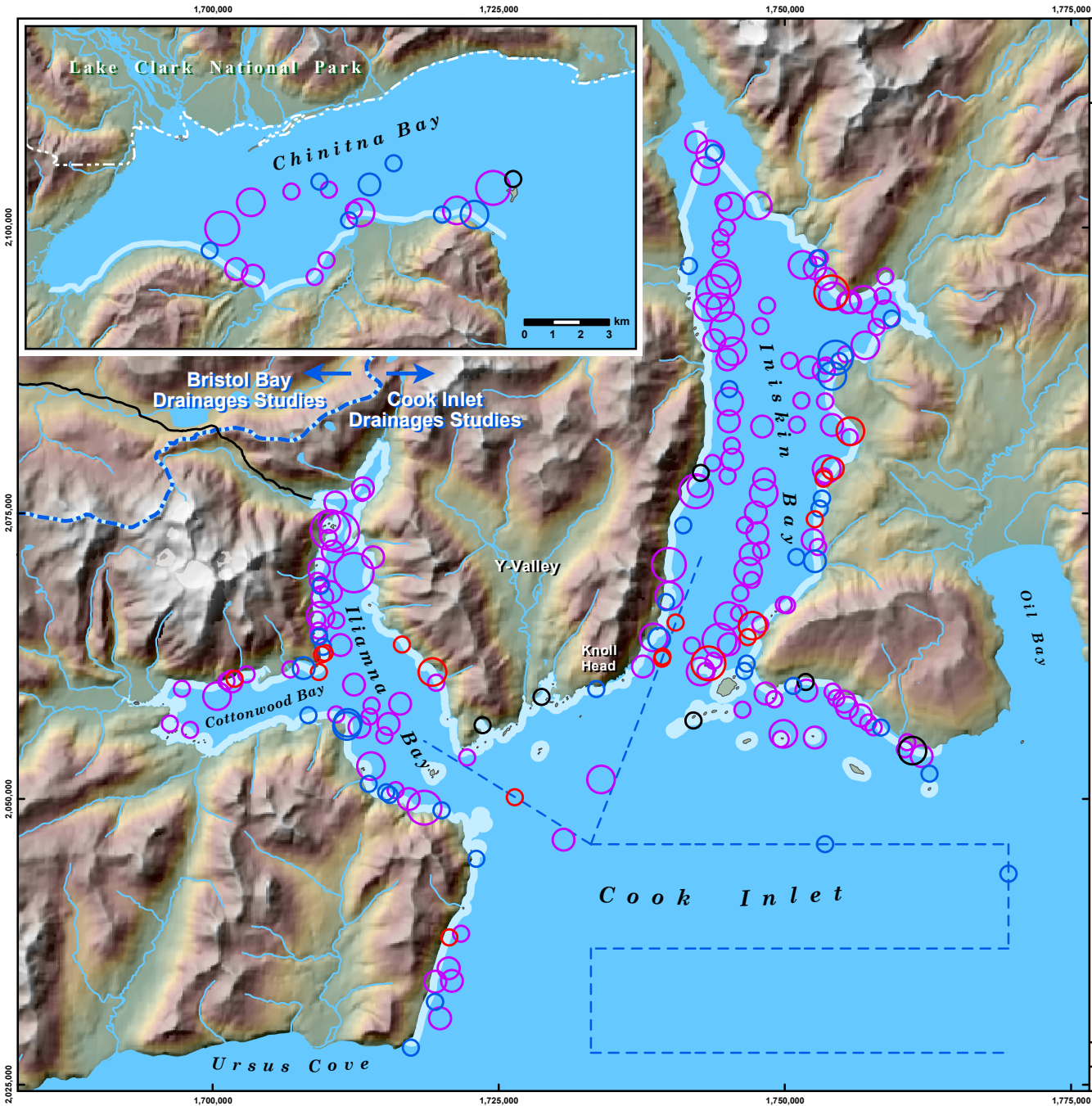
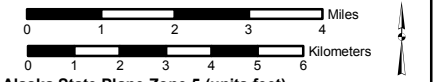
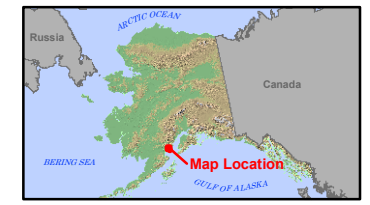
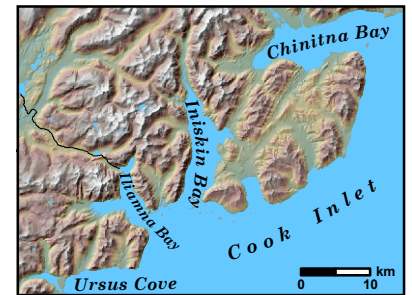


Figure 44-39
Distribution and Abundance of Surf Scoters Counted During Boat-based and Aerial Marine Surveys, Cook Inlet Marine Study Area, 2004–2008

Legend

Number of Individuals	Season
○ 1 – 10	○ Fall
○ 11 – 25	○ Mid-winter
○ 26 – 100	○ Late Winter–Spring
○ 101 – 200	○ Summer
○ 201 – 300	— Offshore Survey Transect
	— 200-m Nearshore Survey Area
	— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:165,000

File: 44-39_SUSCDist_Heil0408_PLP_EBD_v02.mxd Date: Nov. 18, 2010

Version: 2 Author: ABR-AZC

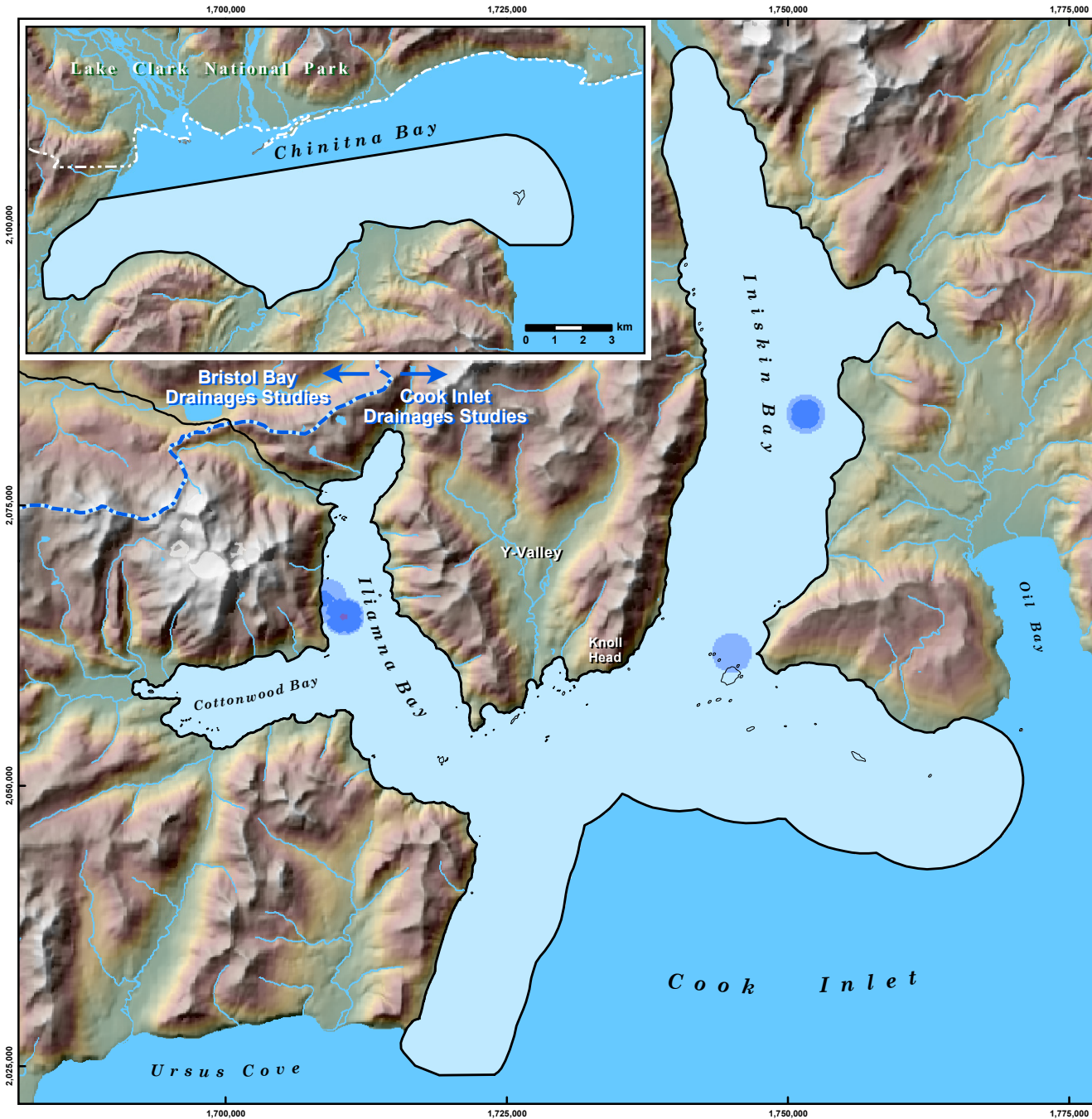
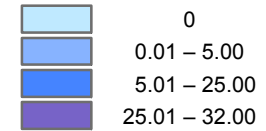


Figure 44-40
Distribution and Abundance of
Long-tailed Ducks Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Fall 2006–2008

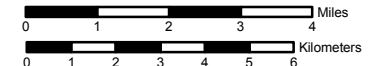
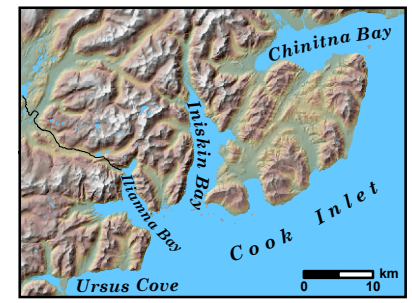
Legend

Mean Density (birds/km²)



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

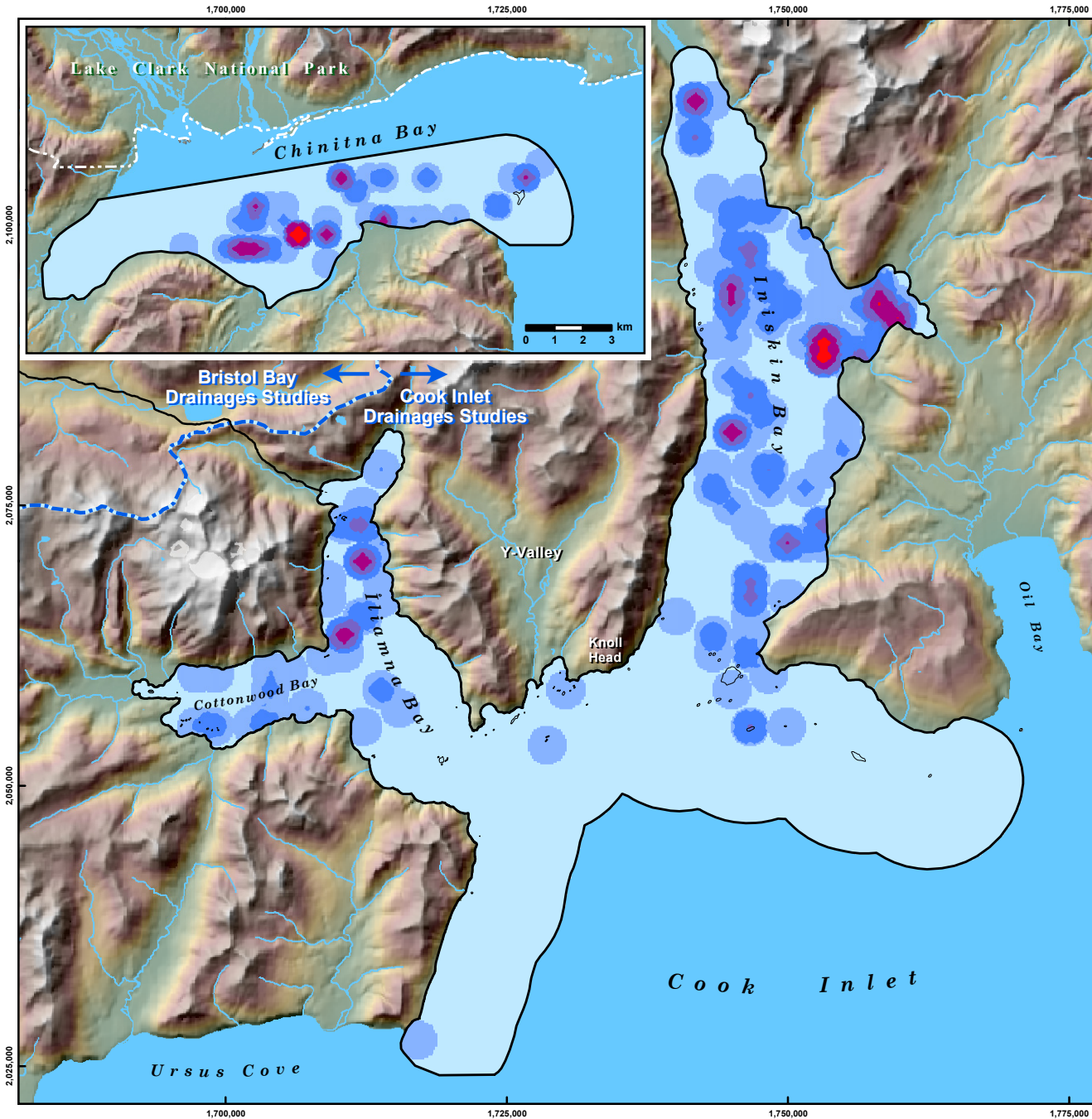
— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-40_LTDUDist_Fall0608_PLP_EBD_v02.mxd Date: Nov. 18, 2010

Version: 2 Author: ABR-AZC



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2,075,000

2,050,000

2,025,000

1,700,000

1,725,000

1,750,000

1,775,000

1,700,000

1,725,000

1,750,000

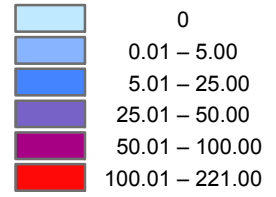
1,775,000



Figure 44-41
Distribution and Abundance of
Long-tailed Ducks Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Mid-winter 2006–2008

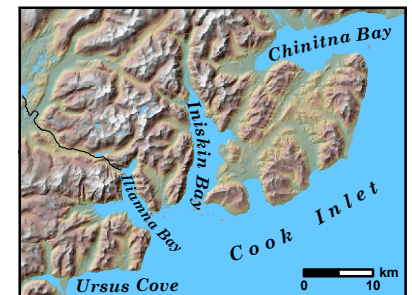
Legend

Mean Density (birds/km²)



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-41_LTDUDist_Win0608_PLP_EBD_v02.mxd Date: Nov. 18, 2010

Version: 2 Author: ABR-AZC

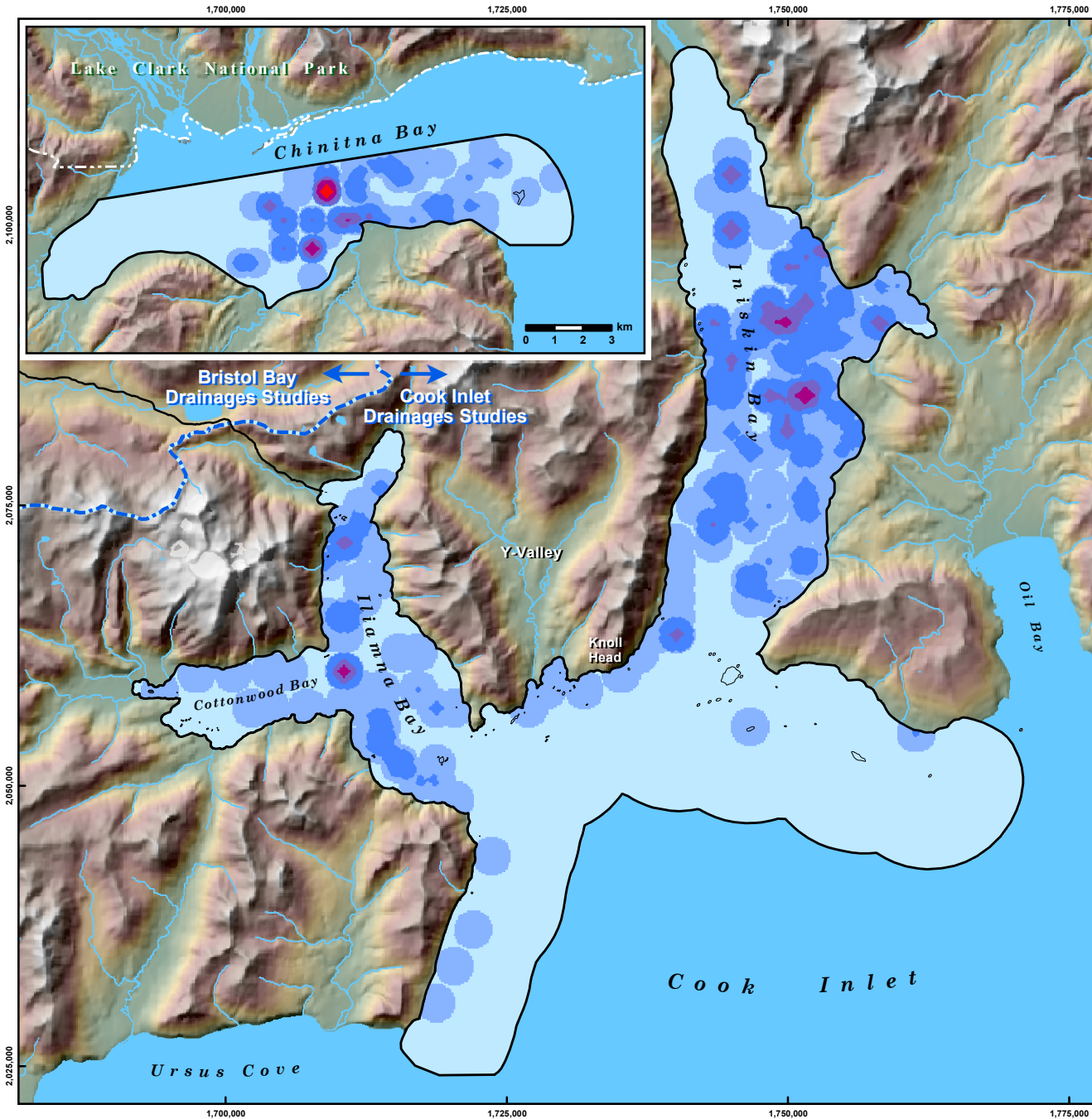
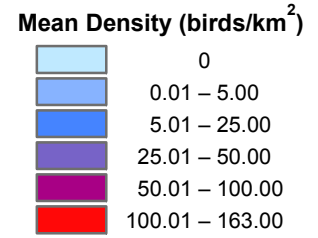


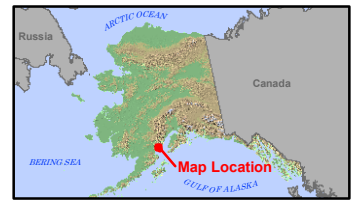
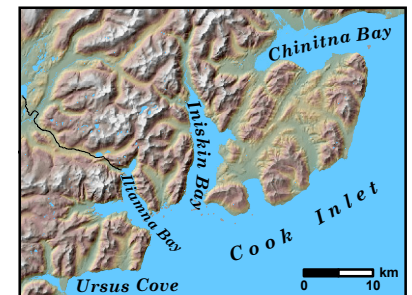
Figure 44-42
Distribution and Abundance of
Long-tailed Ducks Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter–Spring 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-42_LTDUDist_LWinSp0608_PLP_EBD_v02.mxd Date: Nov. 18, 2010

Version: 2 Author: ABR-AZC



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2,075,000
2,050,000
2,025,000

1,700,000 1,725,000 1,750,000 1,775,000

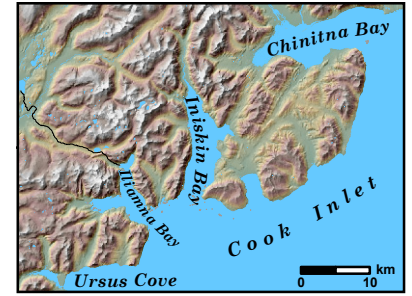


Figure 44-43
Distribution and Abundance of
Waterbirds and Raptors of
Conservation Concern Counted
During Boat-based and Aerial Marine
Surveys, Cook Inlet Marine
Study Area, 2004–2008

Legend

Number of Individuals				Season
Red-throated Loon	Horned Grebe	Golden Eagle	Bald Eagle	
1	☆	△	○	○ Fall
2–3	☆		○	○ Mid-winter
4–5	☆		○	○ Late Winter–Spring
6–8	☆		○	○ Summer

Offshore Survey Transect ——— 200-m Nearshore Survey Area ——— Existing Road ———



0 1 2 3 4 Miles
0 1 2 3 4 5 6 Kilometers

Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-43_MiscConcernDist_0408_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC

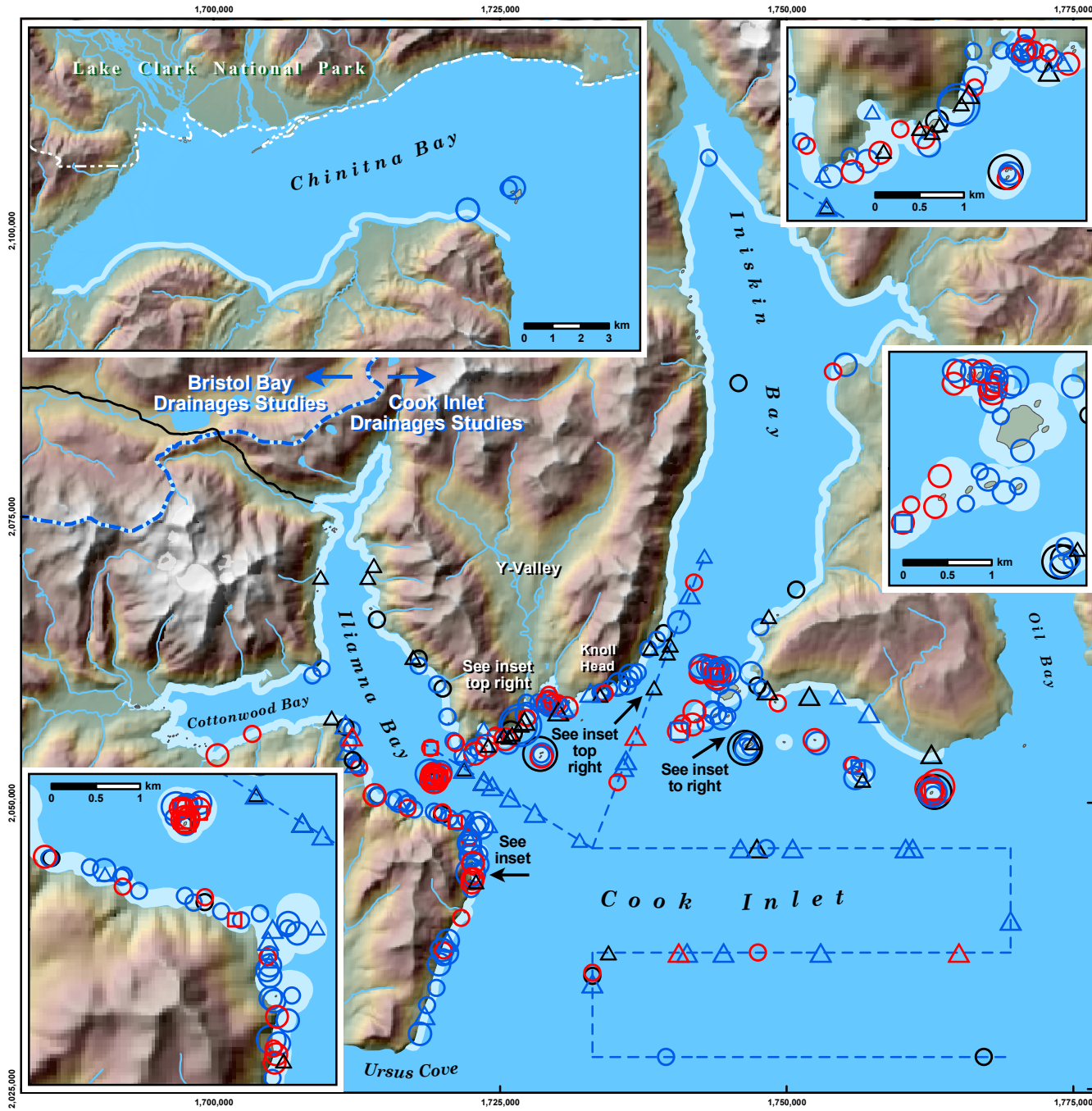
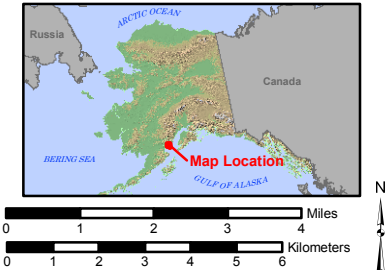
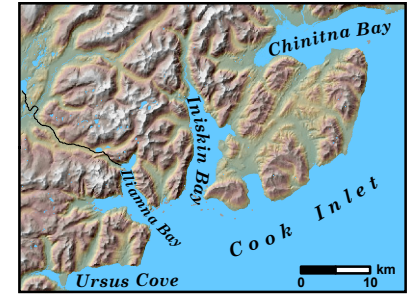


Figure 44-44
Distribution and Abundance of Seabirds of Conservation Concern Counted During Boat-based and Aerial Marine Surveys, Cook Inlet Marine Study Area, 2004–2008

Legend

Number of Individuals			Season
Red-faced Cormorant	Pelagic Cormorant	Marbled Murrelet	○ Mid-winter
1 □	○	△	○ Late Winter-Spring
2-10 □	○	△	○ Summer
11-25 □	○	△	— Offshore Survey Transect
25-45 □	○	△	— 200-m Nearshore Survey Area
90 □	○	△	— Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-44_SeabirdConcernDist_0408_PLP_EBD_v02.mxd Date: Nov. 19, 2010

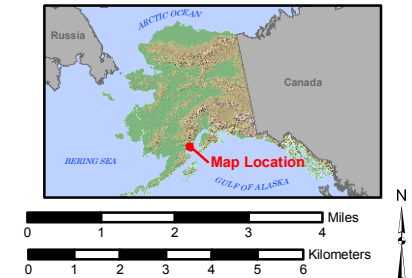
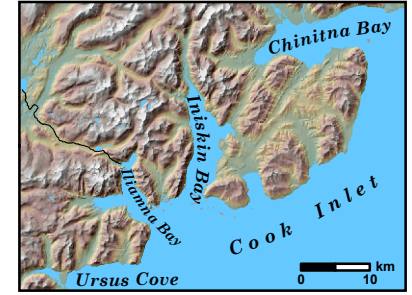
Version: 2 Author: ABR-AZC



Figure 44-45
Distribution and Abundance of
Black Oystercatchers and Dunlins
Counted During Boat-based and
Aerial Marine Surveys, Cook Inlet
Marine Study Area, 2004–2008

Legend

Number of Individuals		Season	
1 – 10	○	Black Oystercatcher	△
11 – 25	○		△
26 – 50	○		△
51 – 100	○		△
101 – 500	○		△
		— —	Offshore Survey Transect
		—	200-m Nearshore Survey Area
		—	Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-45_BLOY-DUNLDist_0408_PLP_EBD_v02.mxd	Date: Nov. 19, 2010
Version: 2	Author: ABR-AZC



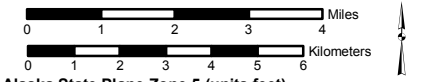
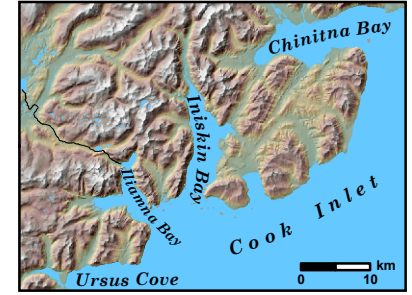
Figure 44-46
Distribution and Abundance of
Shorebird Species of Conservation
Concern During Boat-based and
Aerial Marine Surveys, Cook Inlet
Marine Study Area, 2004–2008

Legend

	Number of Individuals ¹				
	1	2–5	6–10	11–15	41
Marbled Godwit	☆	☆	☆	☆	☆
Black Turnstone	○	○	○	○	○
Surfbird	△	△	△	△	△

¹All birds were seen on spring surveys.

Offshore Survey Transect	—	—	—
200-m Nearshore Survey Area	—	—	—
Existing Road	—	—	—



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-46_SBCConcernDist_0408_PLP_EBD_v02.mxd Date: Nov. 19, 2010

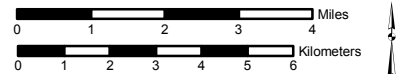
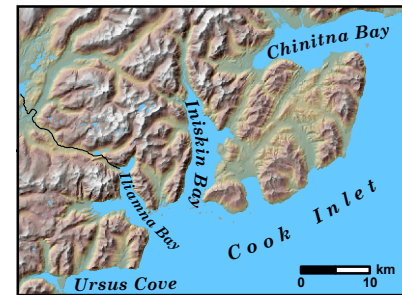
Version: 2 Author: ABR-AZC



Figure 44-47
Distribution and Abundance of
Rock Sandpipers Counted During
Boat-based and Aerial Marine
Surveys, Cook Inlet Marine
Study Area, 2004–2008

Legend

Number of Individuals	Season
○ 1 – 10	○ Fall
○ 11 – 25	○ Mid-winter
○ 26 – 50	○ Late Winter–Spring
○ 51 – 100	— Offshore Survey Transect
○ 101 – 250	— 200-m Nearshore Survey Area
	— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:165,000

File: 44-47_ROSA_Dist_0408_PLP_EBD_v02.mxd Date: Nov. 17, 2010

Version: 2 Author: ABR-AZC

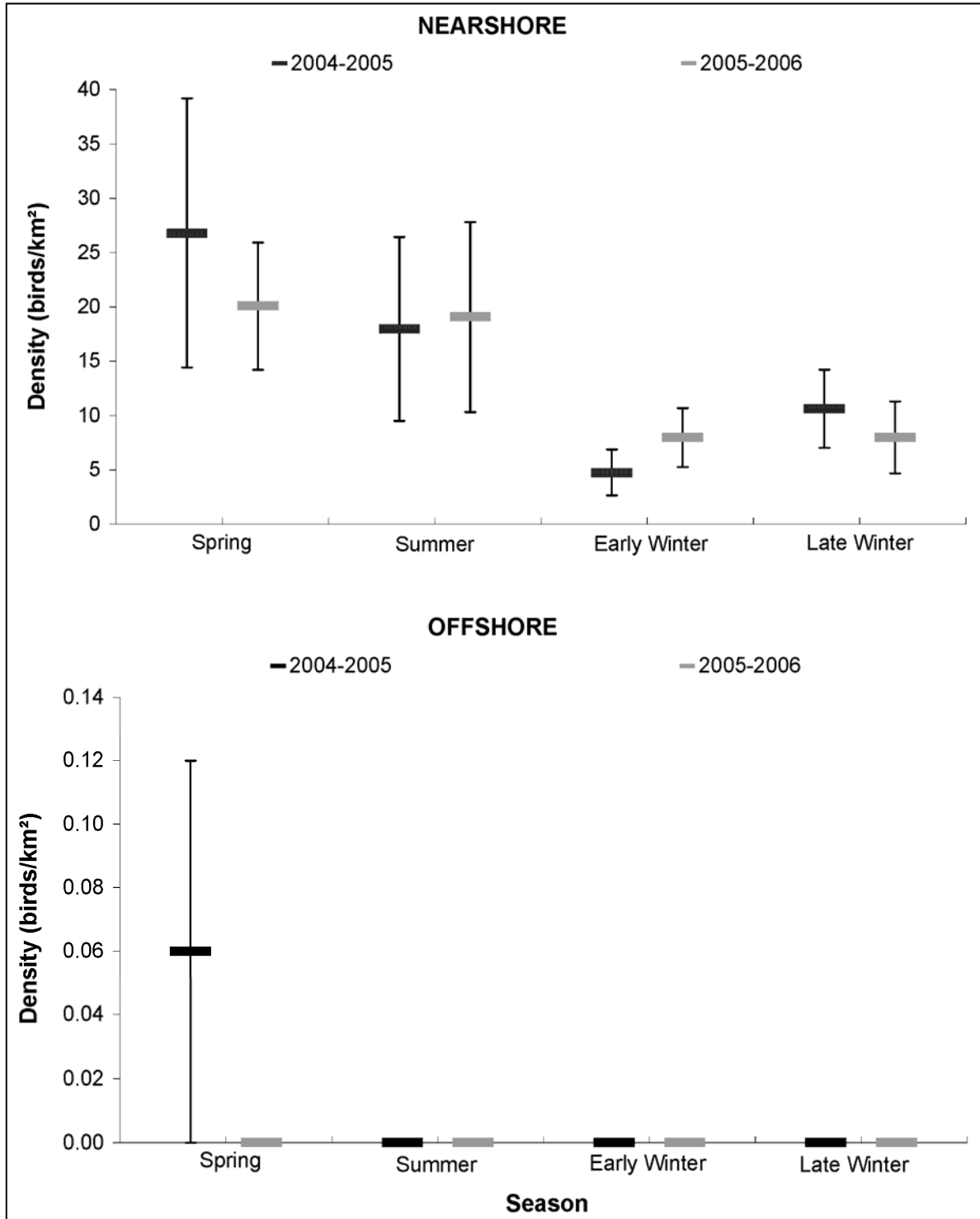


FIGURE 44-48
Mean Densities of Harlequin Ducks Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

Note: Data are presented as mean \pm 1 standard error.

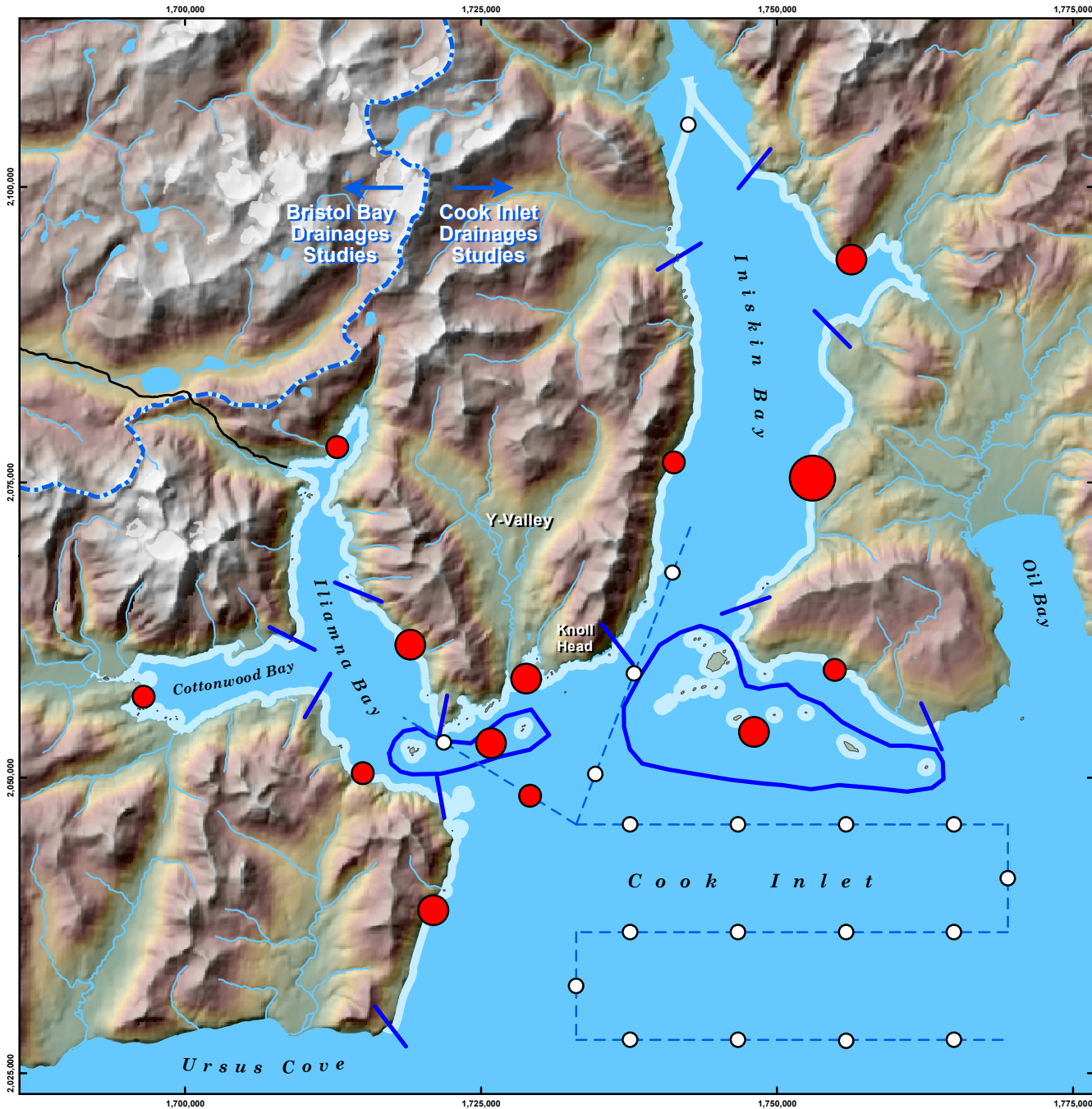
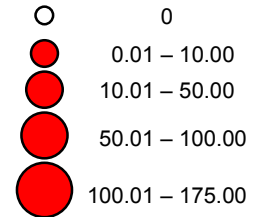


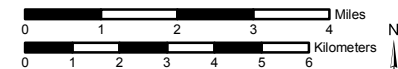
Figure 44-49
Distribution and Abundance of
Harlequin Ducks Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2005 and 2006

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-49_HADUDens_Spr0506_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2 Author: ABR-AZC

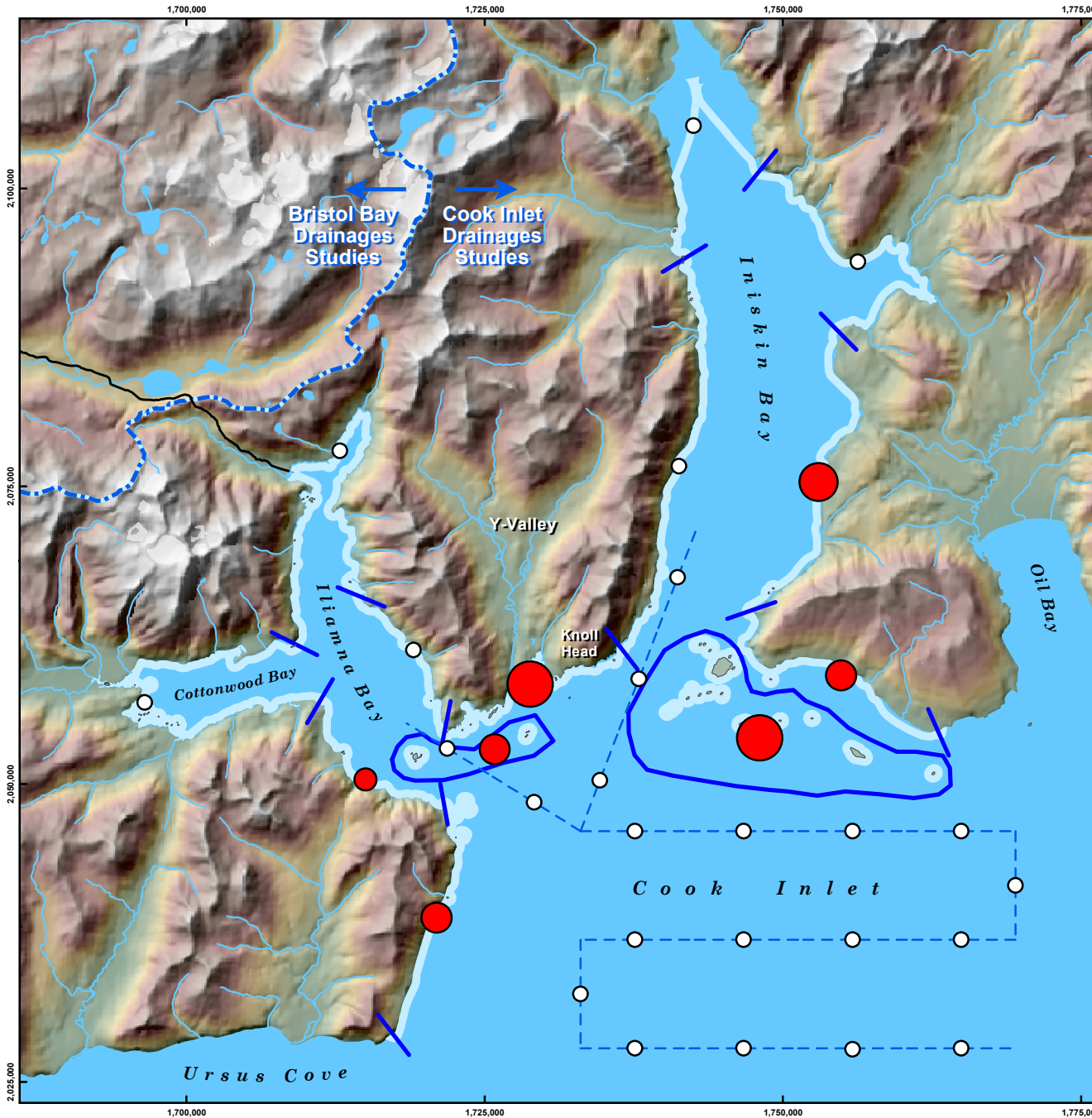
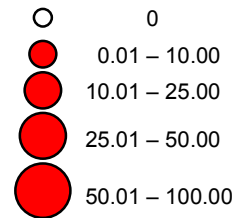


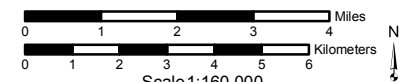
Figure 44-50
Distribution and Abundance of
Harlequin Ducks Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2004 and 2005

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-50_HADUDens_Sum0405_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2 Author: ABR-AZC

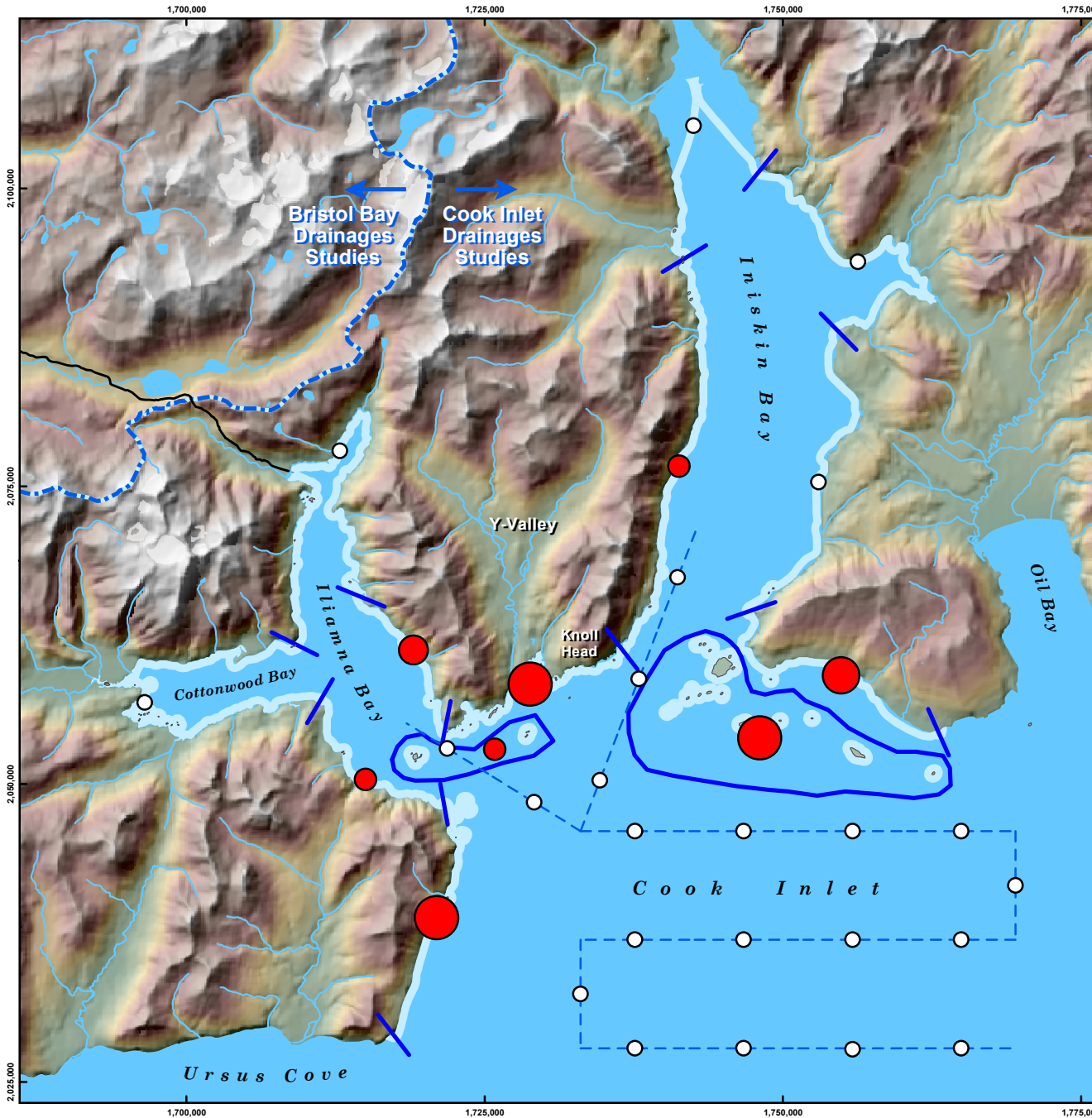


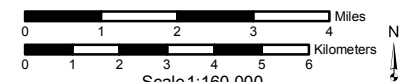
Figure 44-51
Distribution and Abundance of
Harlequin Ducks Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Early Winter 2004 and 2005

Legend

Mean Density (birds/km²)

- 0
- 0.01 – 5.00
- 5.01 – 10.00
- 10.01 – 15.00
- 15.01 – 30.00

- - - Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-51_HADUDens_EWin0405_PLP_EBD_v02.mxd	Date: Nov. 16, 2010
Version: 2	Author: ABR-AZC

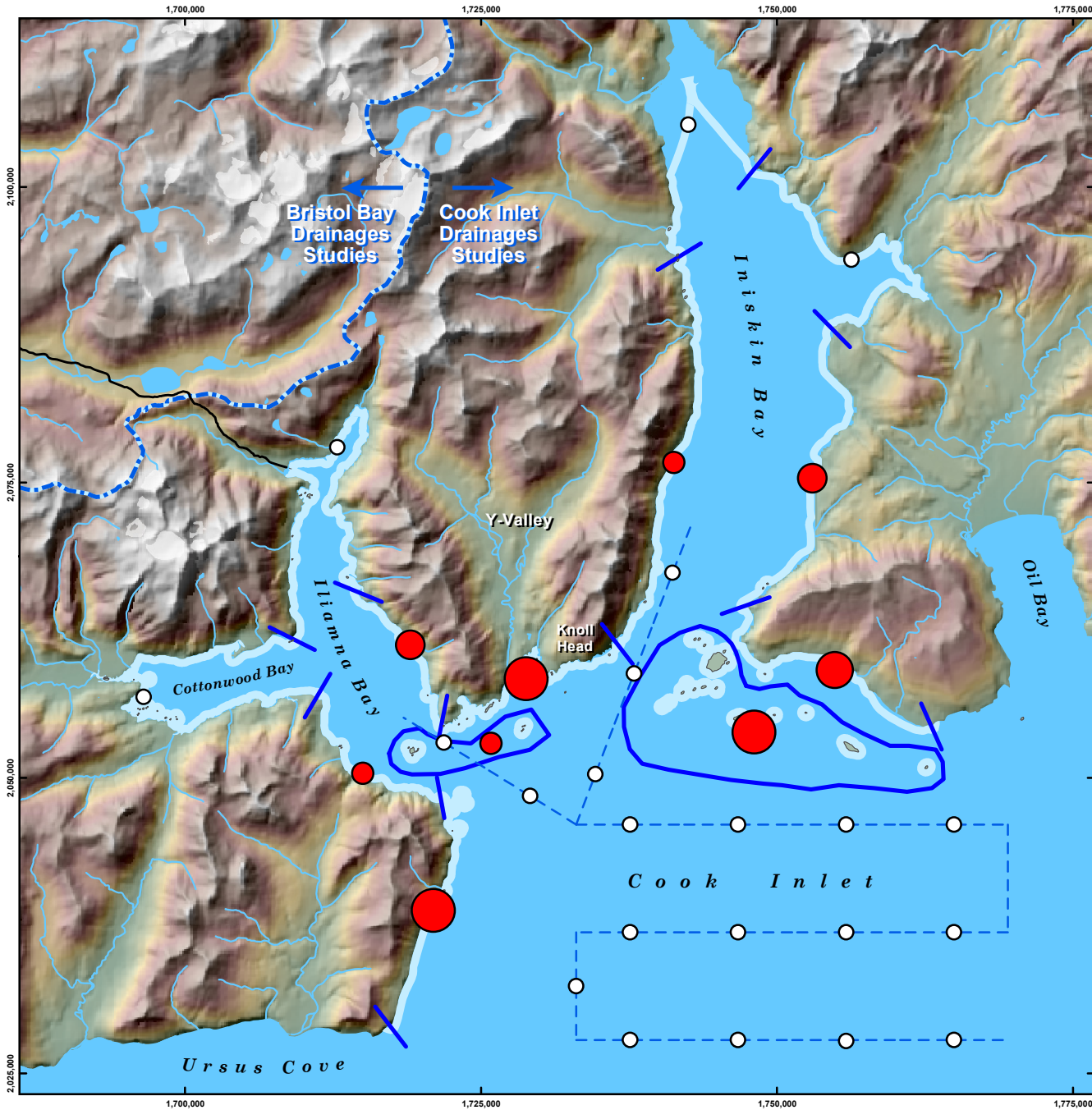
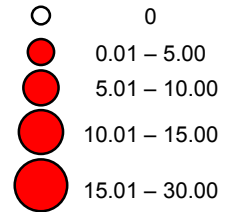


Figure 44-52
Distribution and Abundance of
Harlequin Ducks Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter 2005 and 2006

Legend

Mean Density (birds/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-52_HADUDens_LWin0506_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2

Author: ABR-AZC

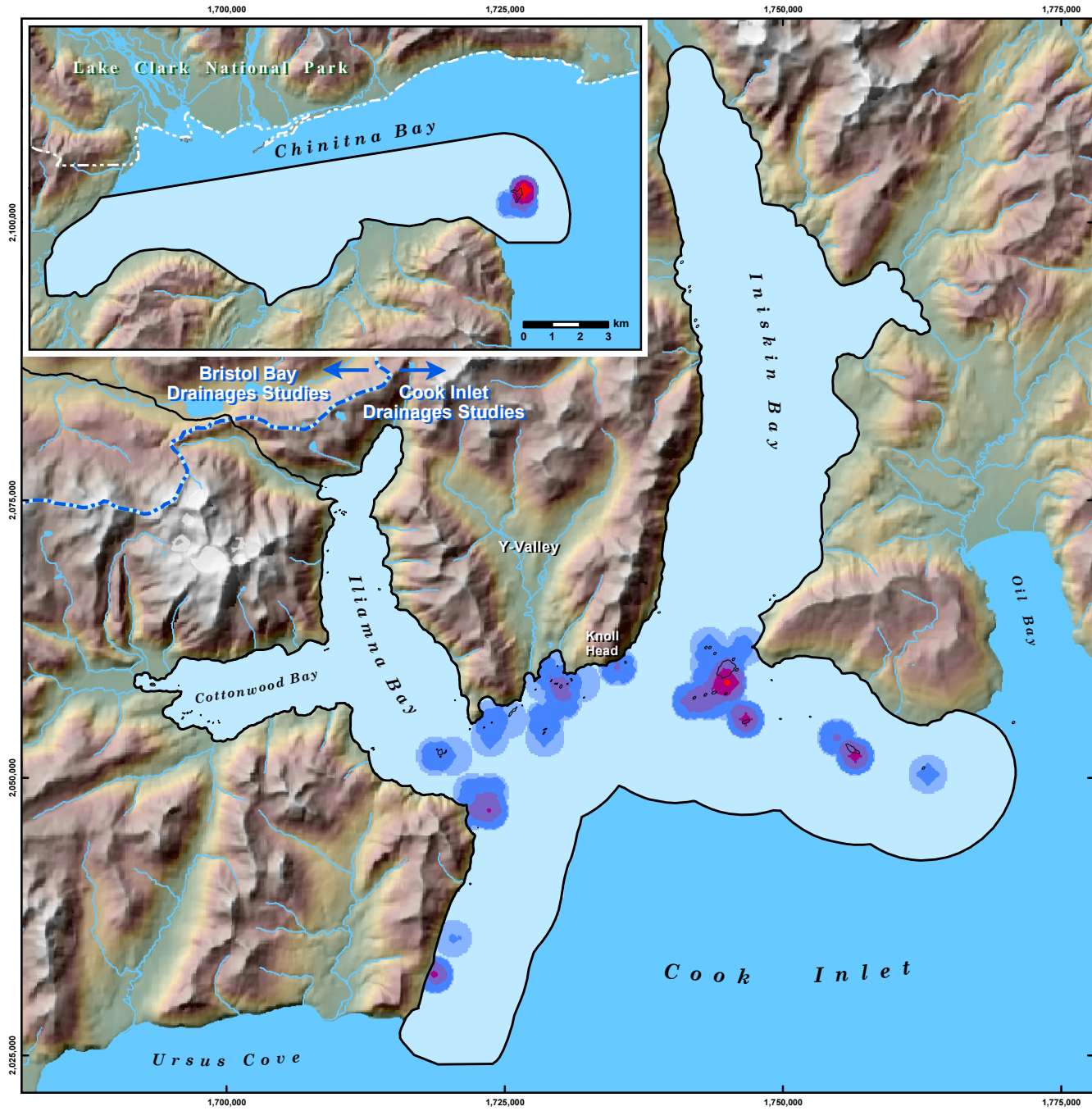
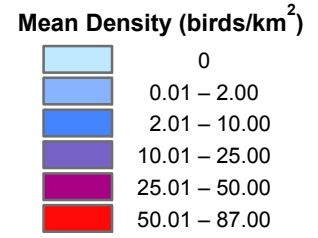


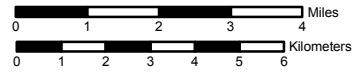
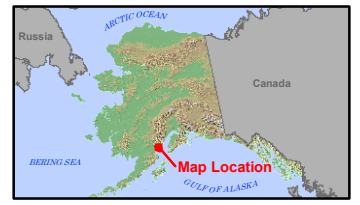
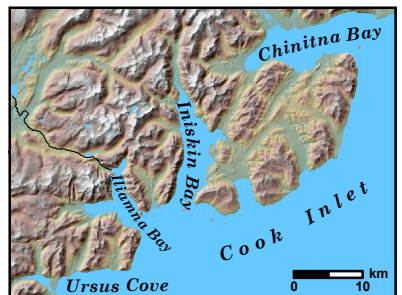
Figure 44-53
Distribution and Abundance of
Harlequin Ducks Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Fall 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-53_HADUDistHei_Fall0608_PLP_EBD_v02.mxd Date: Nov. 20, 2010

Version: 2 Author: ABR-AZC

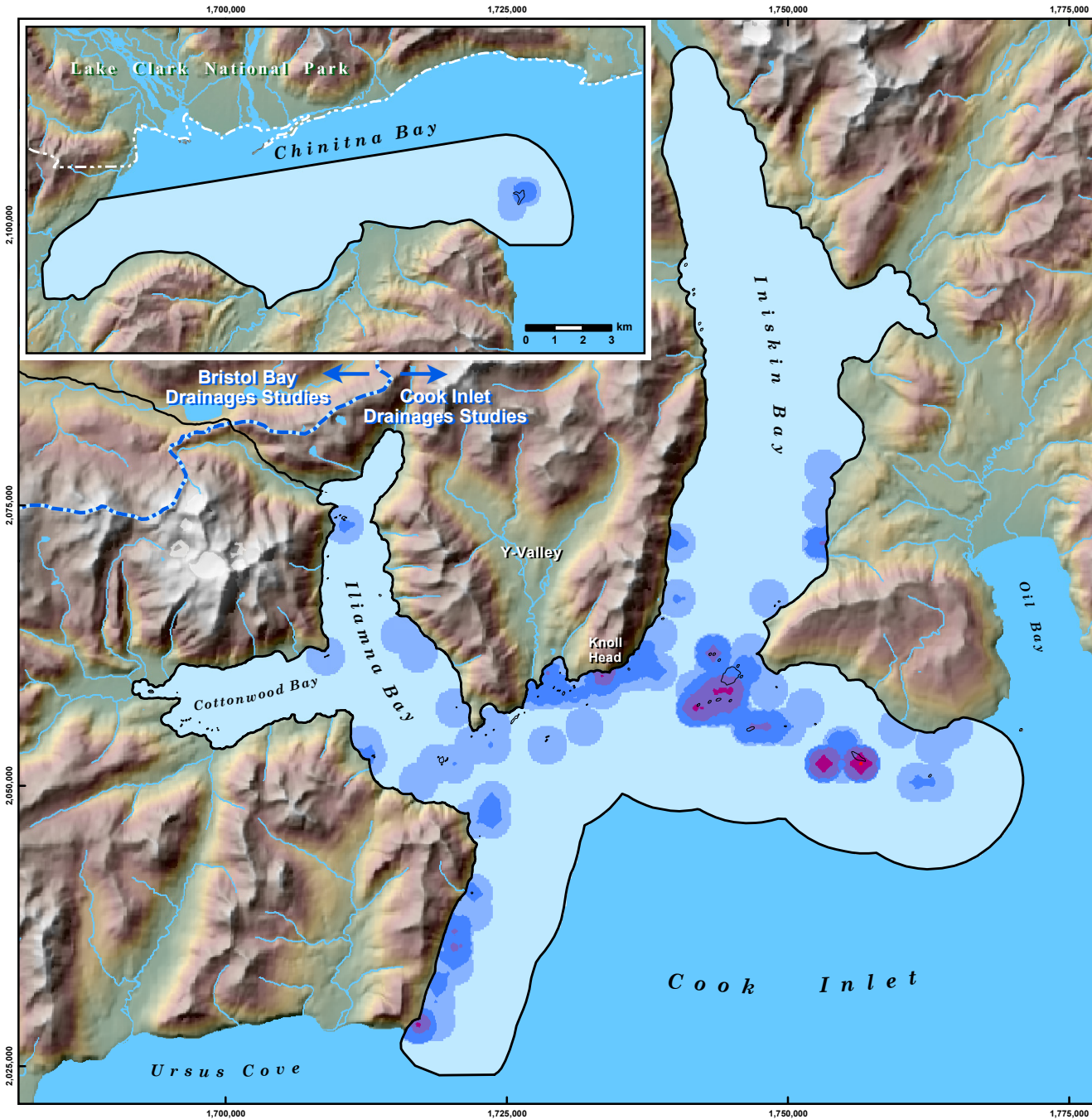
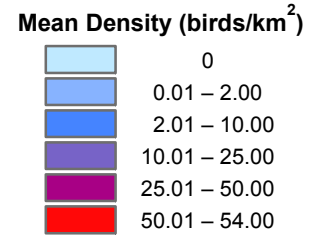


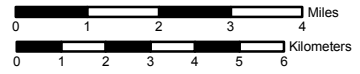
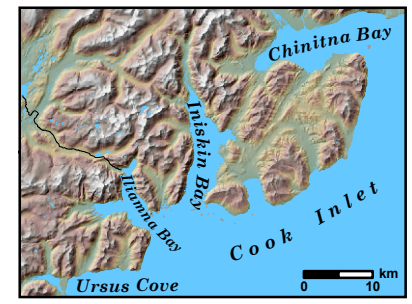
Figure 44-54
Distribution and Abundance of
Harlequin Ducks Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Mid-winter 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

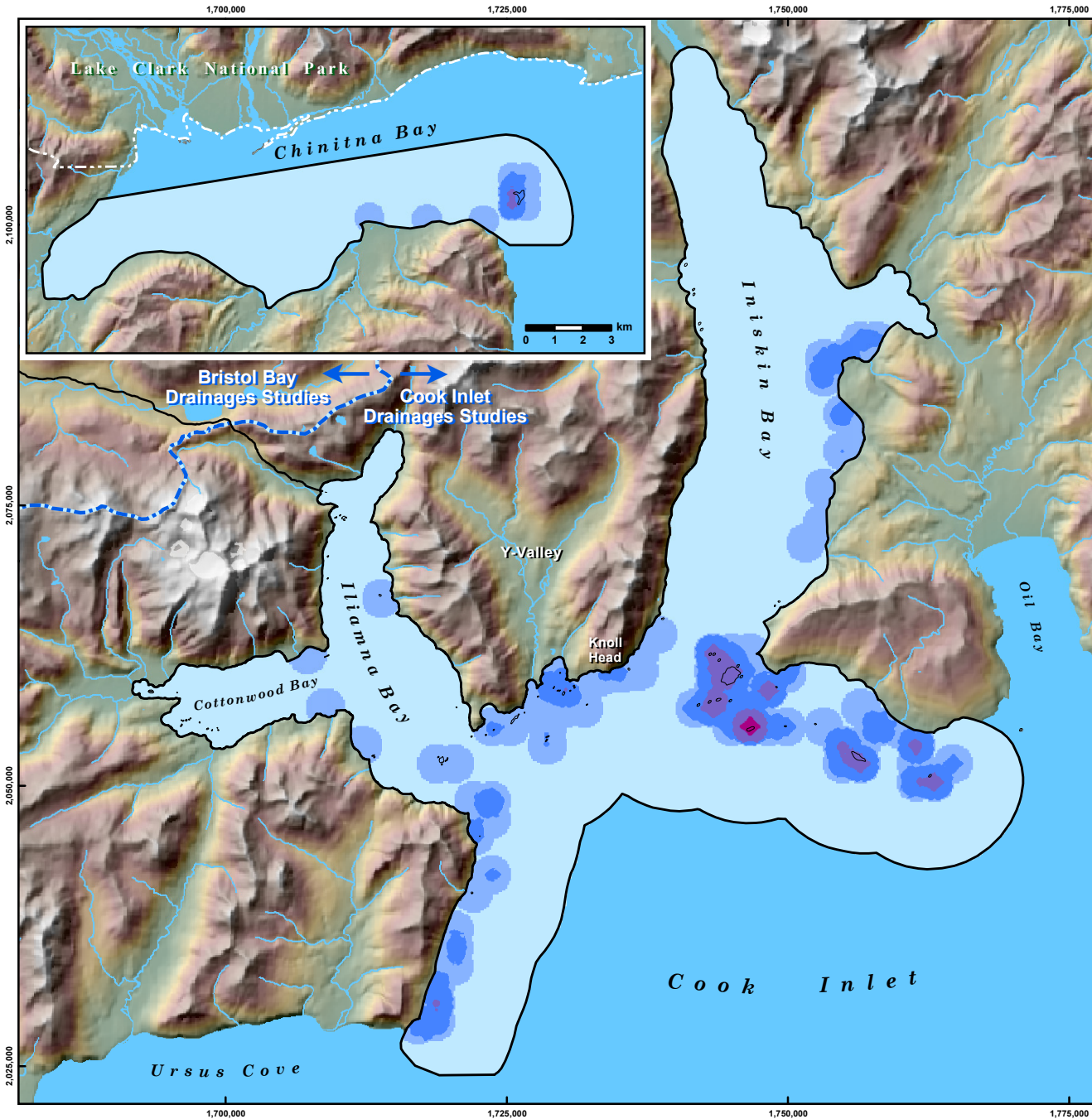
— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-54_HADUDistHeil_Win0608_PLP_EBD_v02.mxd Date: Nov. 20, 2010

Version: 2 Author: ABR-AZC



2,100,000

2,075,000

2,050,000

2,025,000

1,700,000

1,725,000

1,750,000

1,775,000

1,700,000

1,725,000

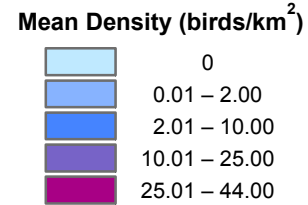
1,750,000

1,775,000



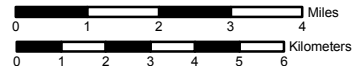
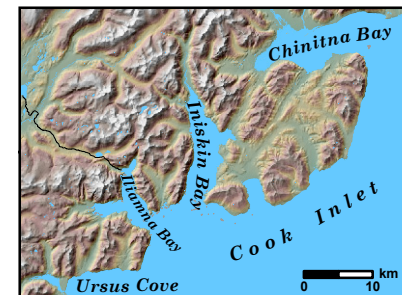
Figure 44-55
Distribution and Abundance of Harlequin Ducks Counted During Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, Late Winter–Spring 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-55_HADUDistHeil_LWinSp0608_PLP_EBD_v02.mxd Date: Nov. 20, 2010

Version: 2 Author: ABR-AZC

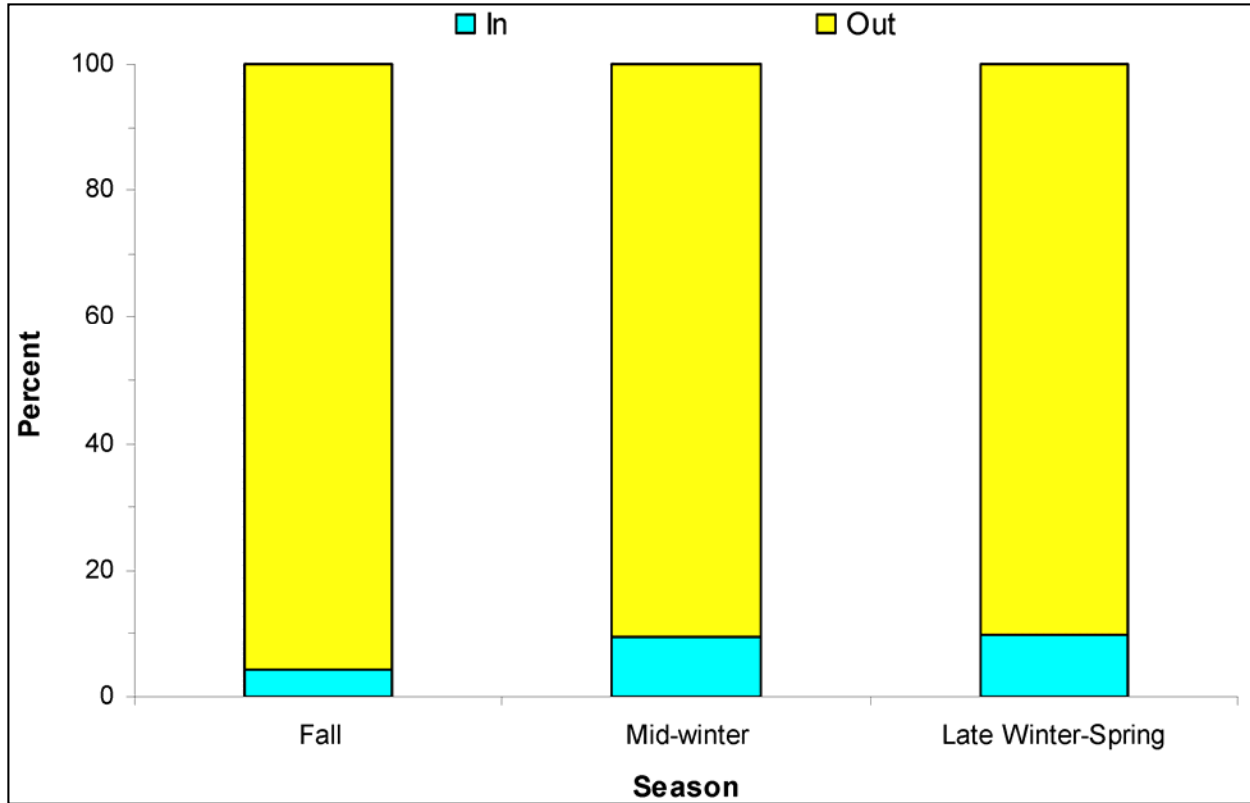


FIGURE 44-56

Inside-/outside-bay Locations of Harlequin Ducks Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

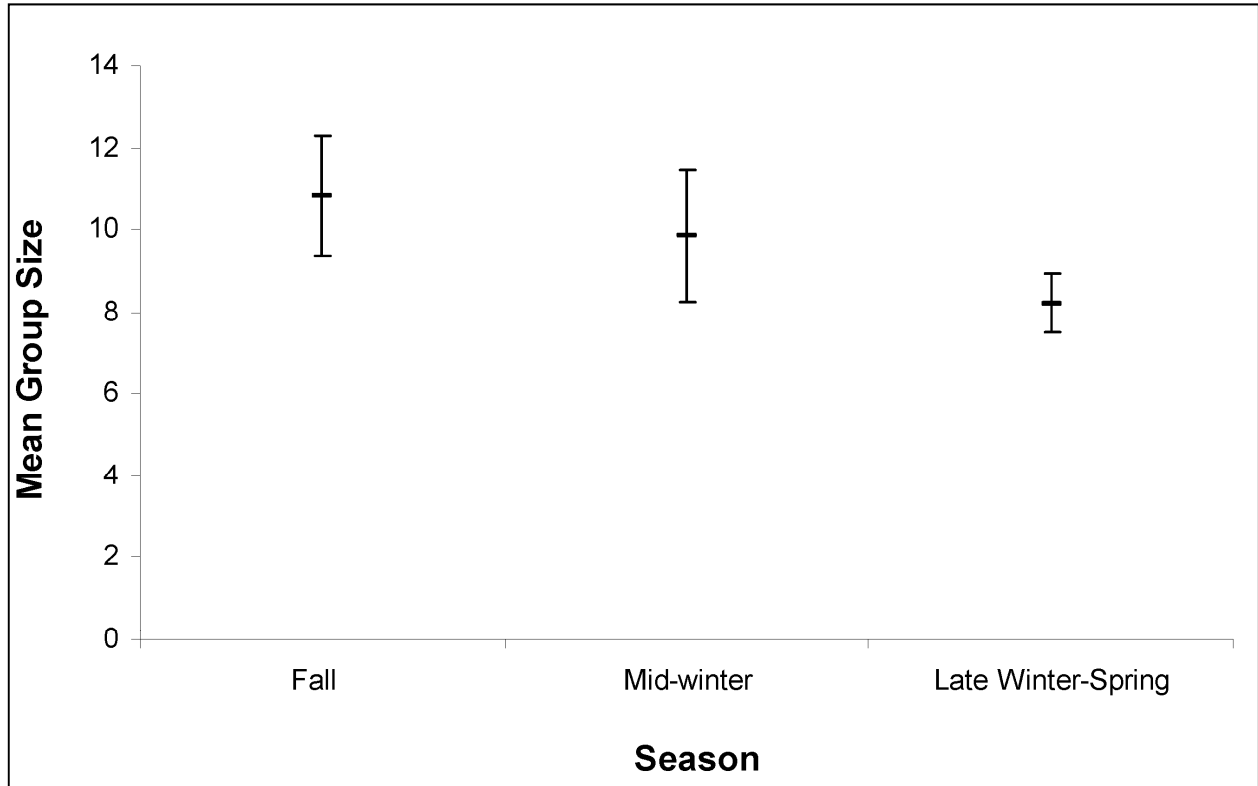


FIGURE 44-57
Mean Group Sizes of Harlequin Ducks Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Data are presented as mean \pm 1 standard error.

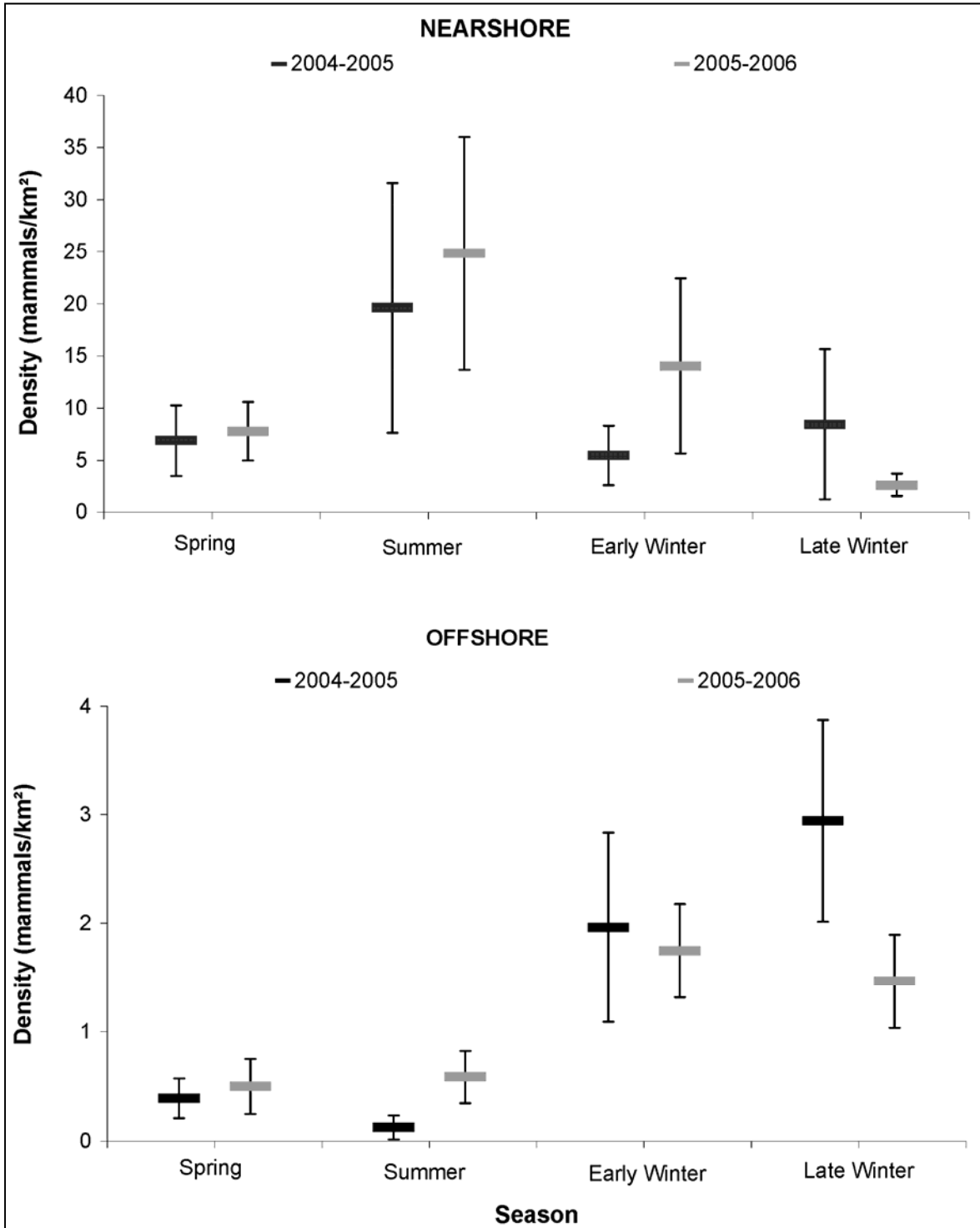


FIGURE 44-58
Mean Densities of Mammals Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

Note: Data are presented as mean \pm 1 standard error.

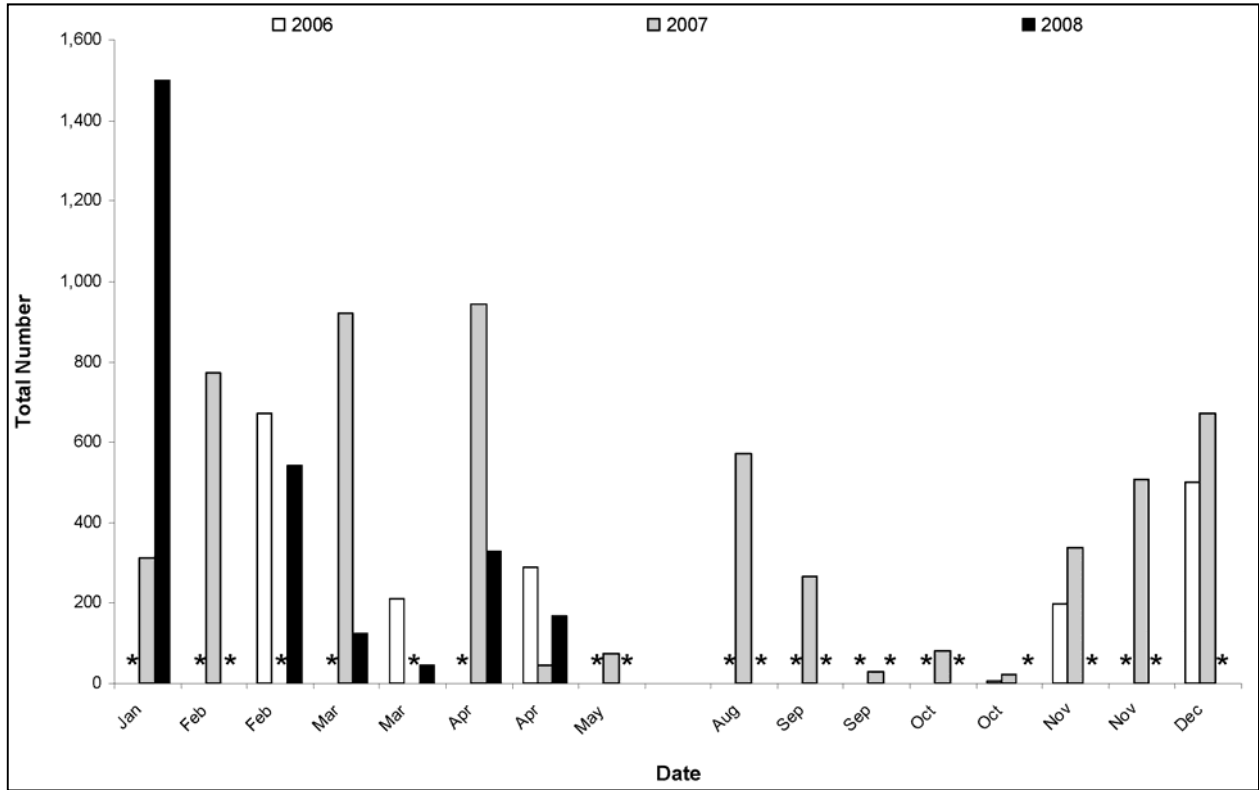


FIGURE 44-59
 Maximal Numbers of Mammals Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

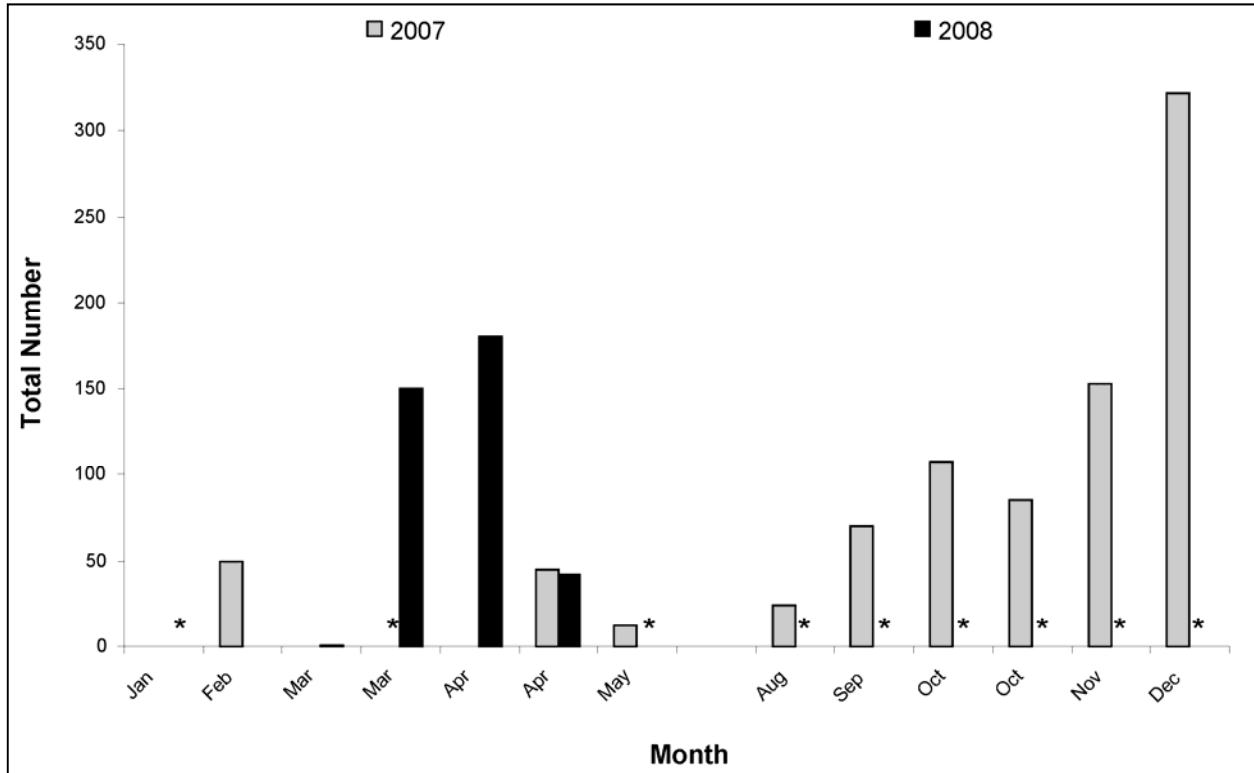


FIGURE 44-60
 Maximal Numbers of Mammals Counted in Chinitna Bay during Helicopter-based Marine Surveys,
 Cook Inlet Marine Study Area, 2007-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

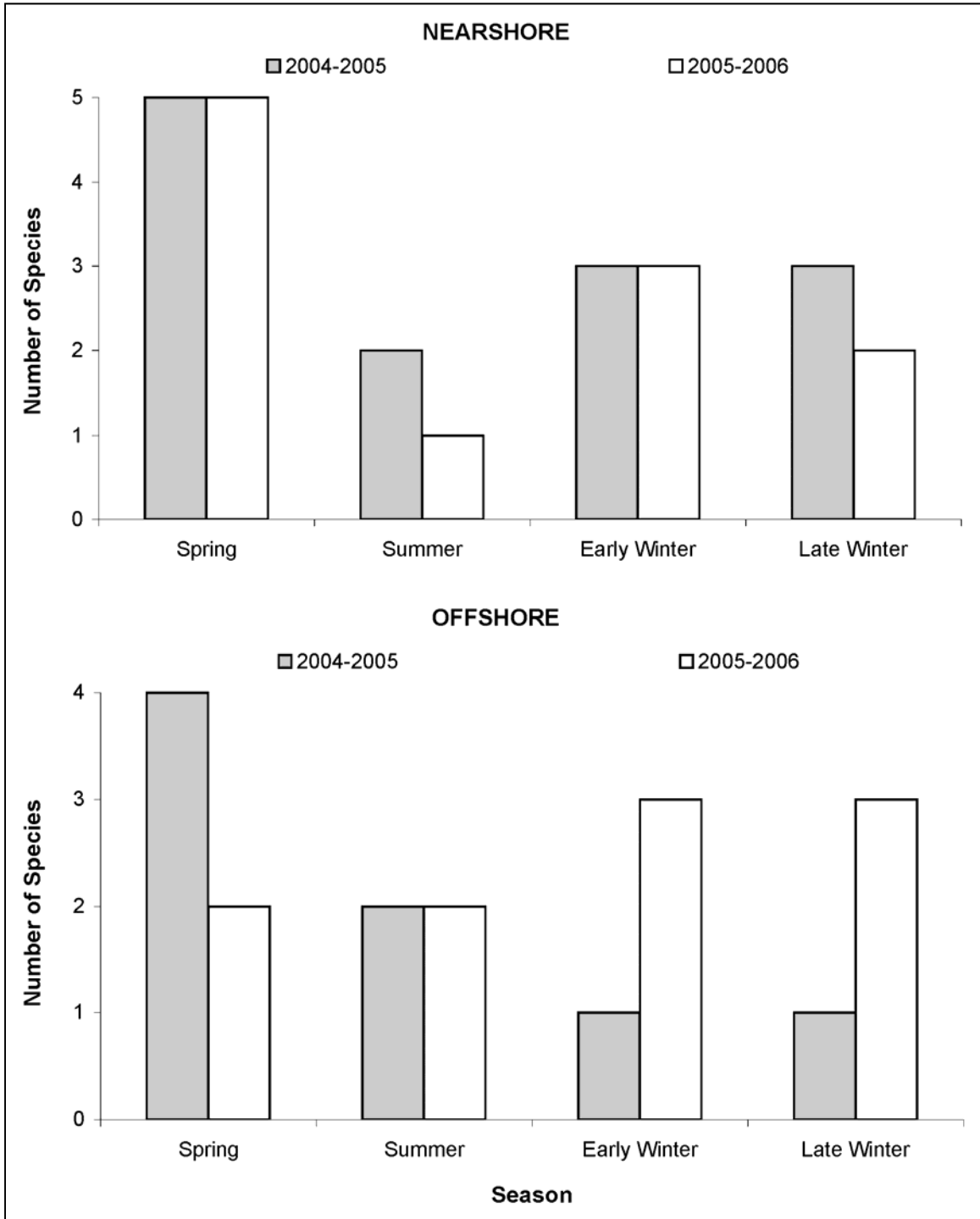


FIGURE 44-61
Species Richness of Mammals Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

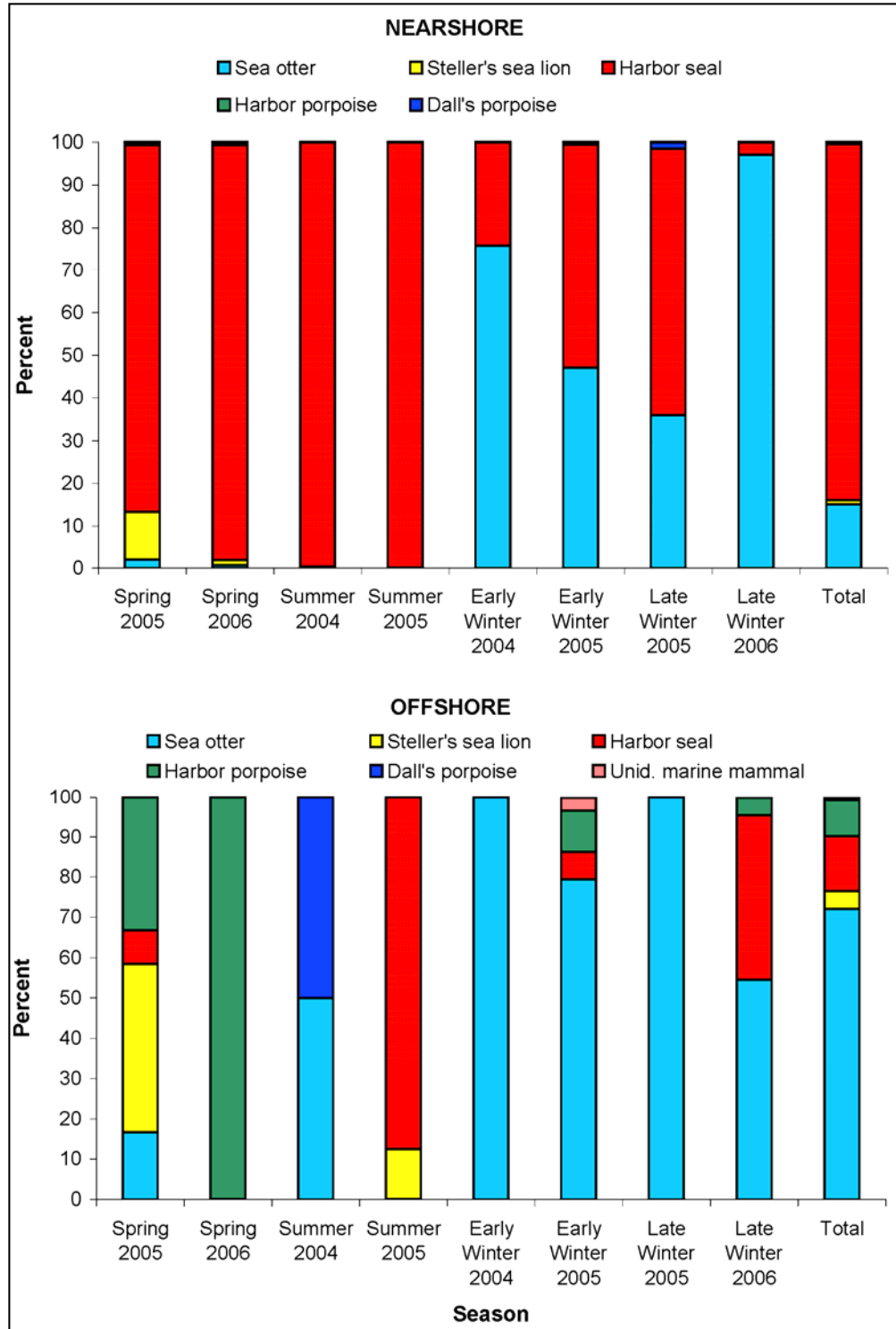


FIGURE 44-62
Species Composition of Mammals Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

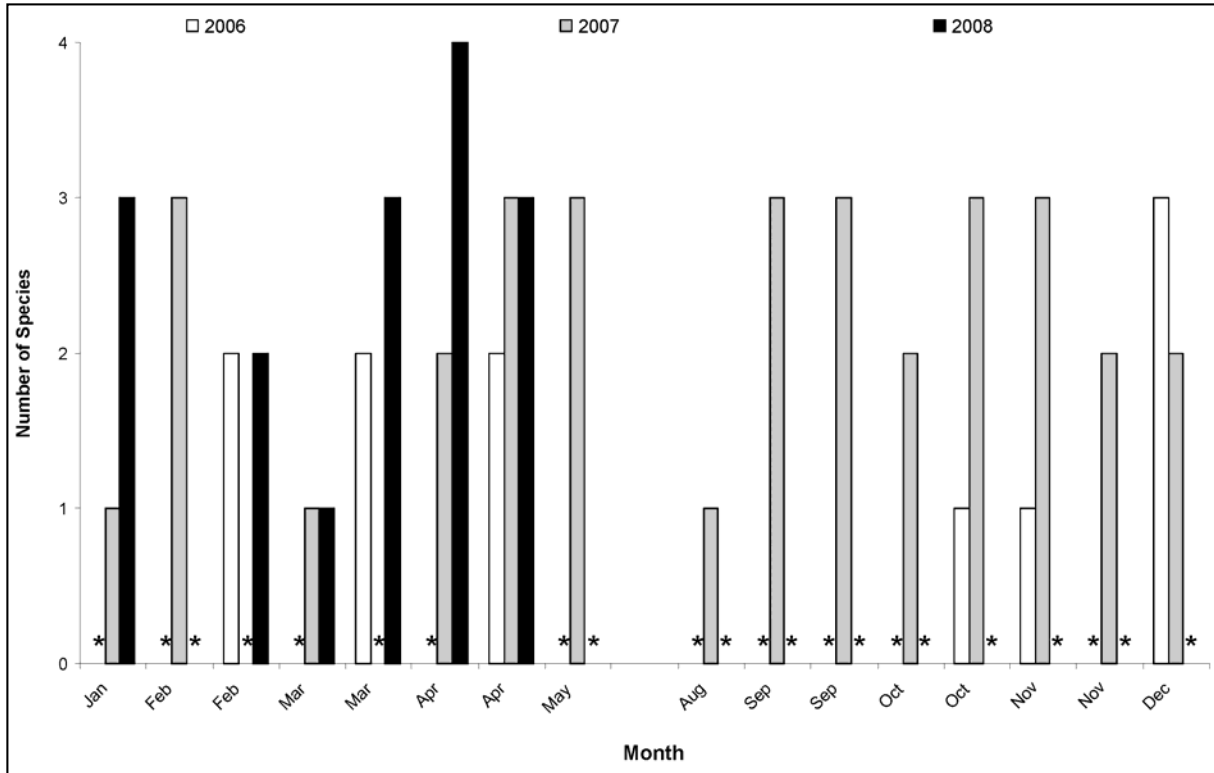


FIGURE 44-63
 Species Richness of Mammals Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

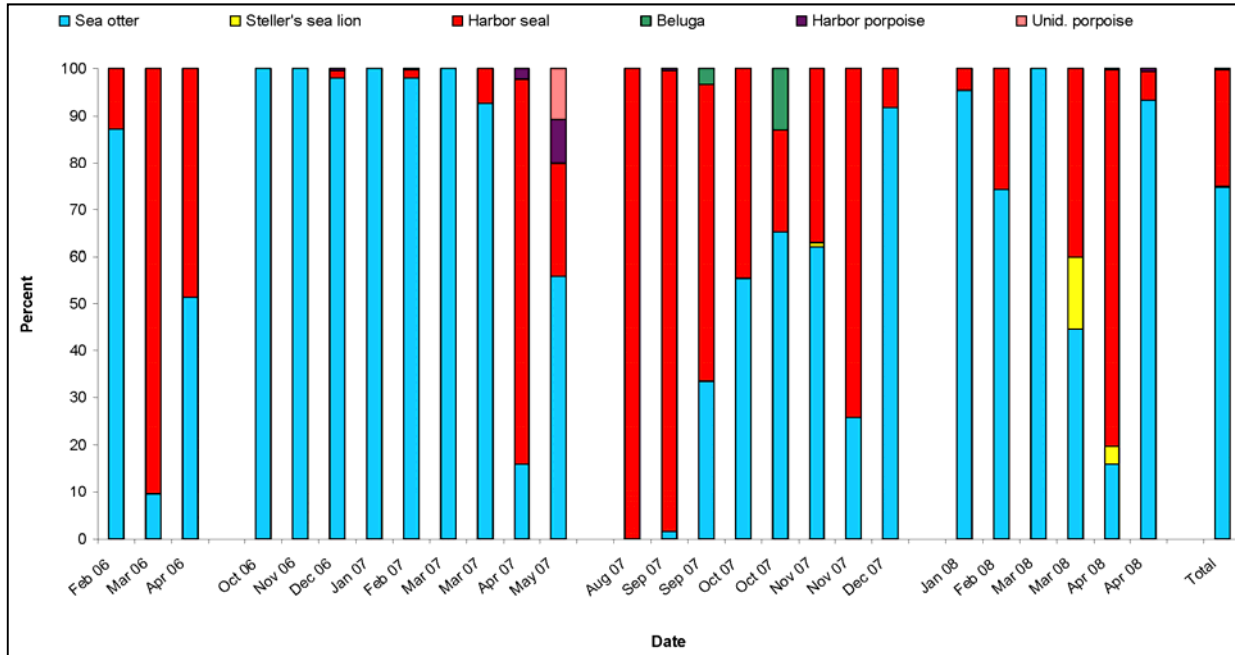


FIGURE 44-64
 Species Composition of Mammals Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

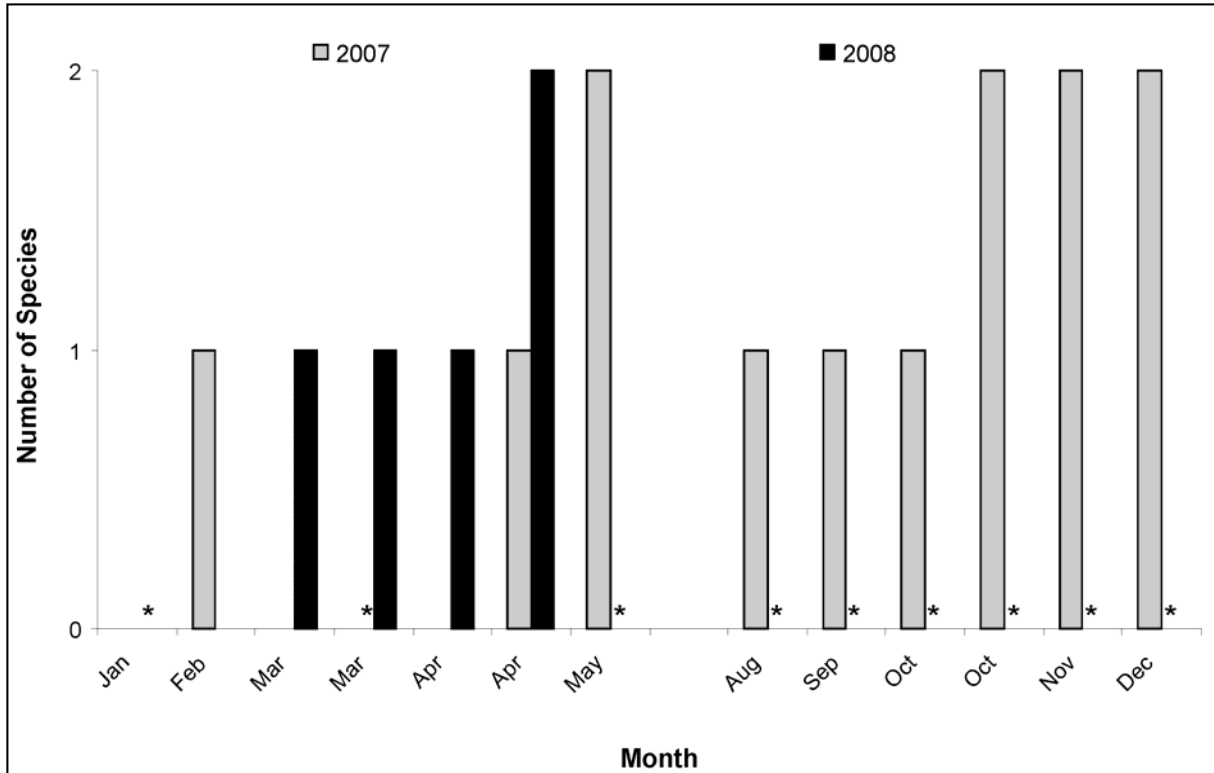


FIGURE 44-65
Species Richness of Mammals Counted in Chinitna Bay during Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area, 2007-2008

Note: Asterisks indicate no survey in a particular year during that survey date

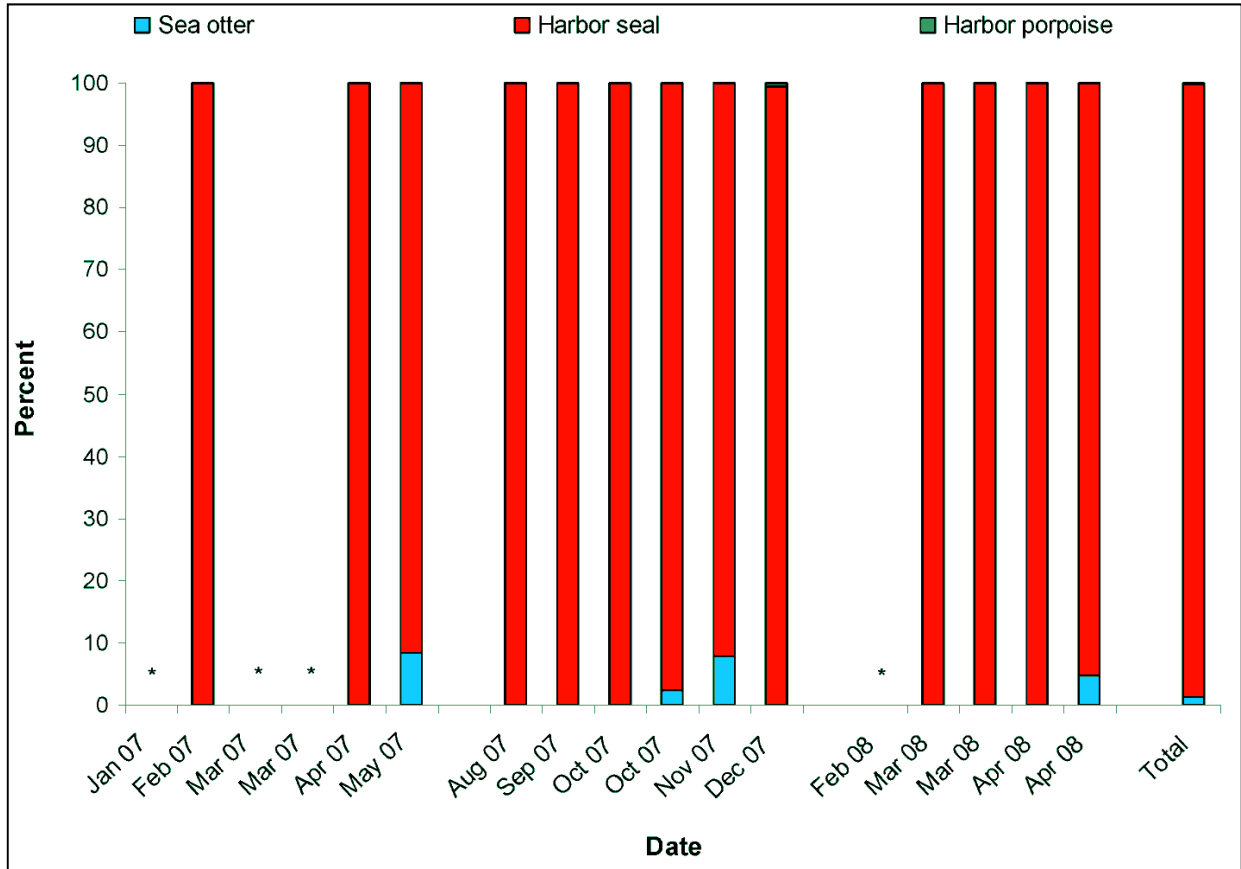


FIGURE 44-66
Species Composition of Mammals Counted in Chinitna Bay during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2007-2008

Note:
 Asterisks indicate that no mammals were seen during that survey date.

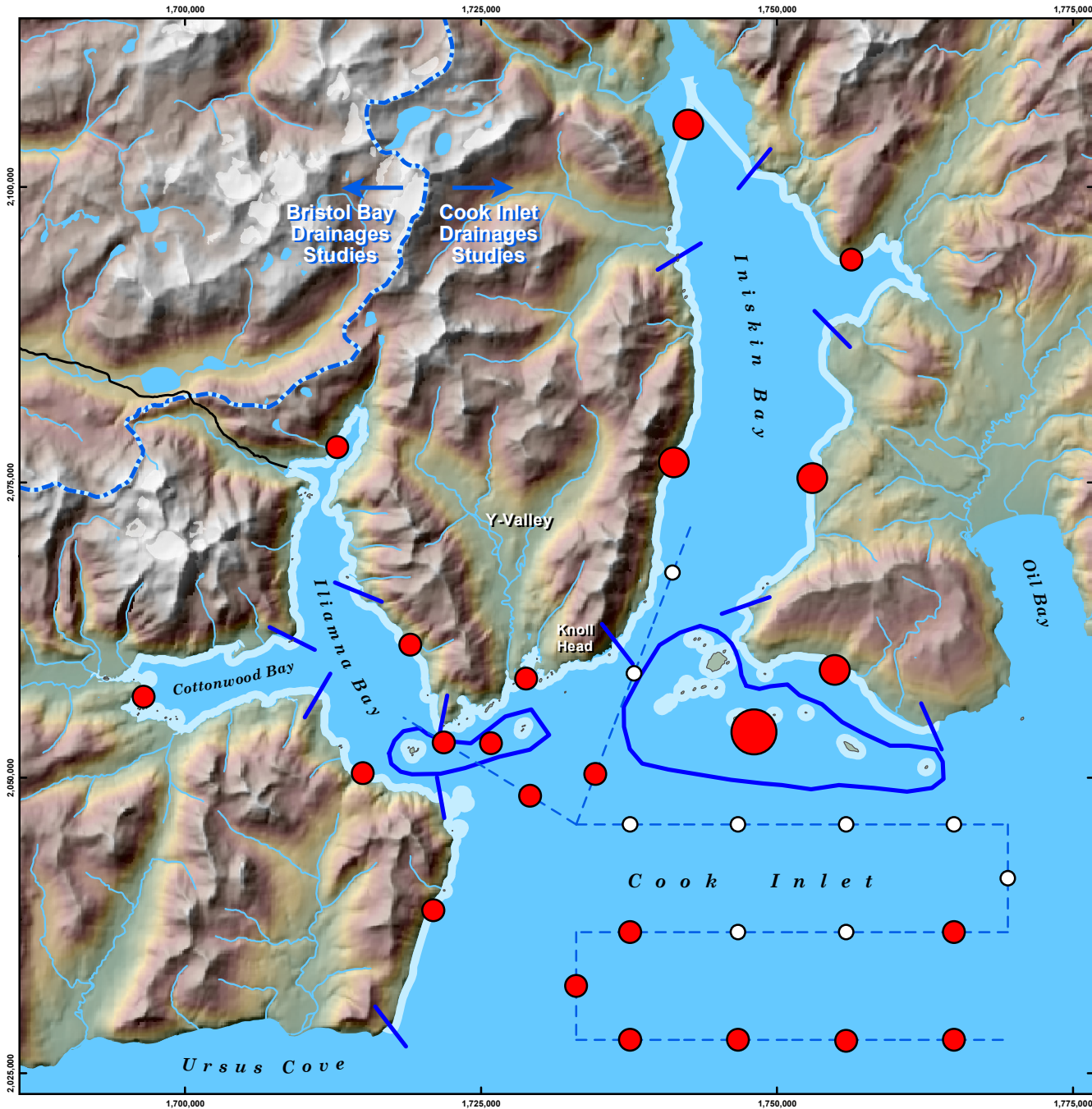
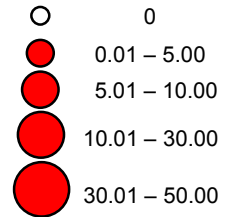


Figure 44-67
Distribution and Abundance
of Mammals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2005 and 2006

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-67_MammDens_Spr0506_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2 Author: ABR-AZC

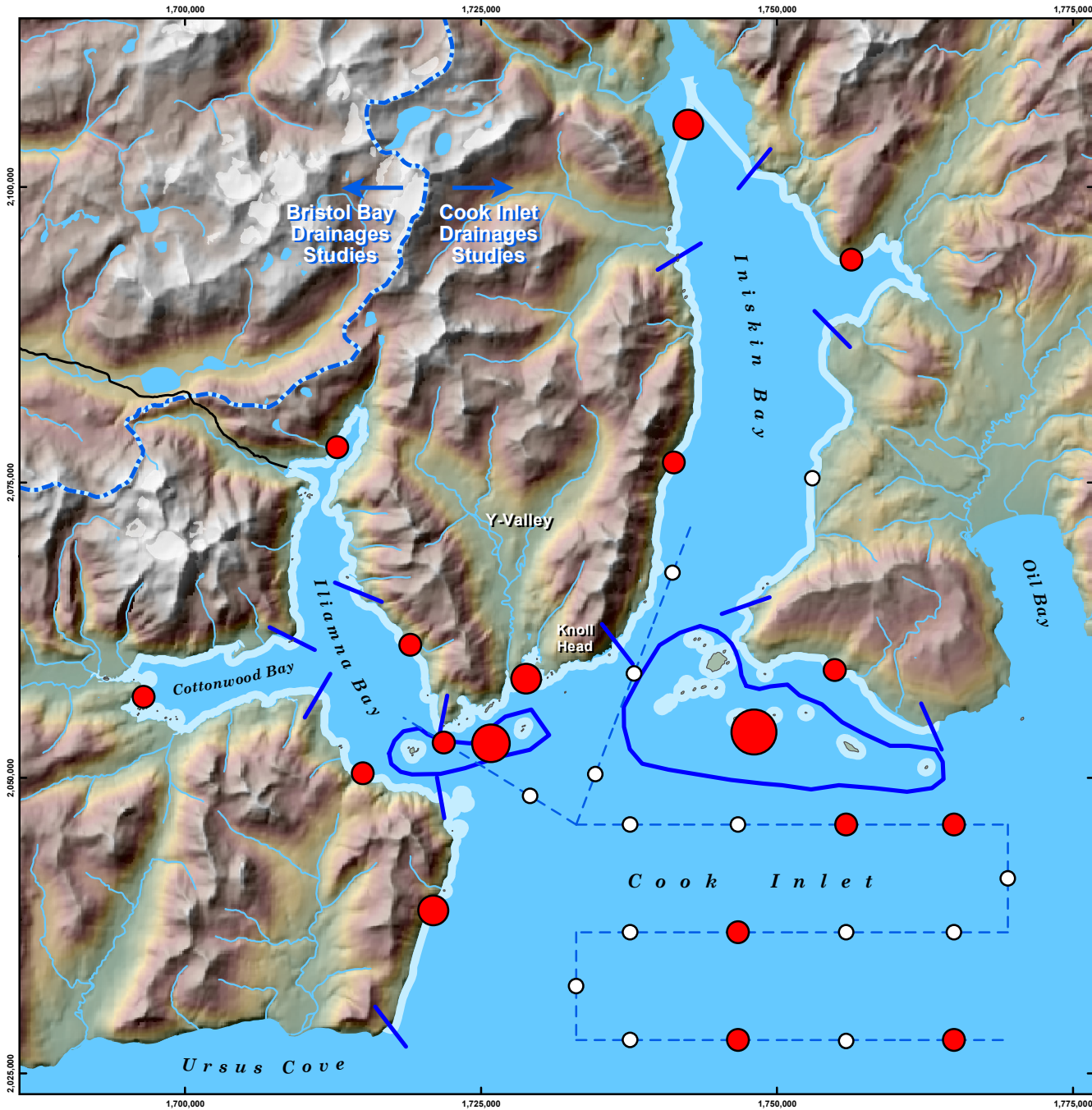
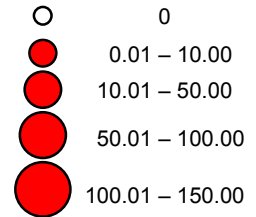


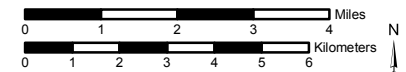
Figure 44-68
Distribution and Abundance
of Mammals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2004 and 2005

Legend

Mean Density (mammals/km²)



- - - Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-68_MammDens_Sum0405_PLP_EBD_v02.mxd Date: Nov. 16, 2010

Version: 2

Author: ABR-AZC

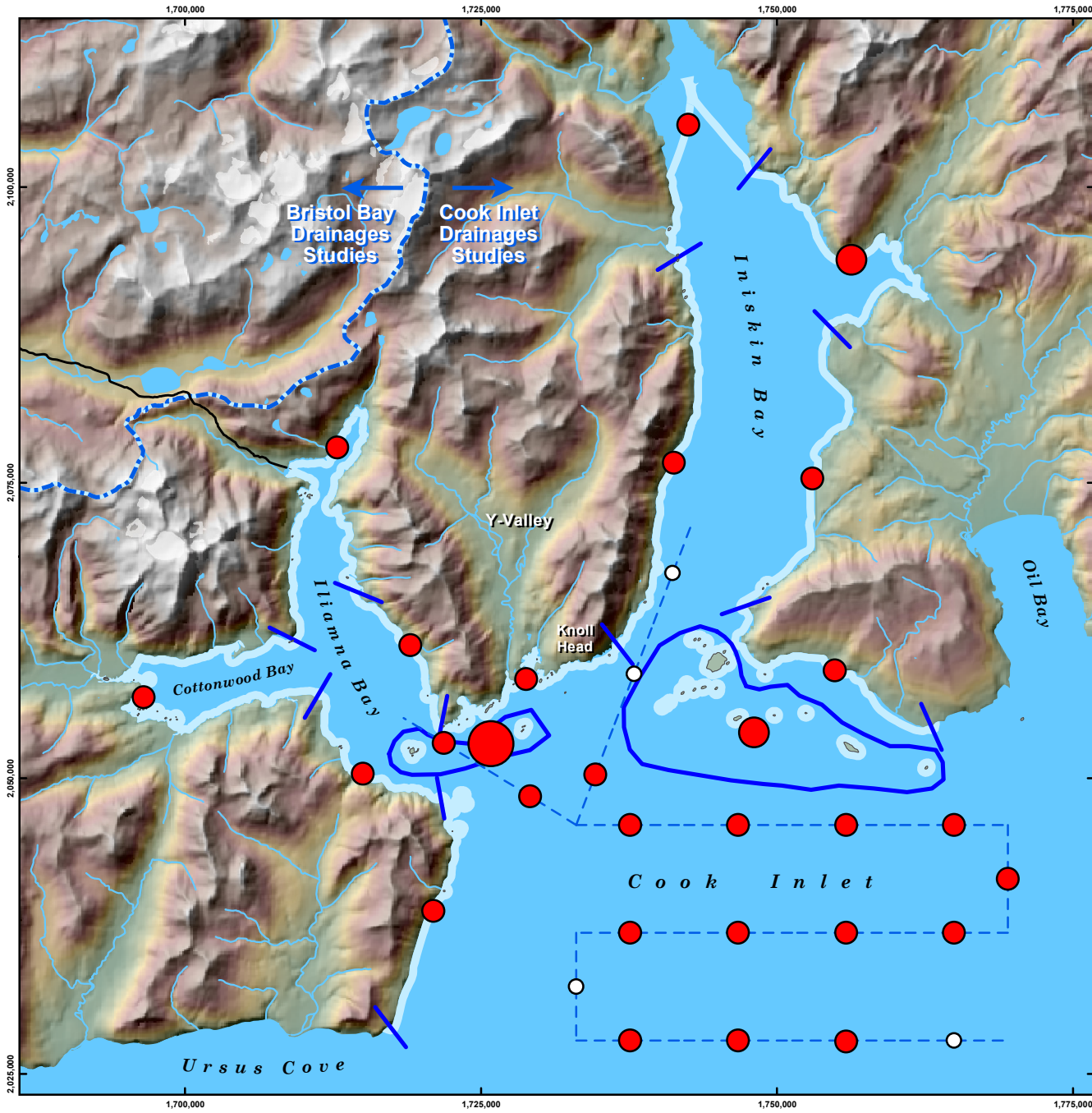
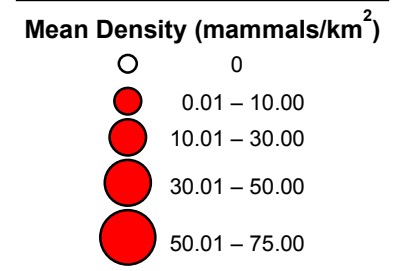
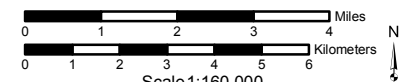


Figure 44-69
Distribution and Abundance
of Mammals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Early Winter 2004 and 2005

Legend



- - - Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-69_MammDens_EWin0405_PLP_EBD_v02.mxd	Date: Nov. 17, 2010
Version: 2	Author: ABR-AZC

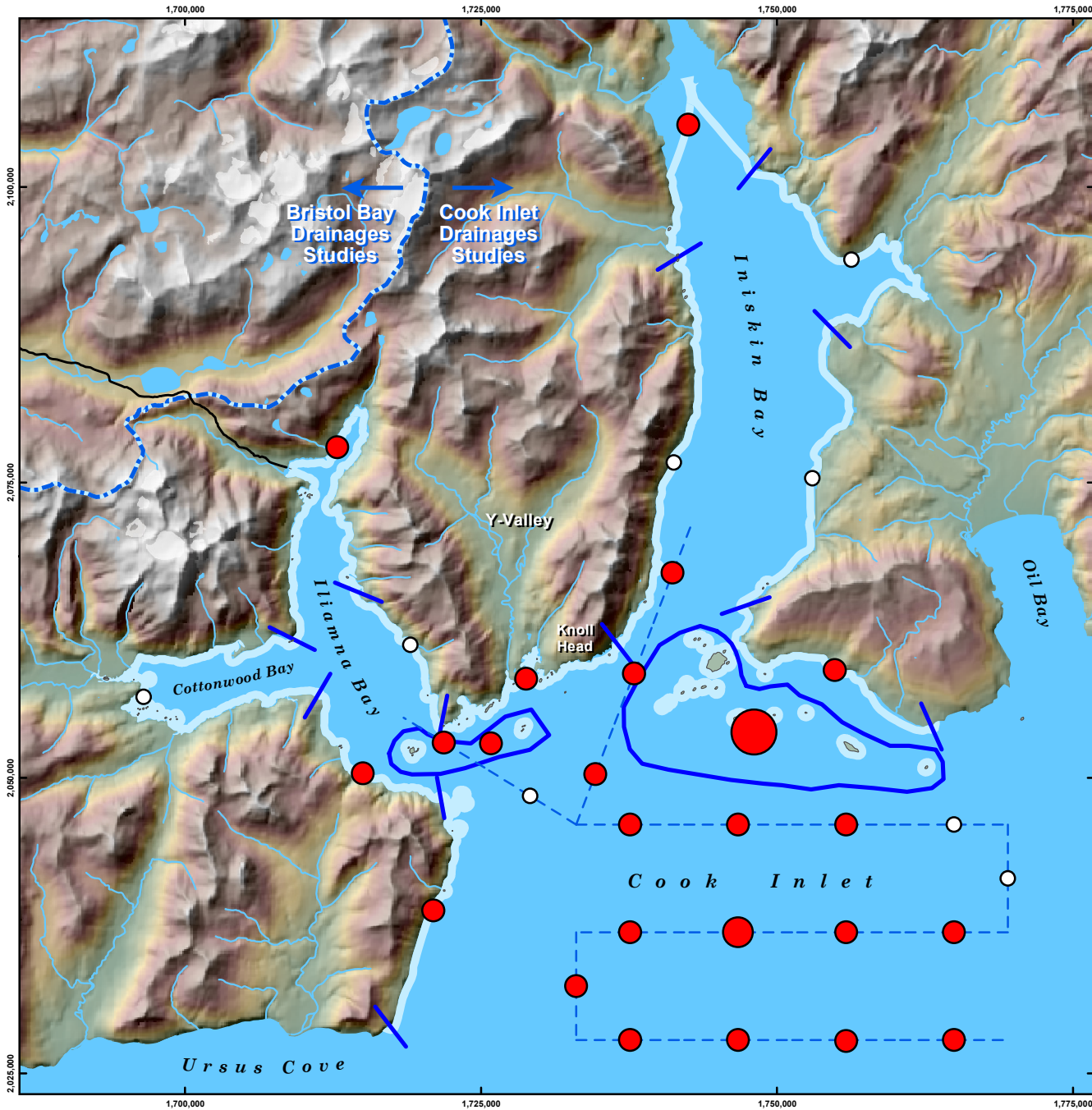


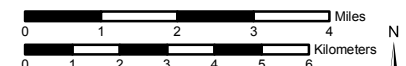
Figure 44-70
Distribution and Abundance
of Mammals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter 2005 and 2006

Legend

Mean Density (mammals/km²)

- 0
- 0.01 – 5.00
- 5.01 – 10.00
- 10.01 – 30.00
- 30.01 – 60.00

- - - Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-70_MammDens_LWin0506_PLP_EBD_v02.mxd	Date: Nov. 17, 2010
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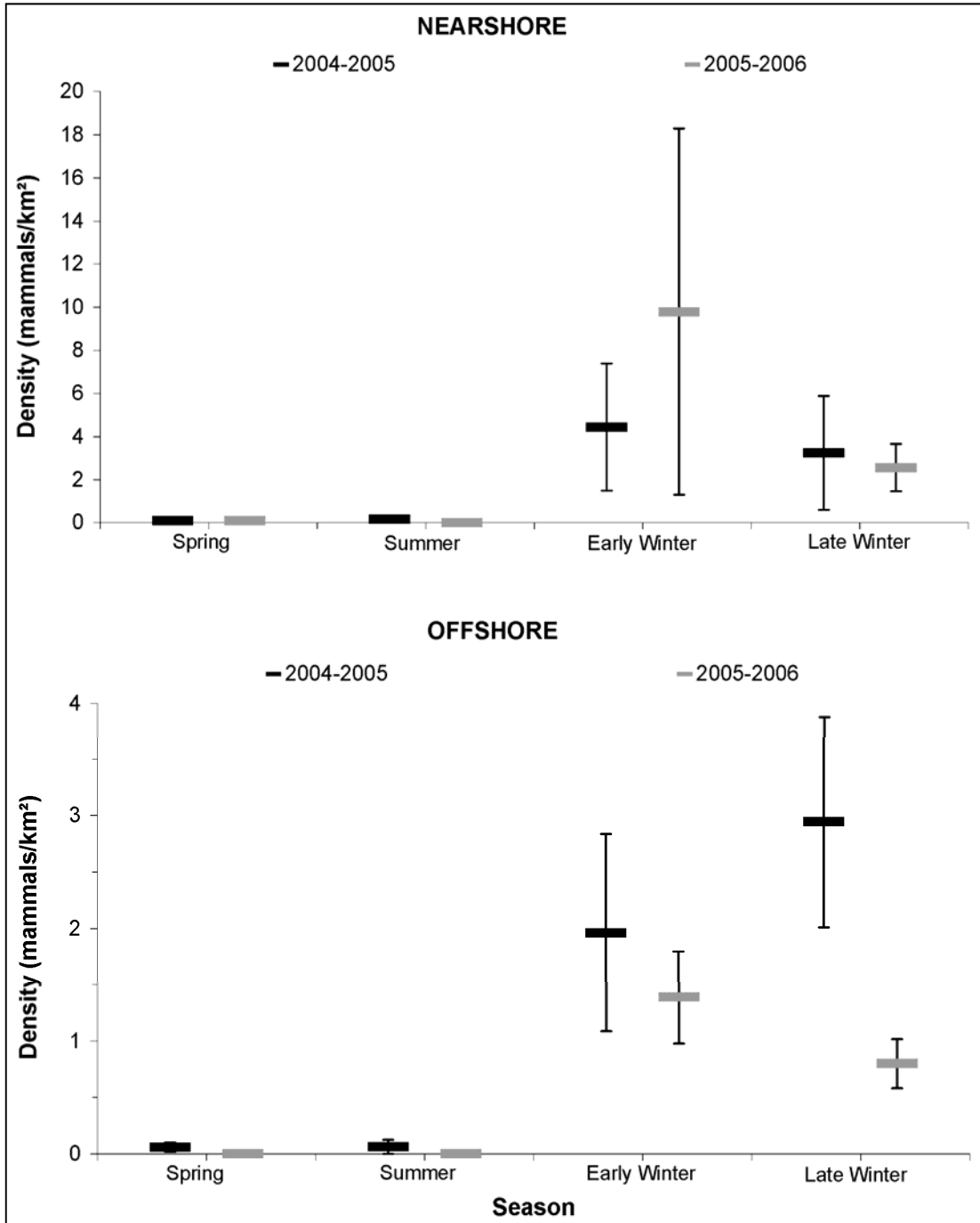


FIGURE 44-71
Mean Densities of Sea Otters Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

Note: Data are presented as mean \pm 1 standard error.

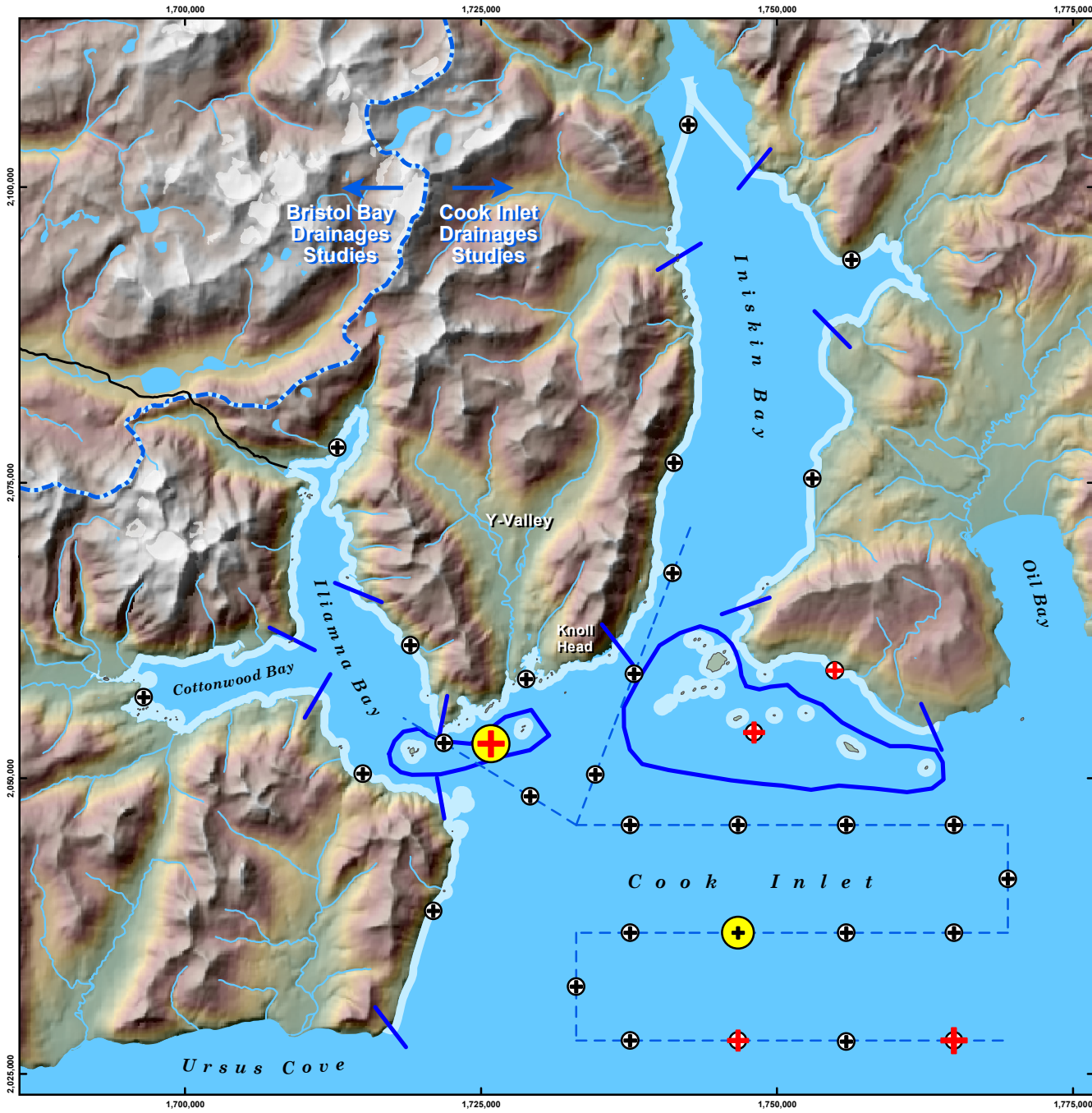
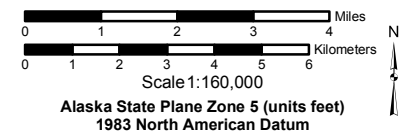


Figure 44-72
Distribution and Abundance of Sea Otters Counted During Boat-based Marine Surveys, Cook Inlet Marine Study Area, Spring 2005 and 2006 and Summer 2004 and 2005

Legend

Mean Density (mammals/km ²)		
Spring		Summer
+	0	○
+	0.01 – 0.25	●
+	0.26 – 0.50	●
+	0.51 – 0.75	●
+	0.76 – 1.00	●

- - - Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



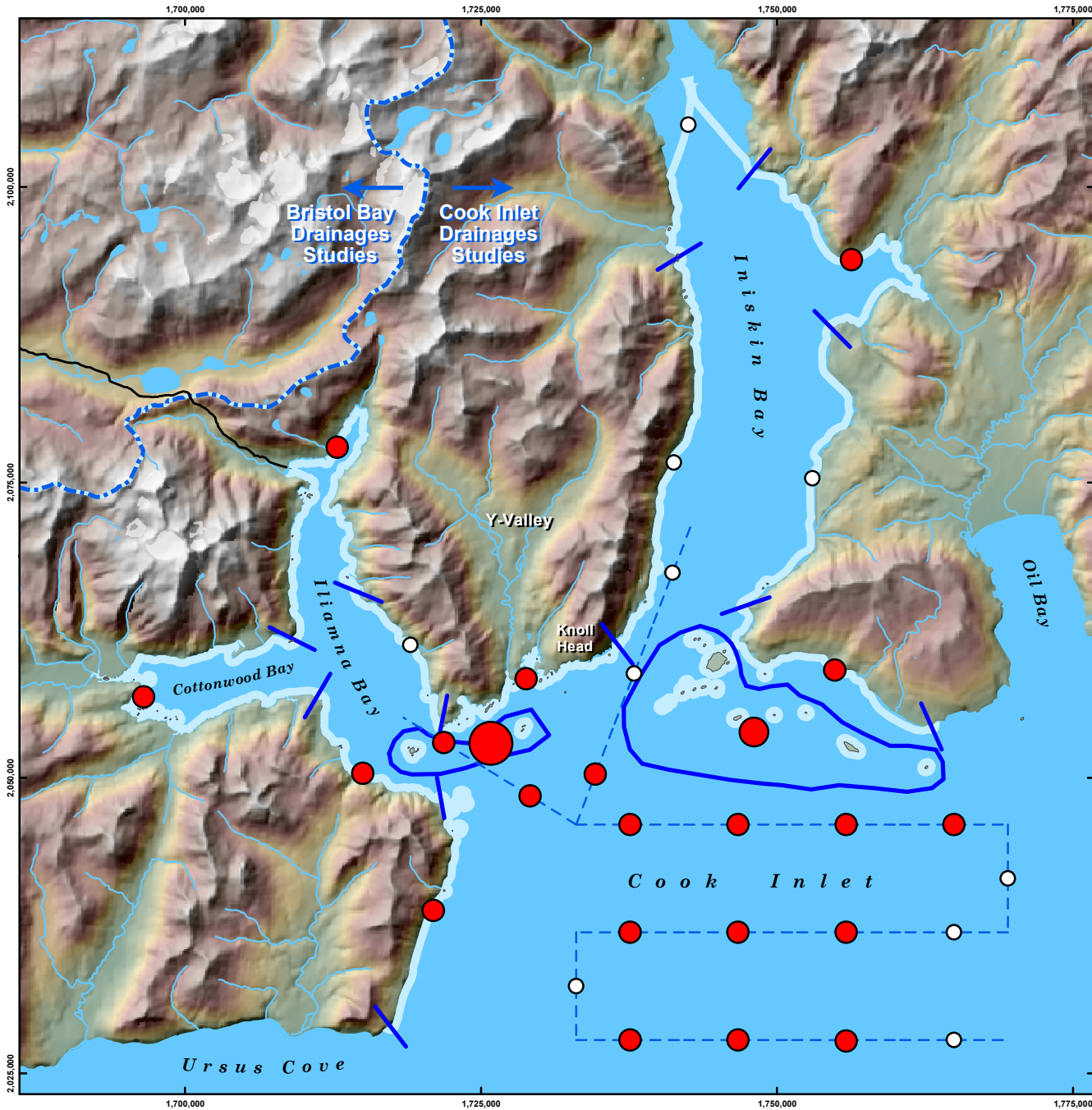
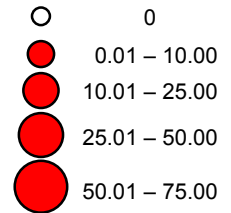


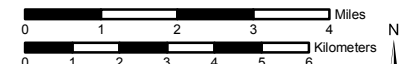
Figure 44-73
Distribution and Abundance
of Sea Otters Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Early Winter 2004 and 2005

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

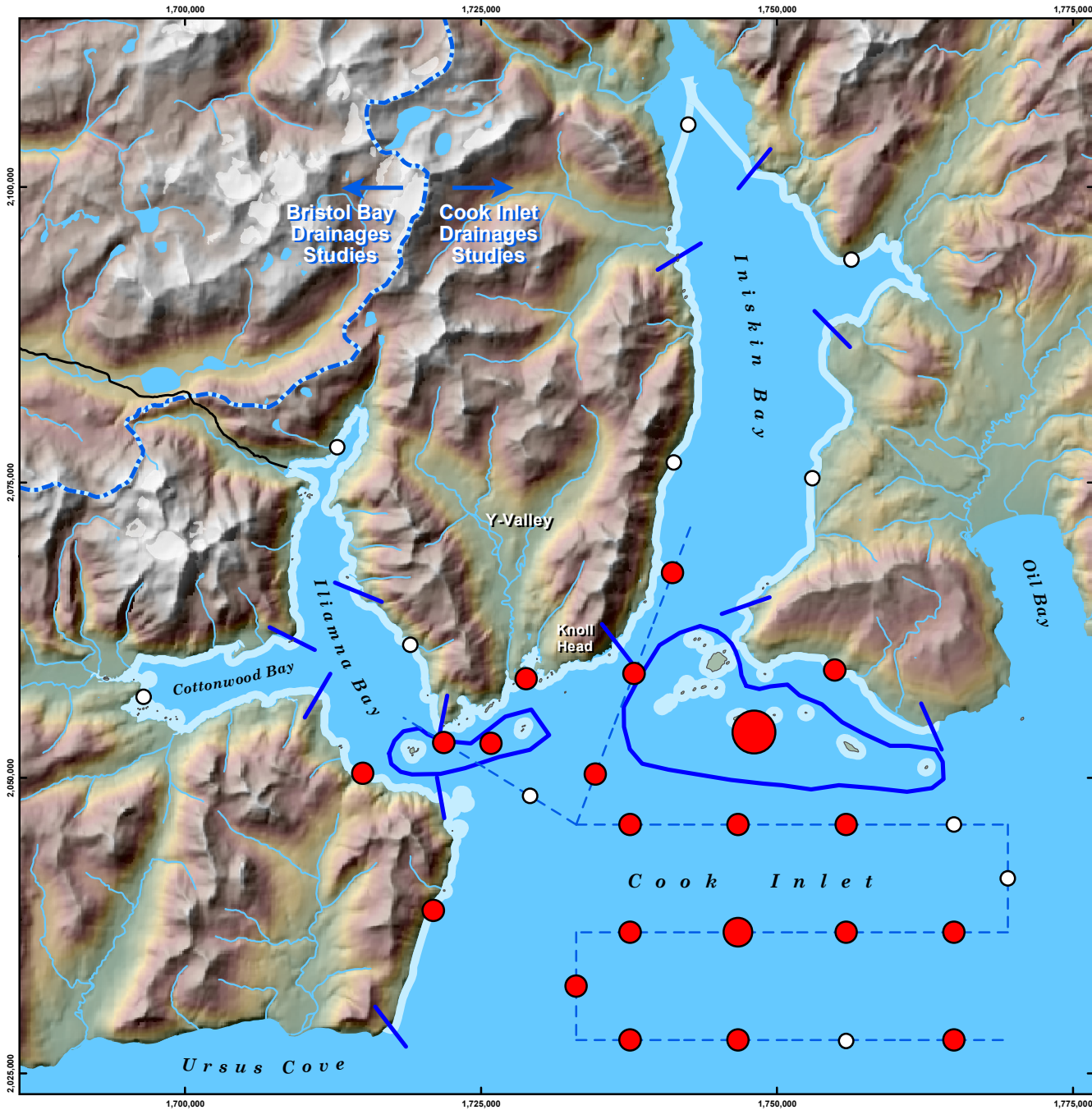
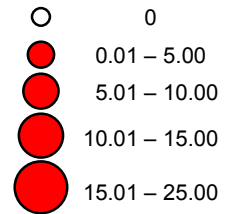


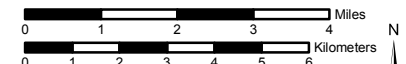
Figure 44-74
Distribution and Abundance
of Sea Otters Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter 2005 and 2006

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-74_SEOTDens_LWIn0506_PLP_EBD_v02.mxd	Date: Nov. 17, 2010
Version: 2	Author: ABR-AZC

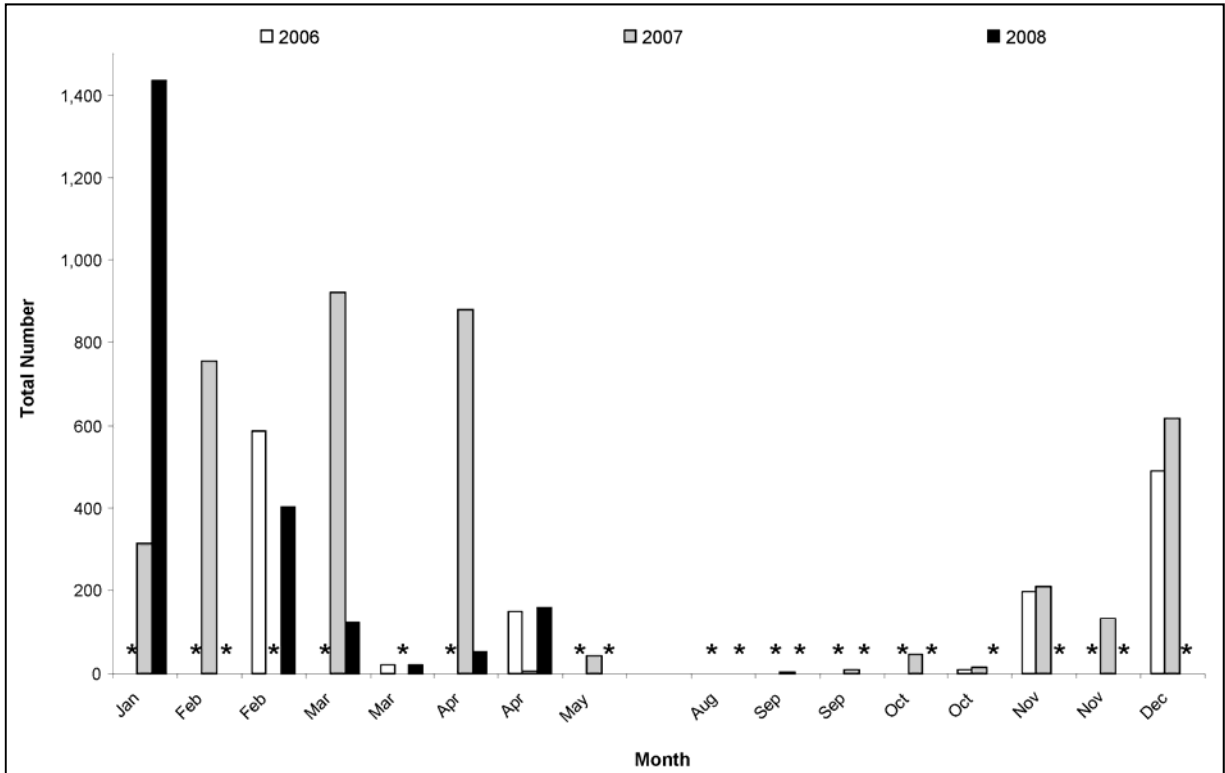


FIGURE 44-75
 Maximal Numbers of Sea Otters Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Asterisks indicate no survey in a particular year during that survey date.

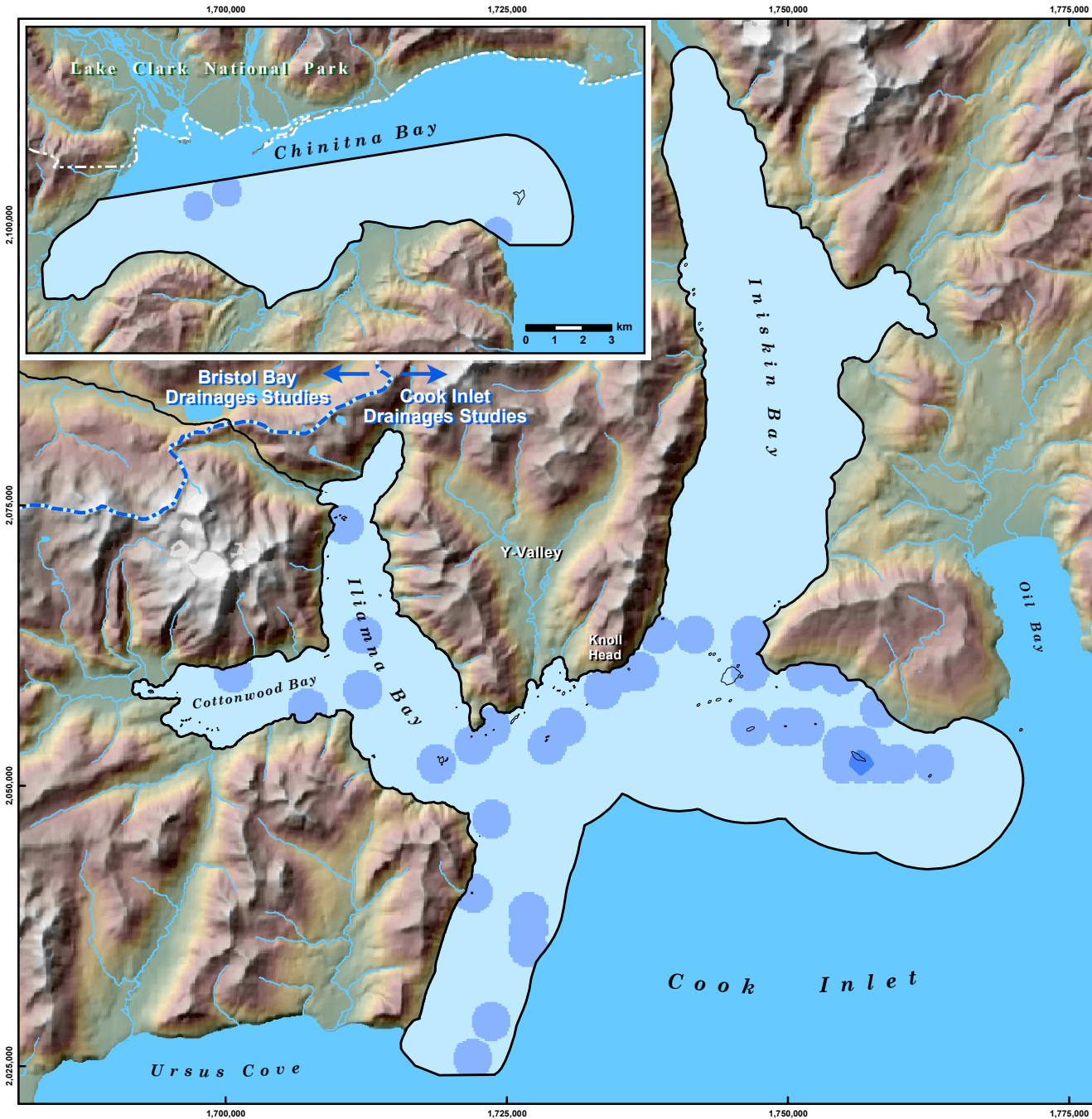


Figure 44-76
Distribution and Abundance of
Sea Otters Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Fall 2006–2008

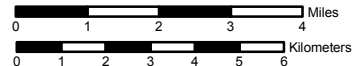
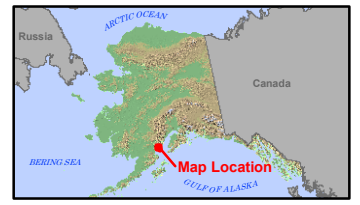
Legend

Mean Density (mammals/km²)

- 0
- 0.01 – 5.00
- 5.01 – 13.00

Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

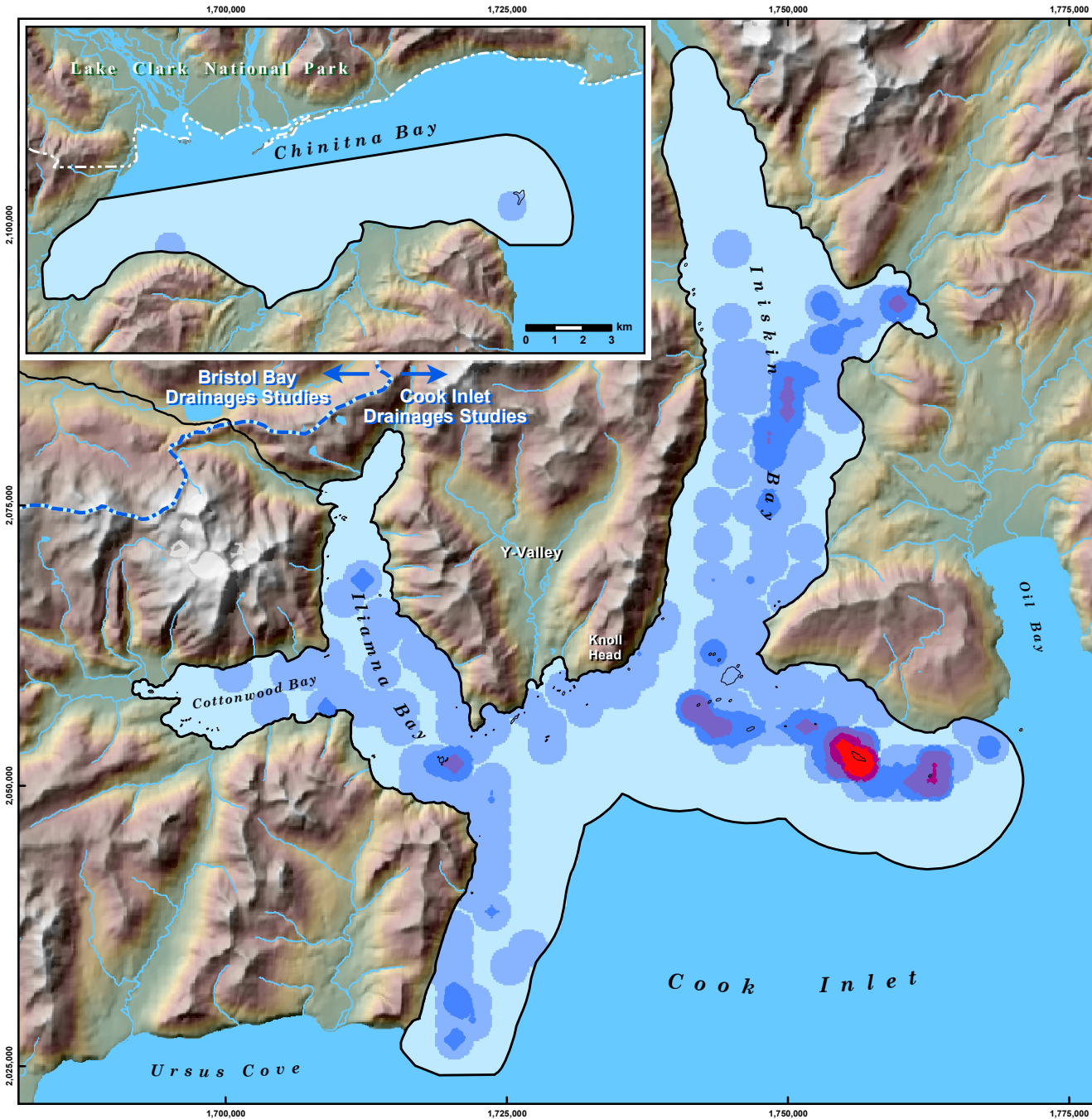
— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-76_SEOTDistHel_Fall0608_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC



2,100,000

2,075,000

2,050,000

2,025,000

1,700,000

1,725,000

1,750,000

1,775,000

1,700,000

1,725,000

1,750,000

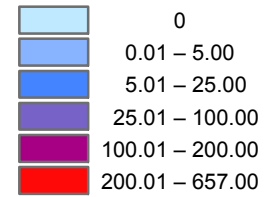
1,775,000



Figure 44-77
Distribution and Abundance of
Sea Otters Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Mid-winter 2006–2008

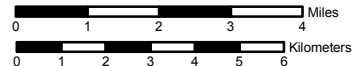
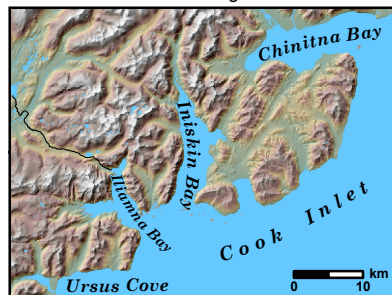
Legend

Mean Density (mammals/km²)



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-77_SEOTDistHel_Win0608_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC

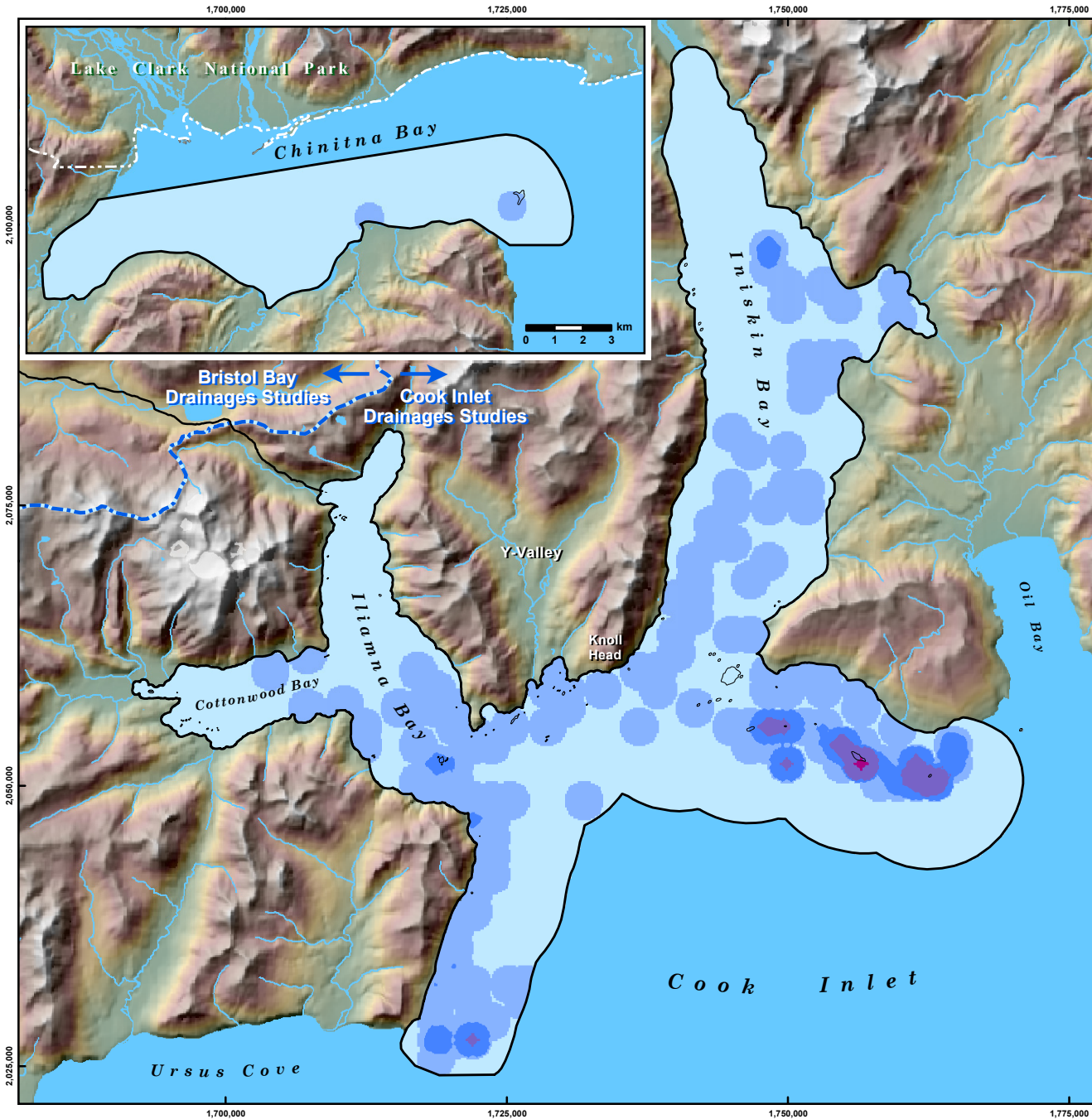
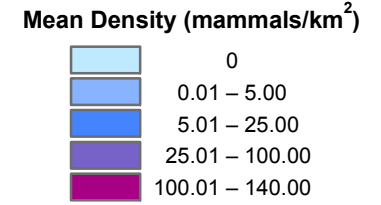


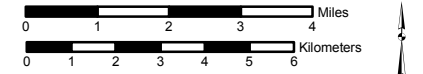
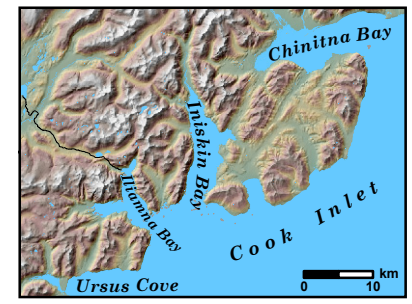
Figure 44-78
Distribution and Abundance of
Sea Otters Counted During
Helicopter-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter–Spring 2006–2008

Legend



Surface models of density were estimated with an inverse-distance weighted (IDW) interpolation of mean density data.

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-78_SEOTDistHeil_LWinSp0608_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC

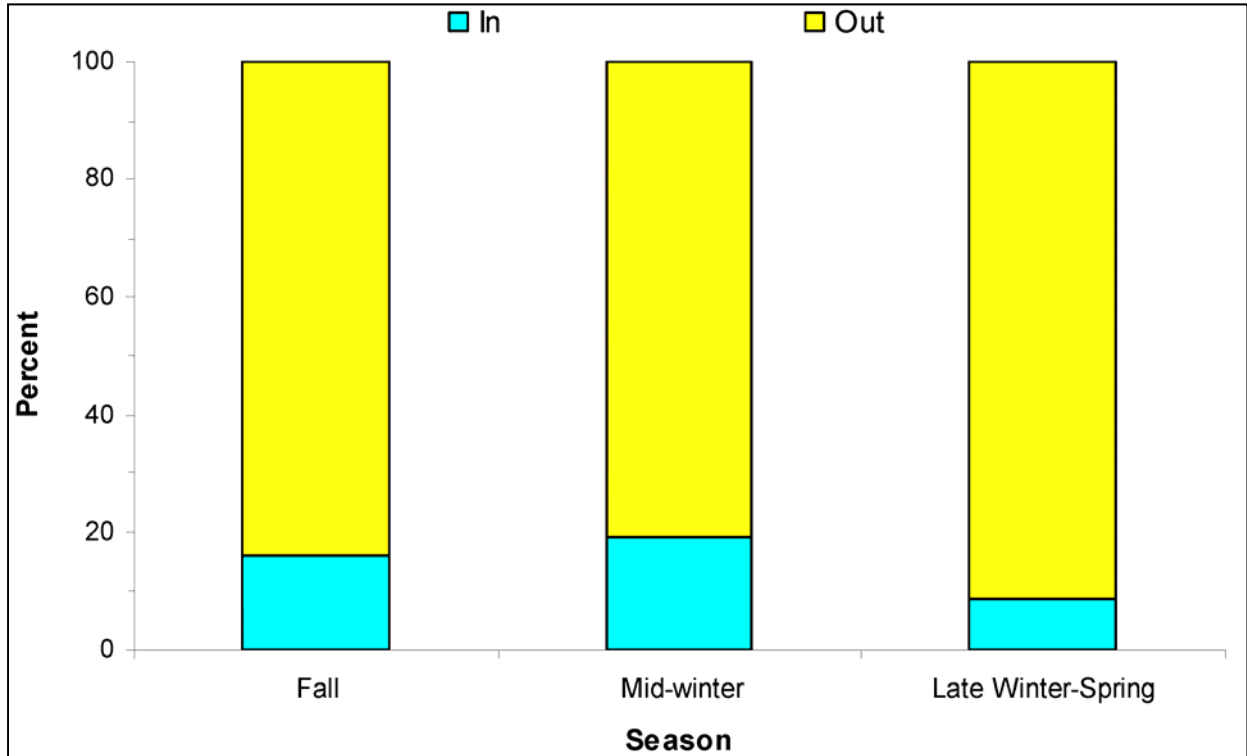


FIGURE 44-79
Inside-/outside-bay Locations of Sea Otters Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

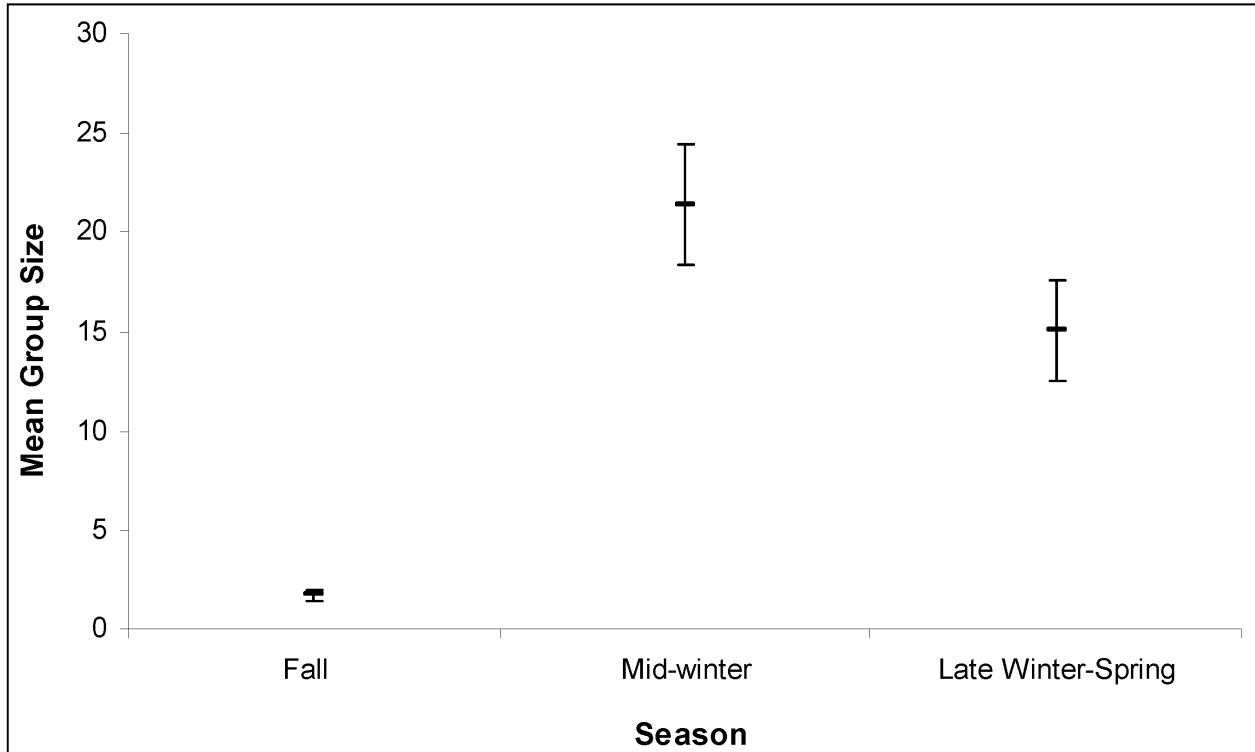


FIGURE 44-80
Mean Group Sizes of Sea Otters Counted in and near Iliamna and Iniskin Bays during Helicopter-based Marine Surveys, Cook Inlet Marine Study Area, 2006-2008

Note: Data are presented as mean \pm 1 standard error.

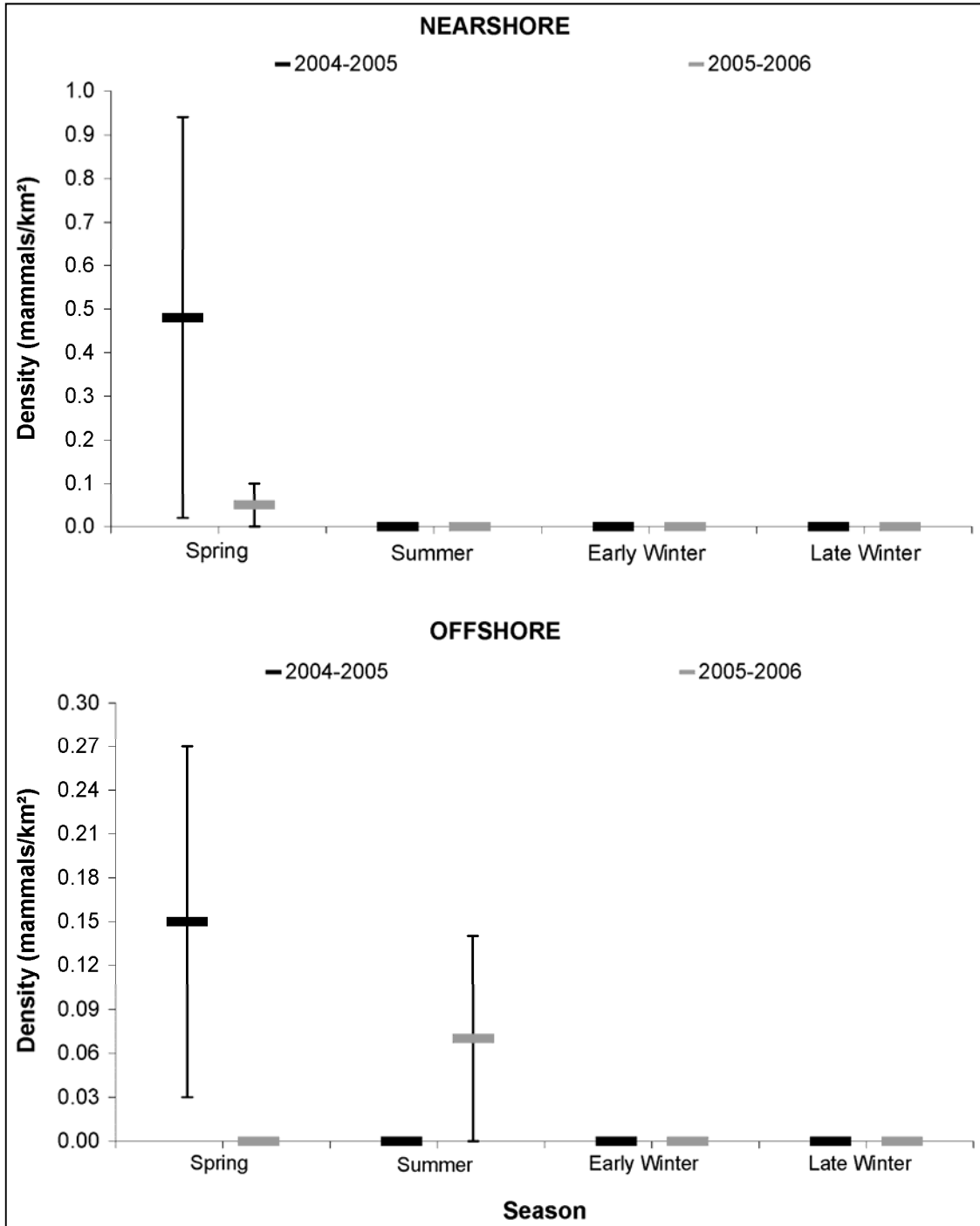


FIGURE 44-81
Mean Densities of Steller's Sea Lions Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

Note: Data are presented as mean \pm 1 standard error.



2,100,000

2,075,000

2,050,000

2,025,000

1,700,000

1,725,000

1,750,000

1,775,000

1,700,000

1,725,000

1,750,000

1,775,000

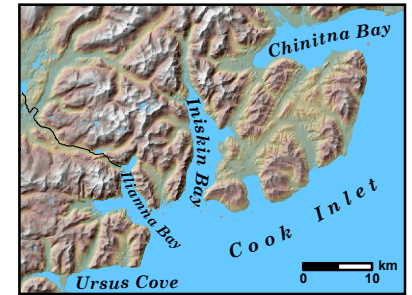


Figure 44-82
Distribution and Abundance of
Steller's Sea Lions Counted During
Boat-based and Aerial Marine
Surveys, Cook Inlet Marine
Study Area, 2004–2008

Legend

Number of Individuals	Month
○ 1	○ January
○ 3–4	○ March
○ 6–13	○ April
○ 33	○ May
	○ June
	○ November

Offshore Survey Transect	200-m Nearshore Survey Area	Existing Road
— — — —	— — — —	— — — —



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-82_STSLDist_BoatHel0408_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC

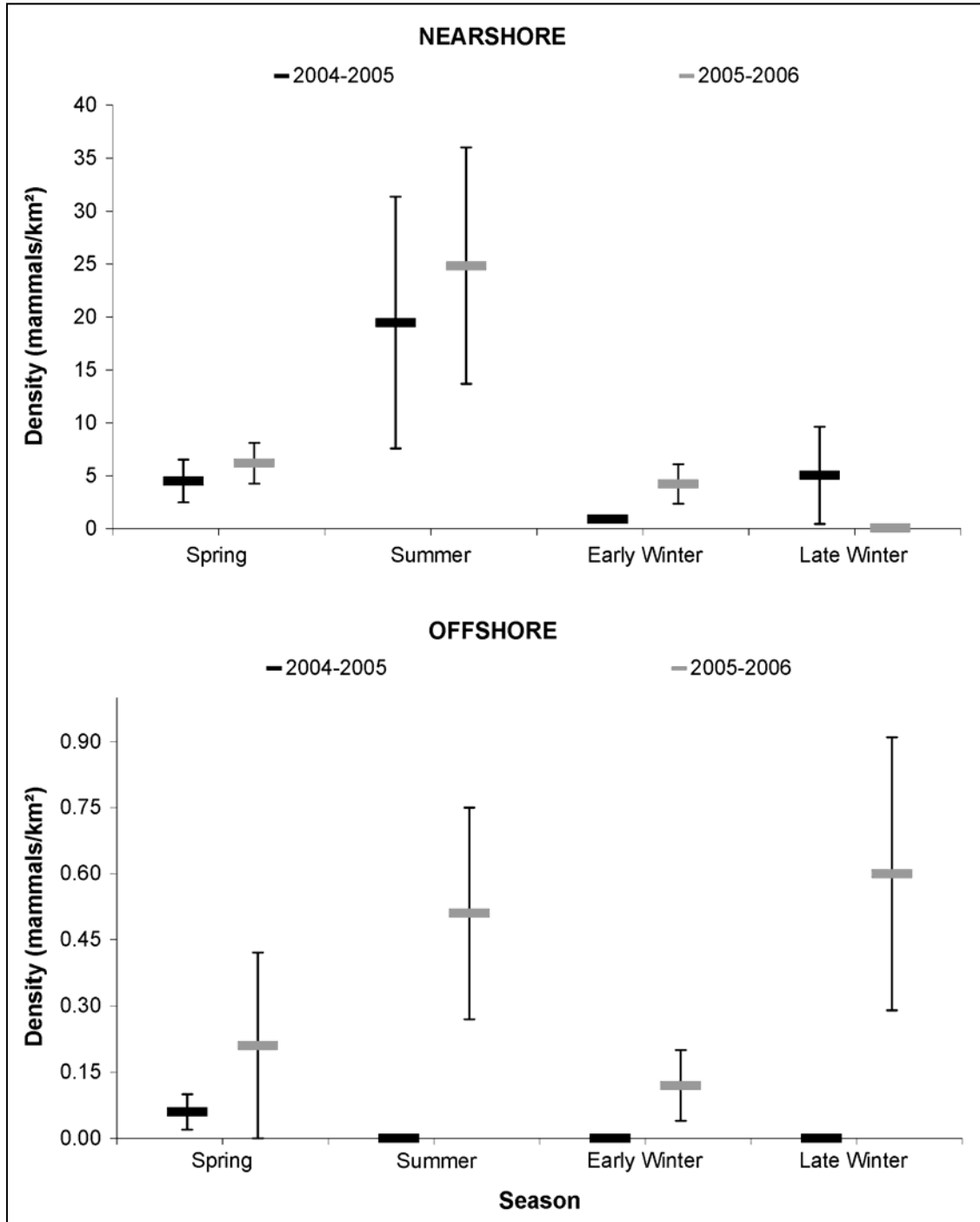


FIGURE 44-83
 Mean Densities of Harbor Seals Counted during Boat-based Marine Surveys, Cook Inlet Marine Study Area, 2004–2006

Note: Data are presented as mean \pm 1 standard error.

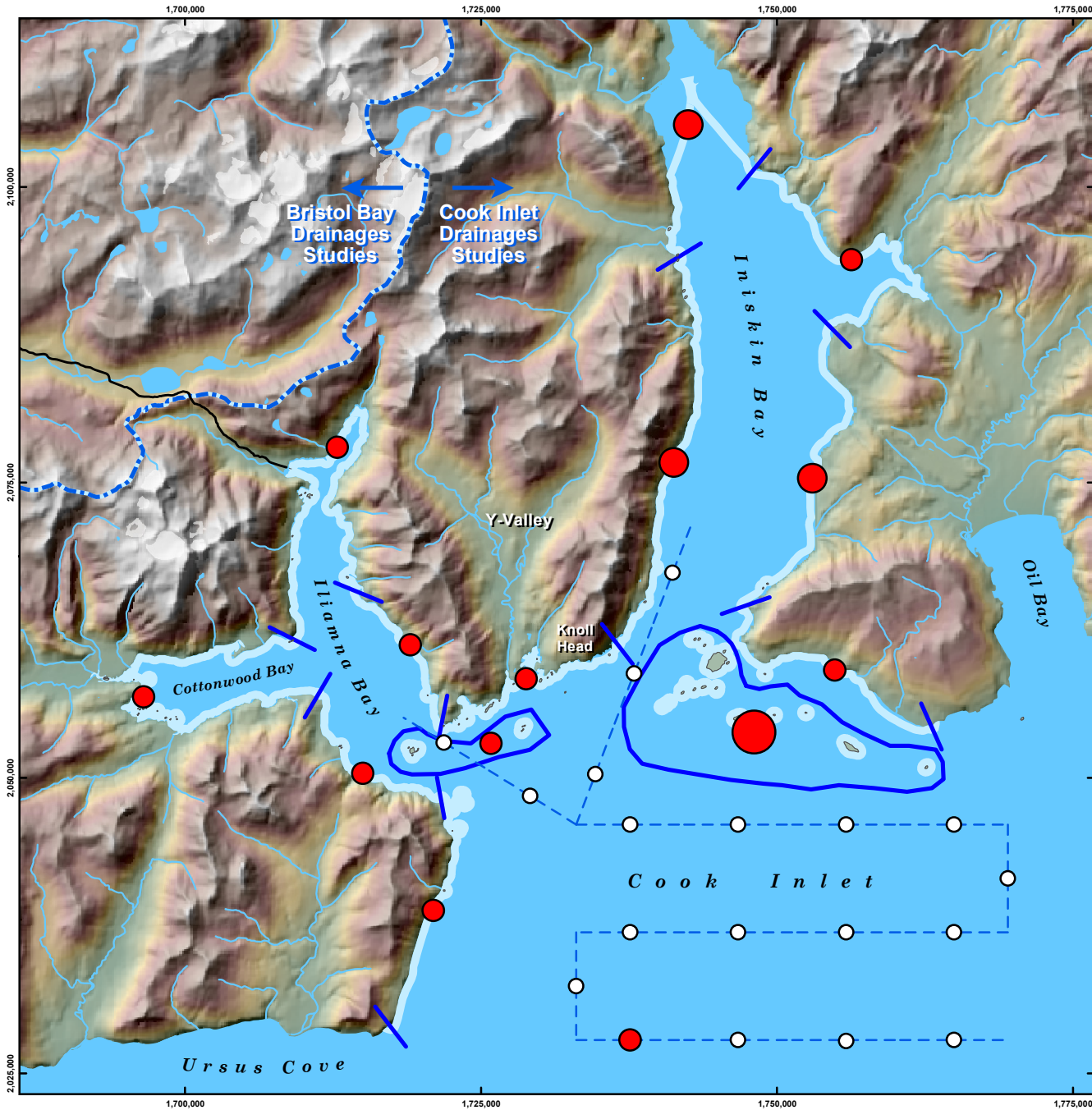
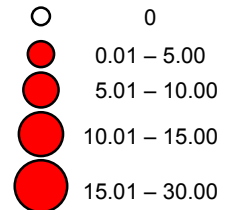


Figure 44-84
Distribution and Abundance
of Harbor Seals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Spring 2005 and 2006

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-84_HASEDens_Spr0506_PLP_EBD_v02.mxd Date: Nov. 24, 2010

Version: 2 Author: ABR-AZC

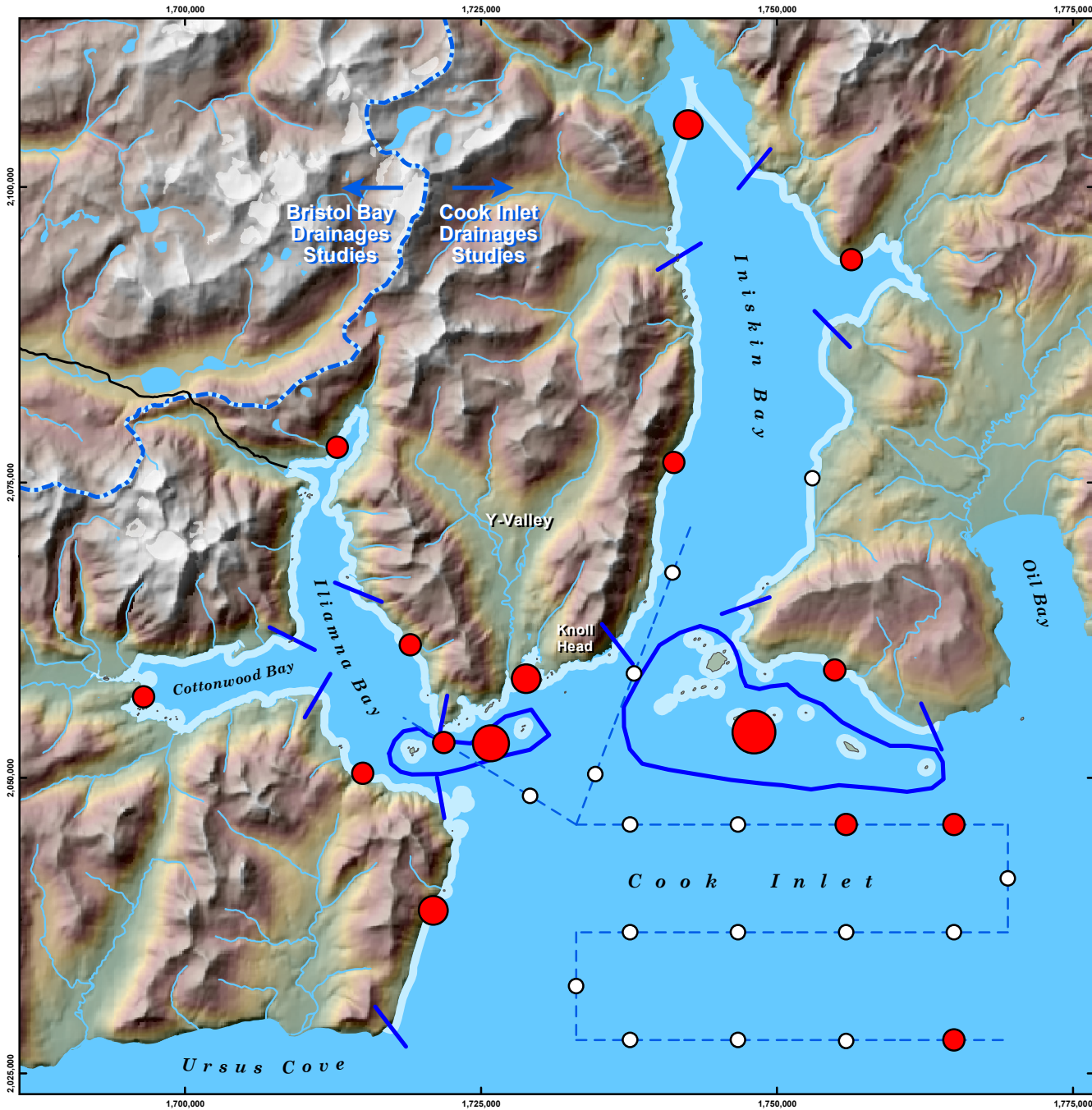
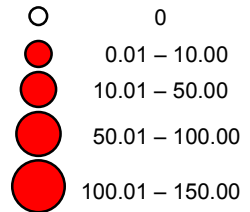


Figure 44-85
Distribution and Abundance
of Harbor Seals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Summer 2004 and 2005

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-85_HASEDens_Sum0405_PLP_EBD_v02.mxd Date: Nov. 24, 2010

Version: 2 Author: ABR-AZC

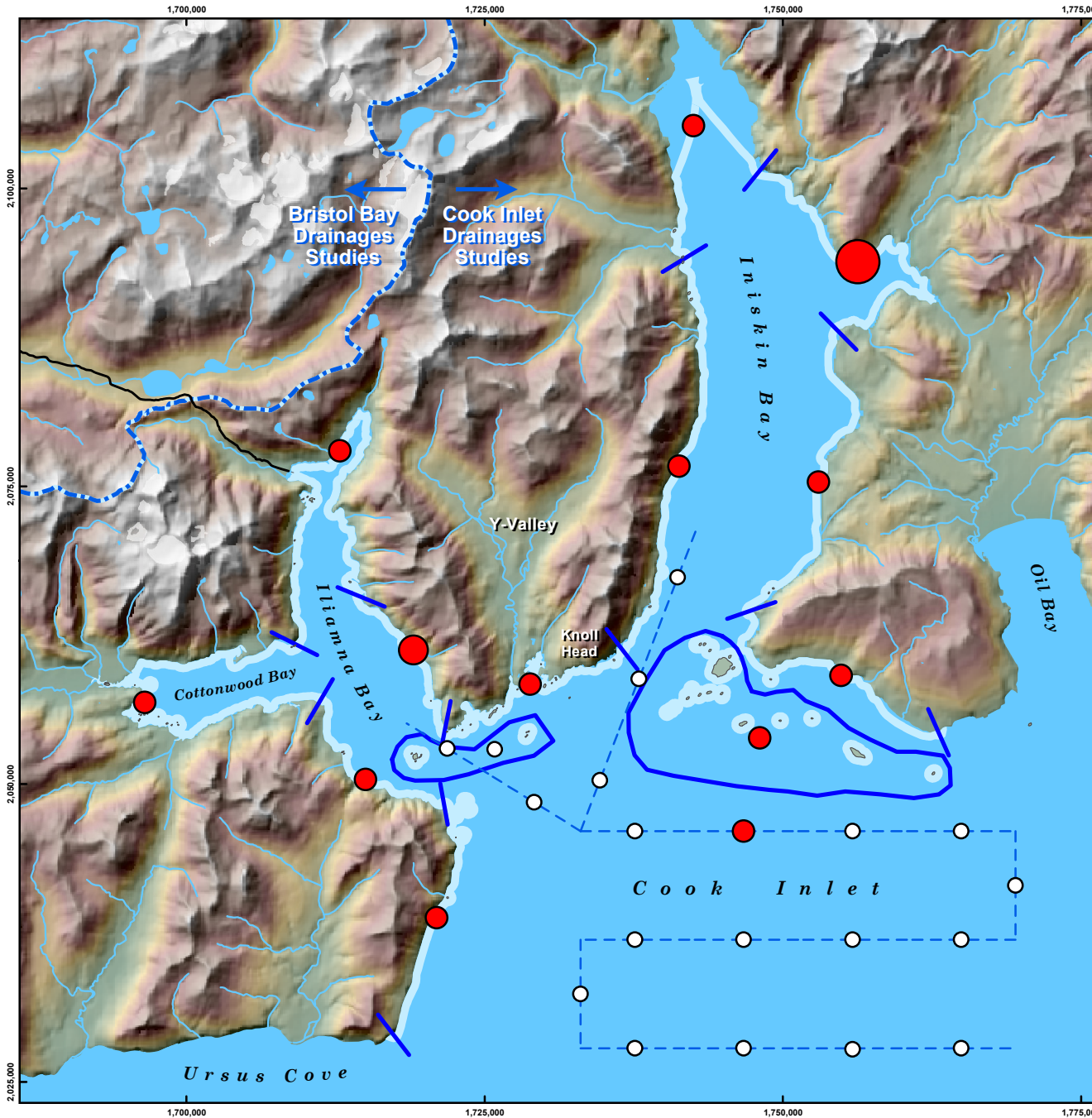


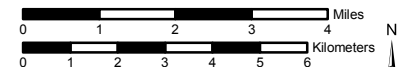
Figure 44-86
Distribution and Abundance
of Harbor Seals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Early Winter 2004 and 2005

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-86_HASEDens_EWin0405_PLP_EBD_v02.mxd Date: Nov. 24, 2010

Version: 2 Author: ABR-AZC

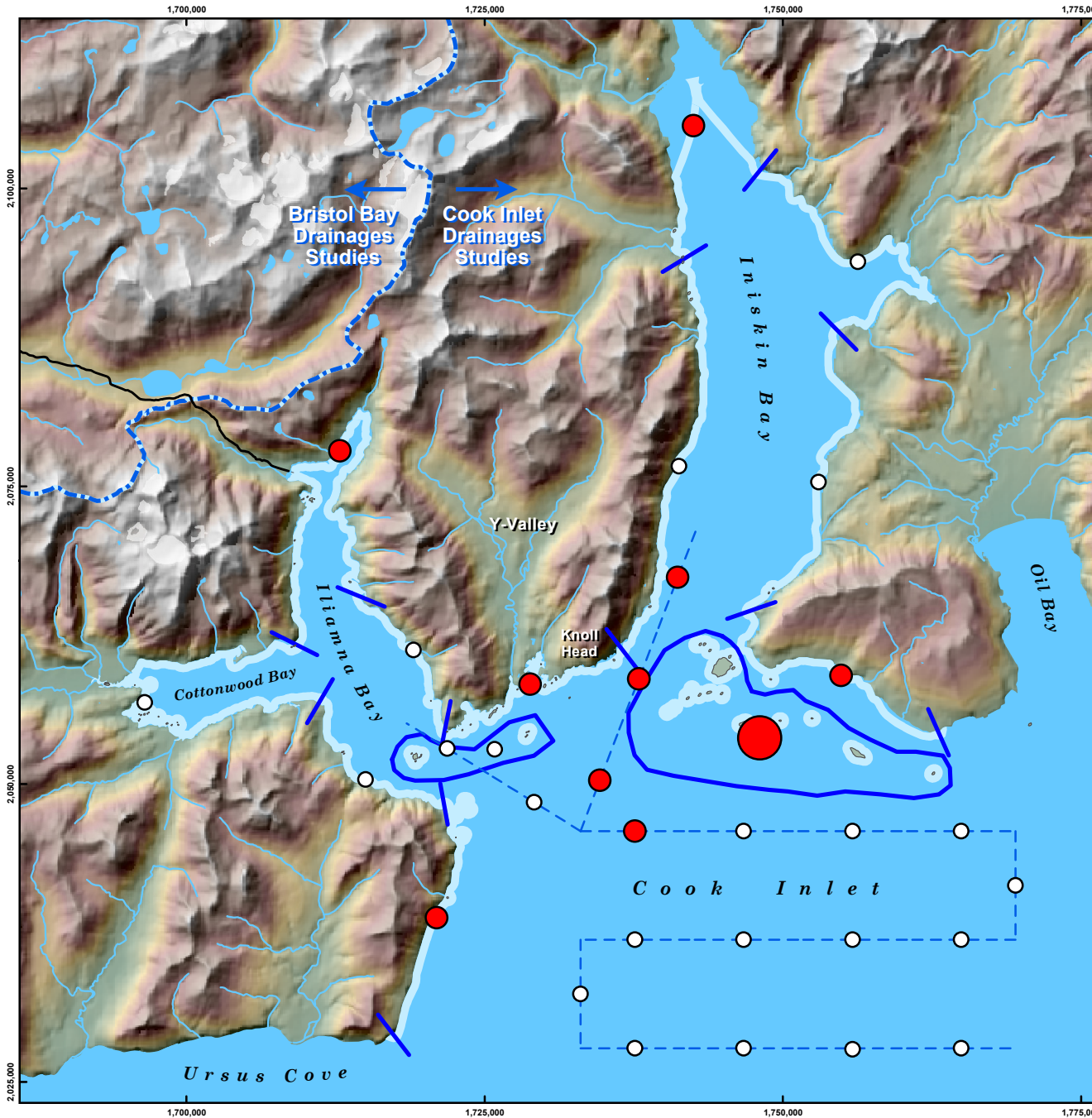
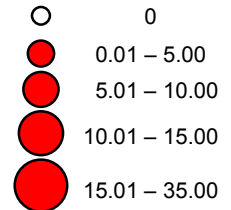


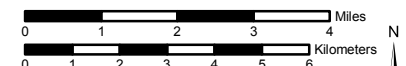
Figure 44-87
Distribution and Abundance
of Harbor Seals Counted During
Boat-based Marine Surveys,
Cook Inlet Marine Study Area,
Late Winter 2005 and 2006

Legend

Mean Density (mammals/km²)



- Offshore Survey Transect
- 200-m Nearshore Survey Area
- Nearshore Survey Segment Boundary
- Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

File: 44-87_HASEDens_LWin0506_PLP_EBD_v02.mxd Date: Nov. 24, 2010

Version: 2 Author: ABR-AZC

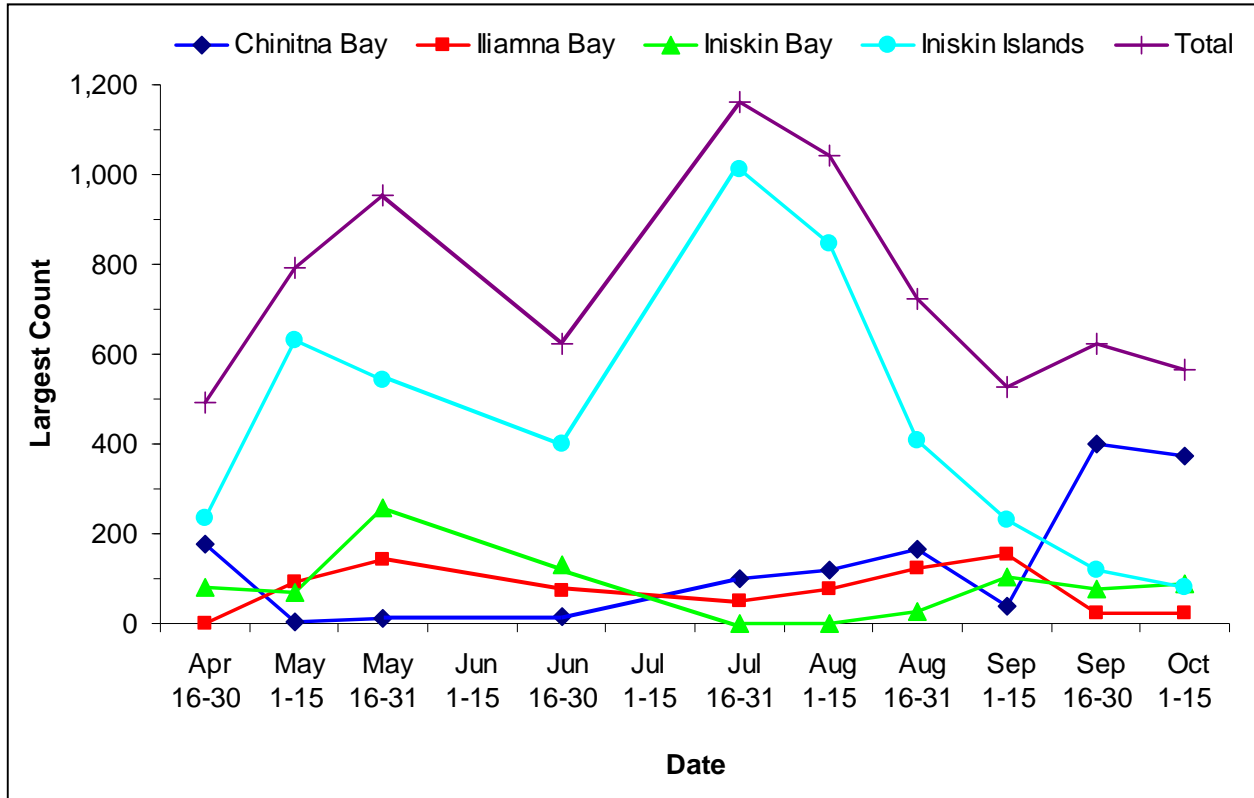


FIGURE 44-88
 Raw (Unadjusted) Counts of Harbor Seals during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2005

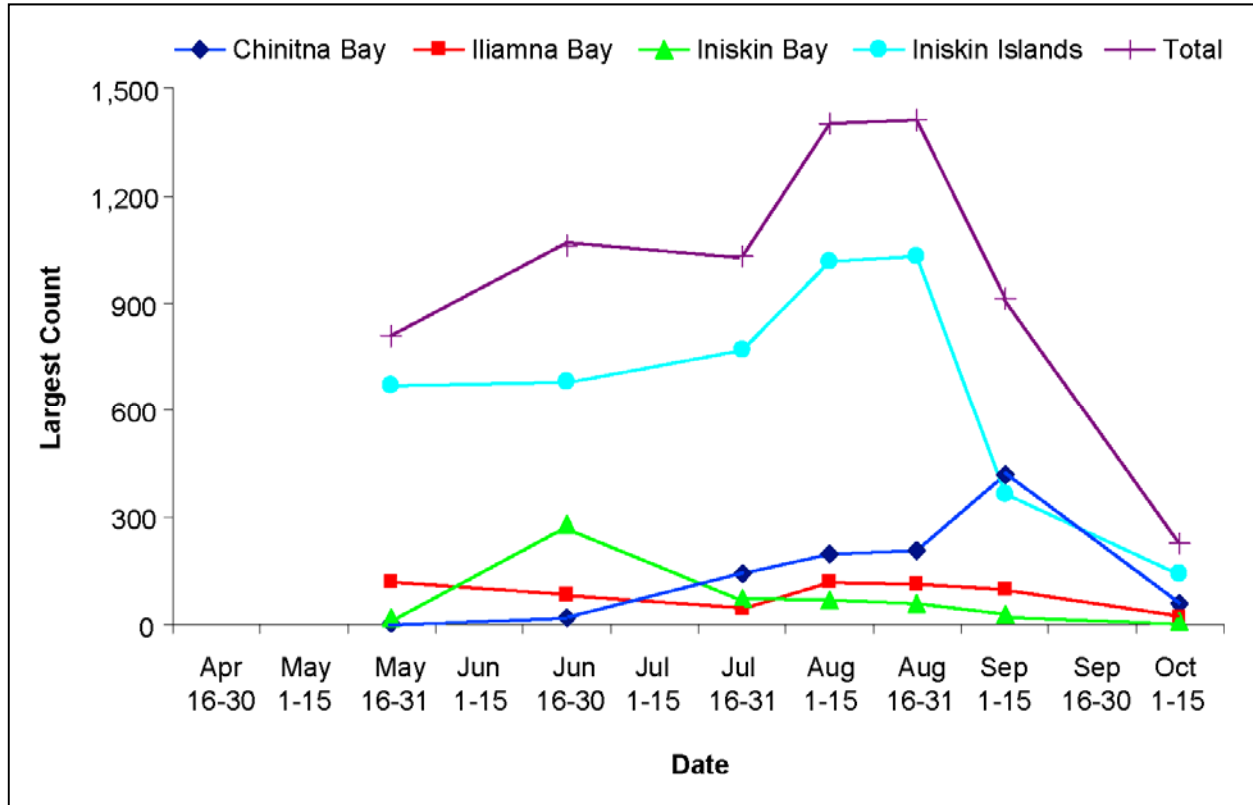


FIGURE 44-89
Raw (Unadjusted) Counts of Harbor Seals during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2007

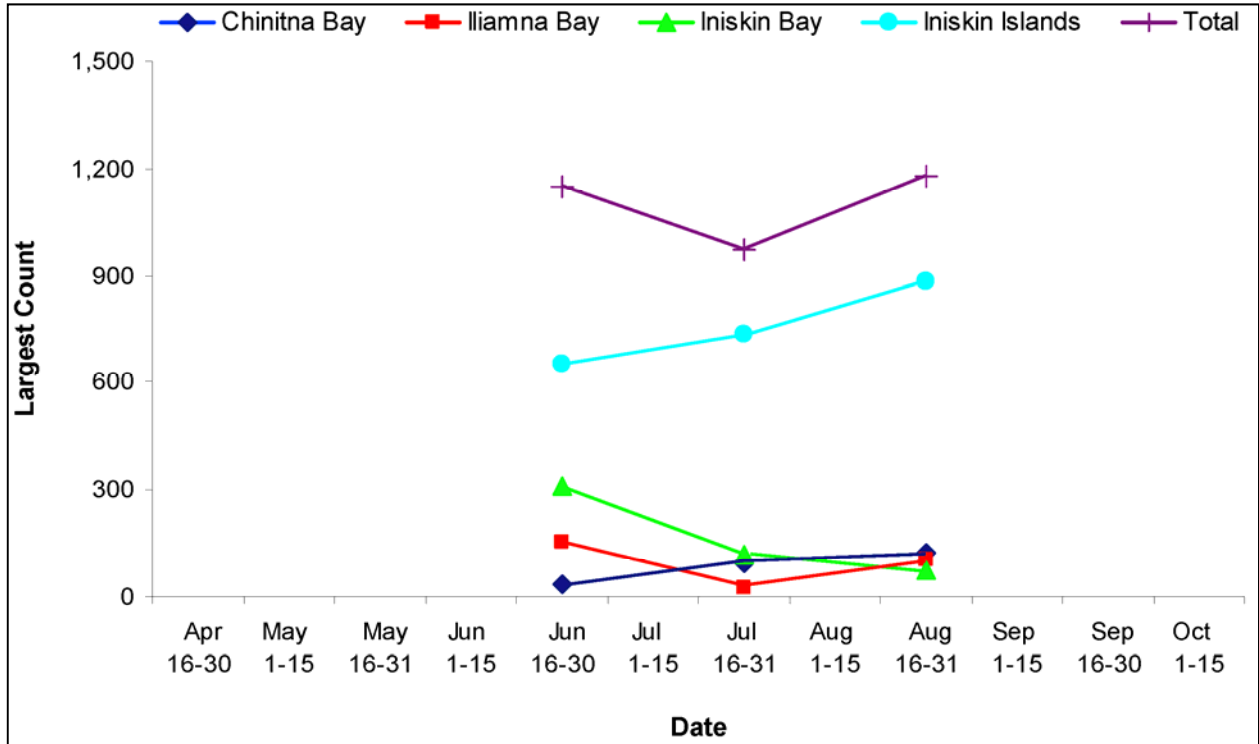


FIGURE 44-90
 Raw (Unadjusted) Counts of Harbor Seals during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2008

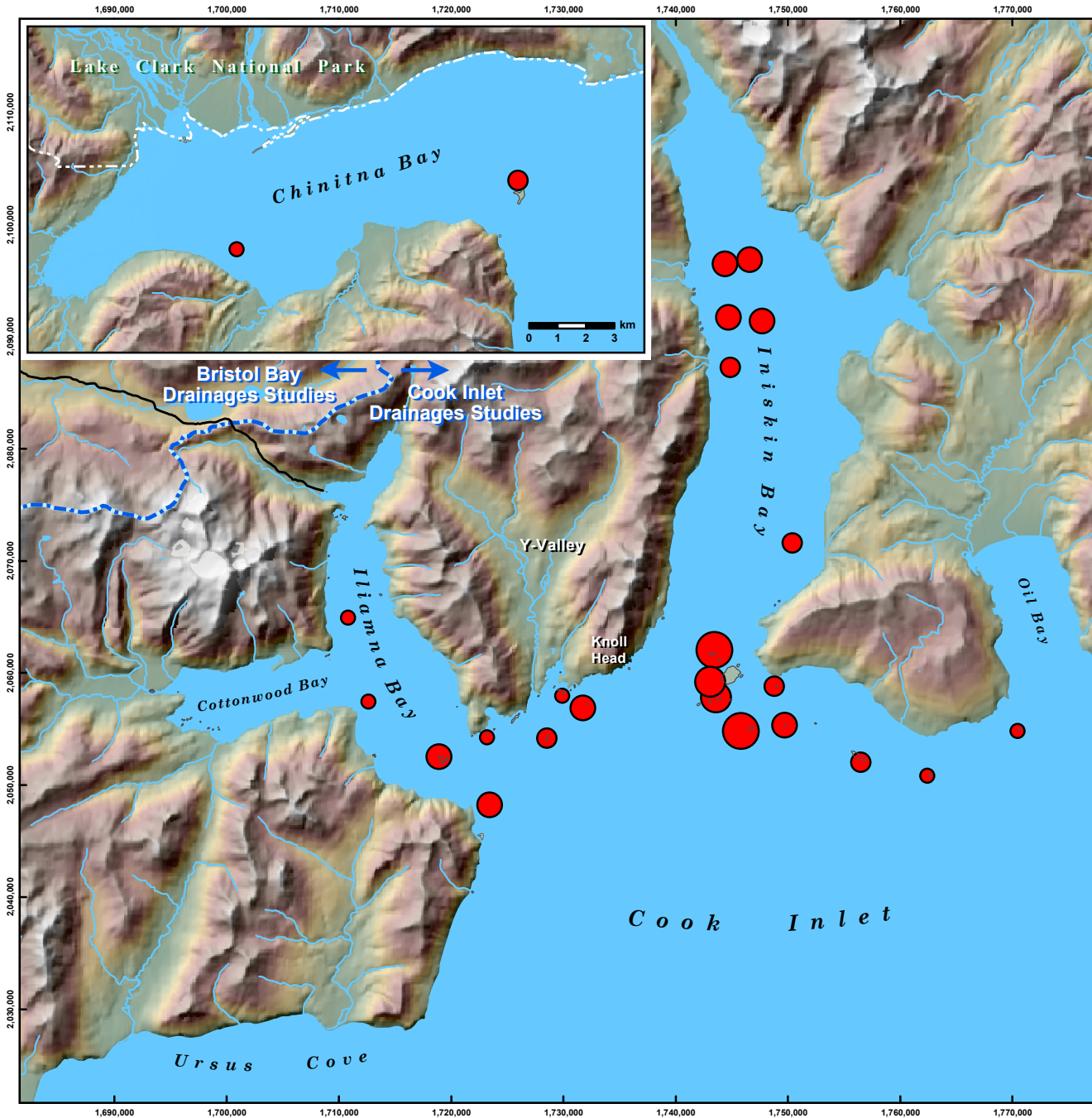
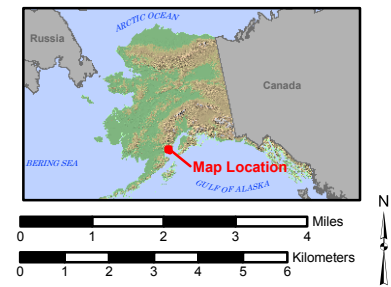
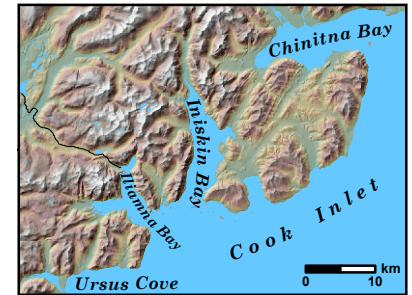


Figure 44-91
Distribution and Abundance of Harbor Seals Counted During Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, May–June 2005, 2007, and 2008

Legend

- Mean Number of Harbor Seals**
- 0.1 – 3.0
 - 3.1 – 10.0
 - 10.1 – 50.0
 - 50.1 – 100.0
 - 100.1 – 166.0
- Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-91_HASEDist_MayJun0508_PLP_EBD_v02.mxd	Date: Nov 24, 2010
Version: 2	Author: ABR-AZC

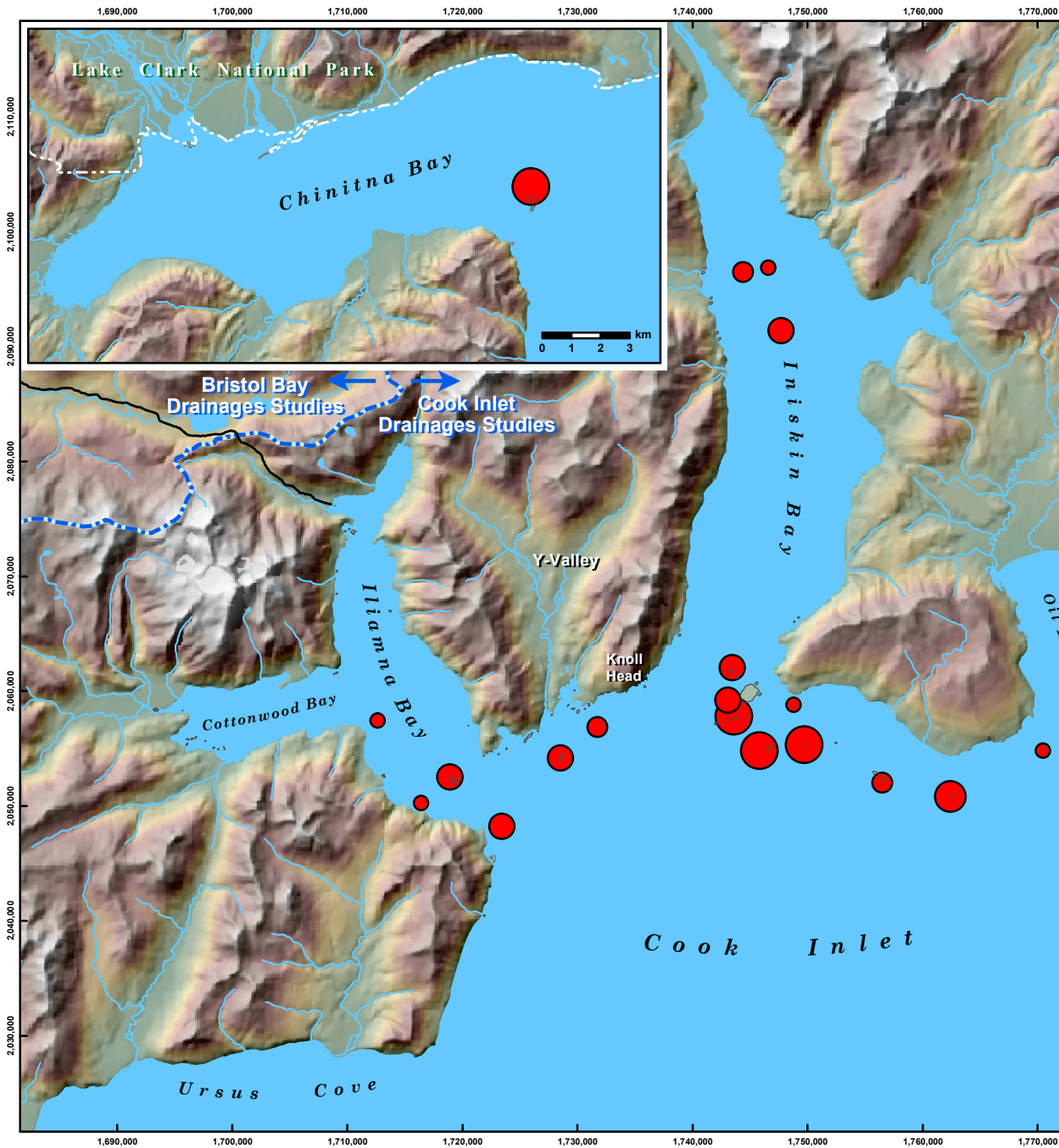


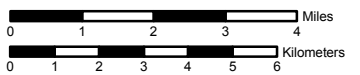
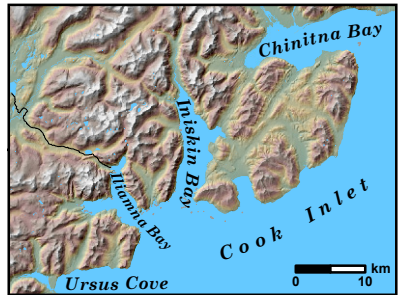
Figure 44-92
Distribution and Abundance of Harbor Seals Counted During Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, July–August 2005, 2007, and 2008

Legend

Mean Number of Harbor Seals

- 0.1 – 3.0
- 3.1 – 10.0
- 10.1 – 50.0
- 50.1 – 100.0
- 100.1 – 270.0

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-92_HASEDist_JulAug0508_PLP_EBD_v02.mxd	Date: Nov 24, 2010
Version: 2	Author: ABR-AZC

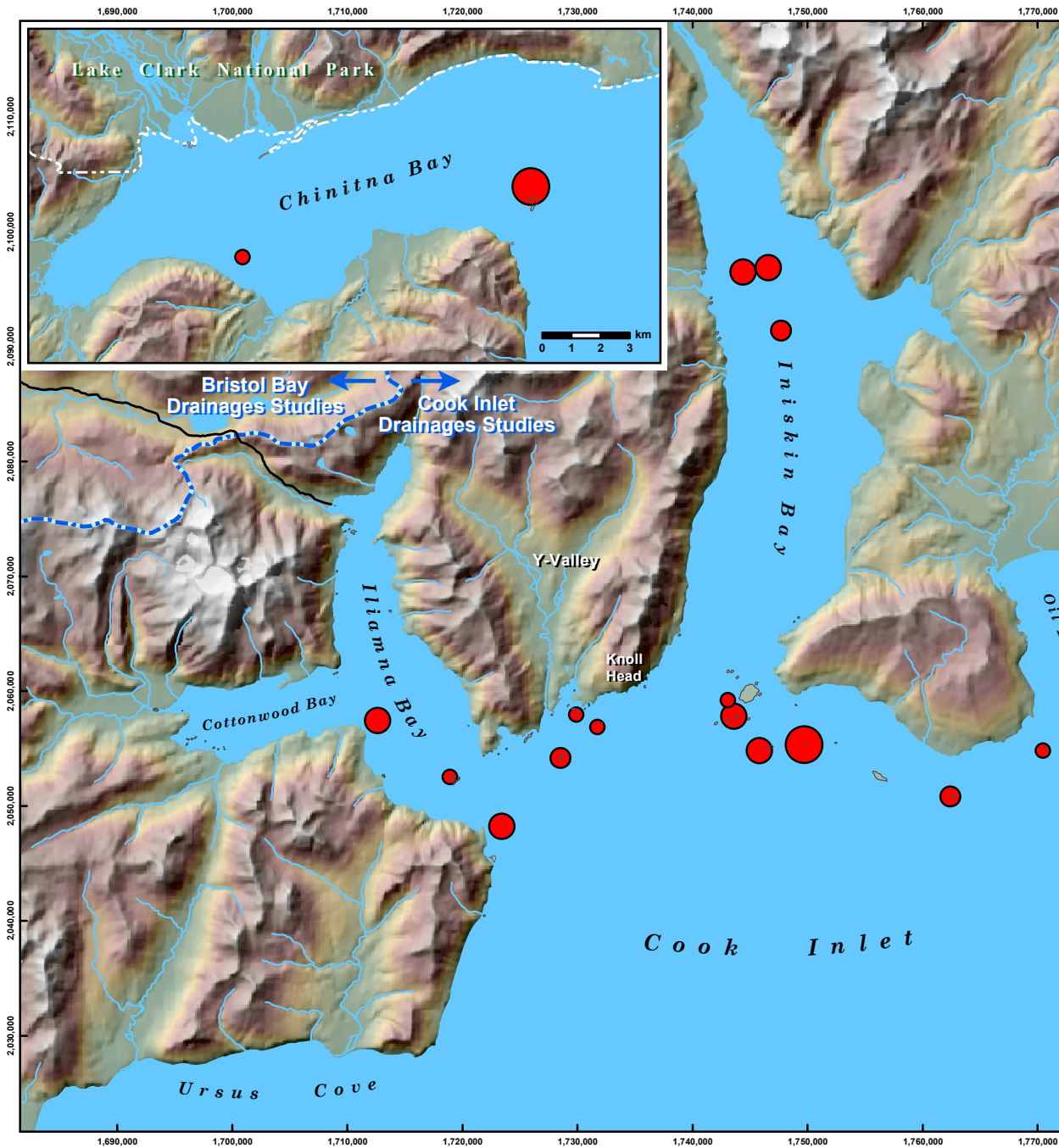


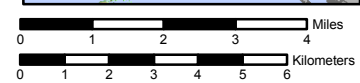
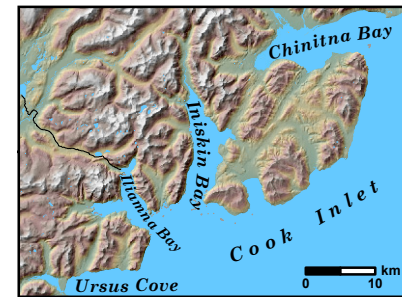
Figure 44-93
Distribution and Abundance of Harbor Seals Counted During Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, September–October 2005, 2007, and 2008

Legend

Mean Number of Harbor Seals

- 0.1 – 3.0
- 3.1 – 10.0
- 10.1 – 50.0
- 50.1 – 100.0
- 100.1 – 270.0

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: 44-93_HASEDist_SepOct0508_PLP_EBD_v02.mxd Date: Nov 24, 2010

Version: 2 Author: ABR-AZC

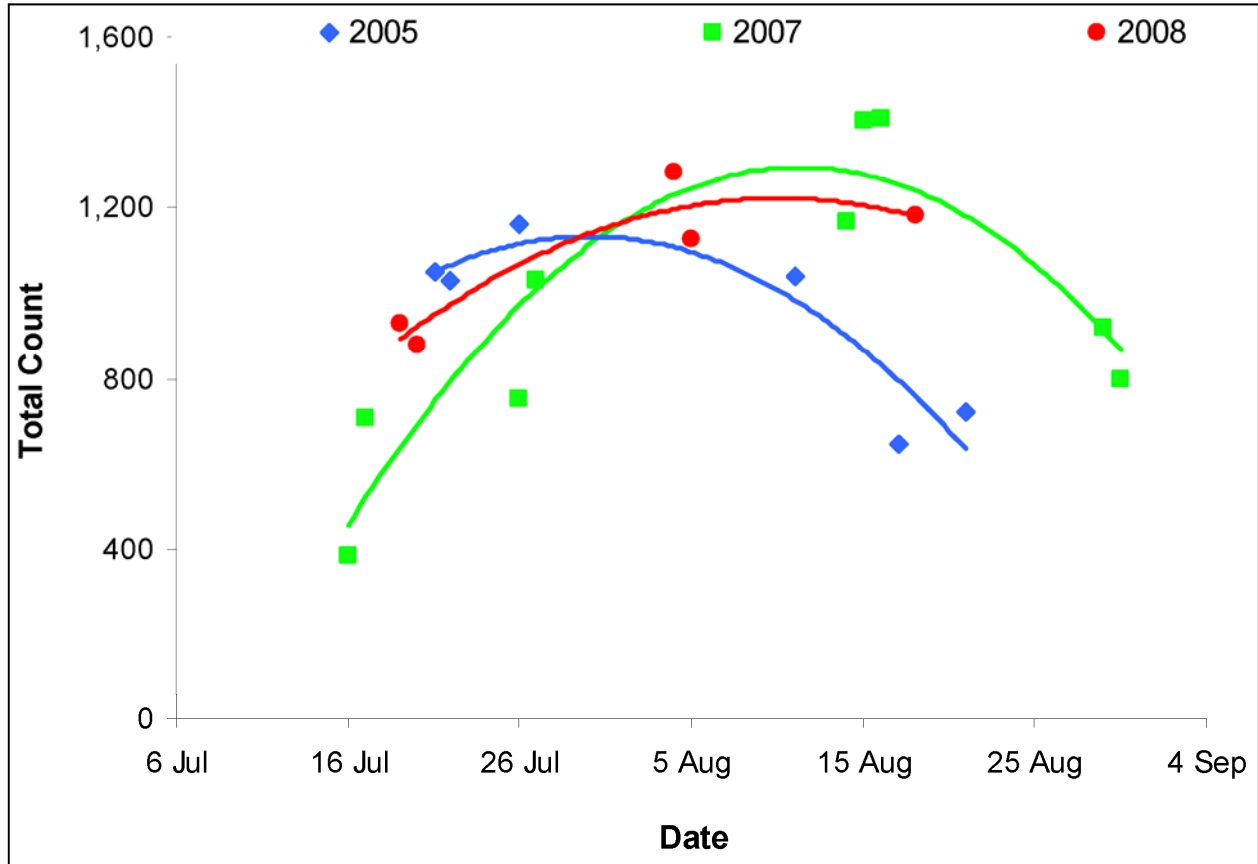


FIGURE 44-94

Raw (unadjusted) Counts of Harbor Seals during July and August Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2005, 2007, and 2008, with a Second-order Polynomial Model for Each Year

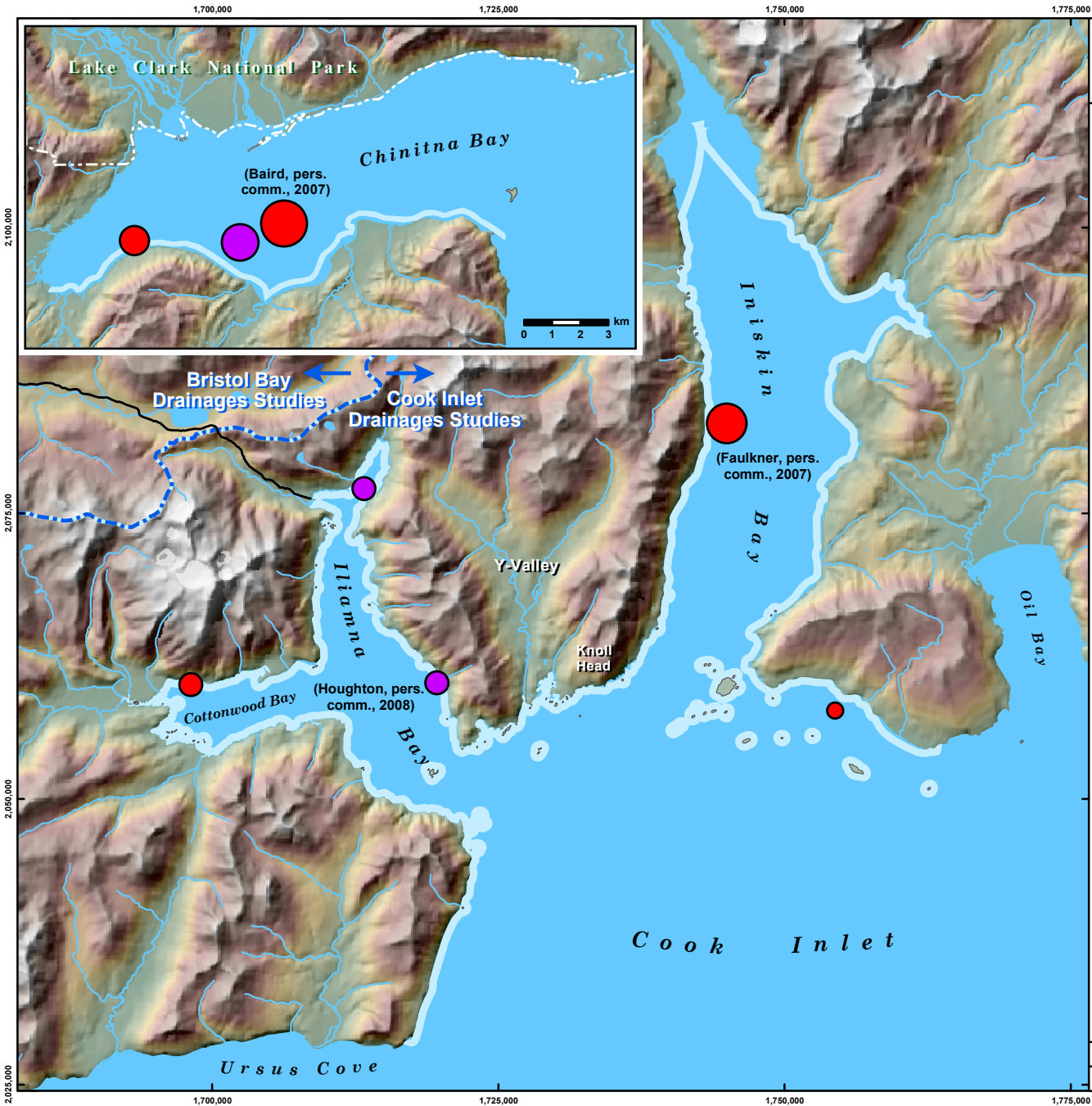
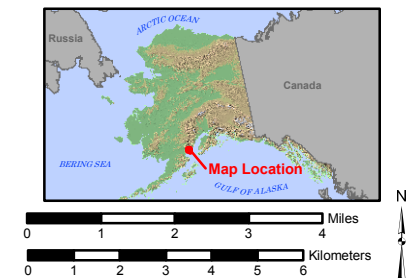
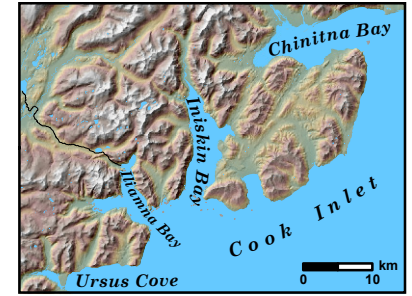
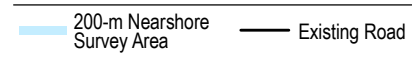
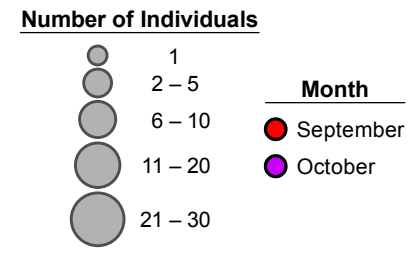


Figure 44-95
Distribution and Abundance of Belugas Counted During Aerial Marine Surveys, 2006–2008, and Other Miscellaneous Records, 2007, Cook Inlet Marine Study Area

Legend



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:165,000

File: 44-95_BELUDist_Hell0608_PLP_EBD_v02.mxd Date: Nov. 24, 2010

Version: 2 Author: ABR-AZC

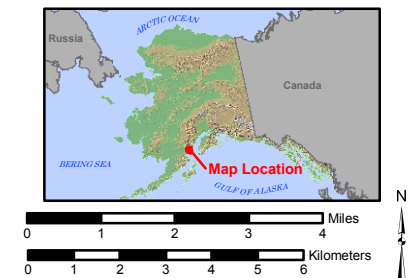
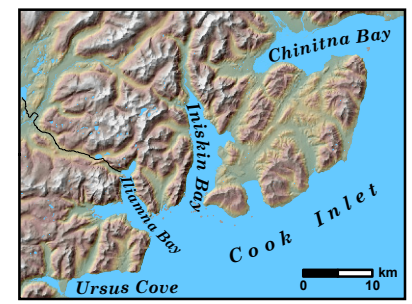


Figure 44-96
Distribution and Abundance of Harbor and Dall's Porpoises Counted During Boat-based and Aerial Marine Surveys, Cook Inlet Marine Study Area, 2004–2008

Legend

- Species:** ○ Harbor Porpoise ☆ Dall's Porpoise
- | Number of Individuals | Season |
|-----------------------|----------------------|
| ○ 1 | ● Fall |
| ○ 2 | ● Mid-winter |
| ○ 4 | ● Late Winter–Spring |
| | ● Summer |

- Offshore Survey Transect ———
 200-m Nearshore Survey Area ———
 Existing Road ———



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:165,000

File: 44-96_DAPOHAPODist_BoatHeil0408_PLP_EBD_v02.mxd	Date: Nov. 24, 2010
Version: 2	Author: ABR-AZC

APPENDICES

APPENDIX 44A

List of Bird and Mammal Species Observed
during Marine Wildlife Studies,
Cook Inlet Marine Study Area, 2004-2008

Bird and Mammal Species Observed during Marine Wildlife Studies, Cook Inlet Marine Study Area, 2004-2008

Common Name	Scientific Name	RECORDED DURING		
		Boat-based Surveys	Fixed-wing Surveys	Helicopter-based Surveys
BIRDS				
Greater White-fronted Goose	<i>Anser albifrons</i>	X	X	X
Emperor Goose	<i>Chen canagica</i>	X	-	-
Brant	<i>Branta bernicla</i>	X	-	-
Cackling/Canada Goose	<i>Branta hutchinsii/canadensis</i>	-	-	X
Unidentified goose		X	X	-
Trumpeter Swan	<i>Cygnus buccinator</i>	X	-	-
Unidentified swan ^a	<i>Cygnus</i> spp.	-	X	-
American Wigeon	<i>Anas americana</i>	X	X	X
Mallard	<i>Anas platyrhynchos</i>	X	X	X
Northern Shoveler	<i>Anas clypeata</i>	X	X	X
Northern Pintail	<i>Anas acuta</i>	X	X	X
Green-winged Teal	<i>Anas crecca</i>	X	X	X
Unidentified dabbling duck	<i>Anas</i> spp.	-	X	-
Canvasback	<i>Aythya valisineria</i>	X	-	-
Greater Scaup	<i>Aythya marila</i>	X	-	X
Unidentified scaup	<i>Aythya</i> spp.	X	X	X
Steller's Eider	<i>Polysticta stelleri</i>	OT	-	X
King Eider	<i>Somateria spectabilis</i>	-	-	X
Common Eider	<i>Somateria mollissima</i>	X	X	X
Unidentified eider	<i>Somateria</i> spp.	-	X	-
Harlequin Duck	<i>Histrionicus histrionicus</i>	X	X	X
Surf Scoter	<i>Melanitta perspicillata</i>	X	X	X
White-winged Scoter	<i>Melanitta fusca</i>	X	X	X
American Scoter	<i>Melanitta americana</i>	X	X	X
Unidentified scoter	<i>Melanitta</i> spp.	X	X	X
Long-tailed Duck	<i>Clangula hyemalis</i>	X	X	X
Bufflehead	<i>Bucephala albeola</i>	X	X	X
Common Goldeneye	<i>Bucephala clangula</i>	X	-	X
Barrow's Goldeneye	<i>Bucephala islandica</i>	X	-	X
Unidentified goldeneye	<i>B. clangula</i> or <i>B. islandica</i>	X	X	X
Common Merganser	<i>Mergus merganser</i>	X	X	X
Red-breasted Merganser	<i>Mergus serrator</i>	X	X	X
Unidentified merganser	<i>Mergus</i> spp.	X	X	X
Unidentified diving duck		X	X	X
Unidentified duck		X	X	X
Red-throated Loon	<i>Gavia stellata</i>	X	-	X

Common Name	Scientific Name	RECORDED DURING		
		Boat-based Surveys	Fixed-wing Surveys	Helicopter-based Surveys
Pacific Loon	<i>Gavia pacifica</i>	X	-	X
Common Loon	<i>Gavia immer</i>	X	X	X
Unidentified loon—large	<i>Gavia</i> spp.	-	-	X
Unidentified loon	<i>Gavia</i> spp.	X	X	X
Horned Grebe	<i>Podiceps auritus</i>	X	X	X
Red-necked Grebe	<i>Podiceps grisegena</i>	X	X	X
Unidentified grebe	<i>Podiceps</i> spp.	-	X	-
Western Grebe	<i>Aechmophorus occidentalis</i>	X	-	-
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	X	-	-
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	X	X	-
Red-faced Cormorant	<i>Phalacrocorax urile</i>	X	-	-
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	X	X	X
Unidentified cormorant	<i>Phalacrocorax</i> spp.	X	X	X
Bald Eagle	<i>Haliaeetus leucocephalus</i>	X	-	X
Golden Eagle	<i>Aquila chrysaetos</i>	X	-	-
Merlin	<i>Falco columbarius</i>	X	-	-
Peregrine Falcon	<i>Falco peregrinus</i>	X	-	X
Black-bellied Plover	<i>Pluvialis squatarola</i>	X	-	-
Semipalmated Plover	<i>Charadrius semipalmatus</i>	X	-	-
Black Oystercatcher	<i>Haematopus bachmani</i>	X	X	X
Spotted Sandpiper	<i>Actitis macularius</i>	X	-	-
Unidentified yellowlegs ^b	<i>Tringa</i> spp.	X	X	-
Marbled Godwit	<i>Limosa fedoa</i>	X	-	-
Ruddy Turnstone	<i>Arenaria interpres</i>	X	-	-
Black Turnstone	<i>Arenaria melanocephala</i>	X	-	-
Unidentified turnstone	<i>Arenaria</i> spp.	X	-	-
Surfbird	<i>Aphriza virgata</i>	X	-	-
Western Sandpiper	<i>Calidris mauri</i>	X	-	-
Unidentified sandpiper—small	<i>Calidris</i> spp.	X	X	X
Rock Sandpiper	<i>Calidris ptilocnemis</i>	X	-	X
Dunlin	<i>Calidris alpina</i>	X	-	-
Red-necked Phalarope	<i>Phalaropus lobatus</i>	X	-	-
Unidentified sandpiper—medium		X	-	-
Unidentified dowitcher	<i>Limnodromus</i> spp.	X	-	-
Unidentified shorebird		X	X	X
Unidentified shorebird—small		-	X	X
Unidentified shorebird—large		-	-	X
Black-legged Kittiwake	<i>Rissa tridactyla</i>	X	-	-
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>	X	-	-

Common Name	Scientific Name	RECORDED DURING		
		Boat-based Surveys	Fixed-wing Surveys	Helicopter-based Surveys
Mew Gull	<i>Larus canus</i>	X	X	X
Herring Gull	<i>Larus argentatus</i>	X	X	X
Glaucous-winged Gull	<i>Larus glaucescens</i>	X	X	X
Unidentified gull—small	small <i>Larus</i> or <i>Rissa</i>	-	-	X
Unidentified gull—large	large <i>Larus</i>	-	-	X
Unidentified gull		X	X	X
Caspian Tern	<i>Hydroprogne caspia</i>	X	-	-
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	X	-	-
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	X	-	-
Common Murre	<i>Uria aalge</i>	X	-	-
Pigeon Guillemot	<i>Cephus columba</i>	X	X	X
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	X	-	-
Unidentified murrelet	<i>Brachyramphus</i> spp.	X	-	-
Horned Puffin	<i>Fratercula corniculata</i>	X	-	X
Tufted Puffin	<i>Fratercula cirrhata</i>	X	-	X
Unidentified puffin	<i>Fratercula</i> spp.	-	X	-
Gray Jay	<i>Perisoreus canadensis</i>	X	-	-
Black-billed Magpie	<i>Pica hudsonia</i>	X	-	X
Common Raven	<i>Corvus corax</i>	X	-	X
<u>MAMMALS</u>				
Sea otter	<i>Enhydra lutris</i>	X	-	X
Steller's sea lion	<i>Eumetopias jubatus</i>	X	-	X
Harbor seal	<i>Phoca vitulina</i>	X	-	X
Common minke whale ^c	<i>Balaenoptera acutorostrata</i>	-	-	-
Gray whale	<i>Eschrichtius robustus</i>	OT	-	-
Beluga	<i>Delphinapterus leucas</i>	-	-	X
Harbor porpoise	<i>Phocoena phocoena</i>	X	-	X
Dall's porpoise	<i>Phocoenoides dalli</i>	X	-	-
Unidentified porpoise		-	-	X
Unidentified marine mammal		X	-	-

Notes:

- Both Trumpeter and Tundra swans may be present.
- Greater Yellowlegs probably is the primary yellowlegs species in the area of Iliamna and Iniskin bays, but Lesser Yellowlegs also may be present.
- Recorded near the mouth of Iniskin Bay in summer 2006 (Houghton, pers. comm., 2006); see Section 44.7.2.3, subsection on species of conservation concern or special interest.

OT = Seen only off transect outside of survey zone during sampling or only during non-sampling periods.

APPENDIX 44B

Numbers of Birds and Mammals Counted
during Boat-based Nearshore Marine Surveys,
Cook Inlet Marine Study Area, 2004-2006

Numbers of Birds and Mammals Counted during Boat-based Nearshore Marine Surveys, Cook Inlet Marine Study Area, 2004-2006

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006 ^a	
<u>BIRDS</u>									
WATERFOWL									
Greater White-fronted Goose	0	0	0	0	0	0	0	177	177
Emperor Goose	0	0	0	0	0	0	0	2	2
Brant	0	0	0	0	0	0	0	12	12
Unidentified goose	0	0	0	0	0	0	26	0	26
American Wigeon	0	0	0	21	1	0	0	78	100
Mallard	62	4	31	149	67	3	0	393	709
Northern Shoveler	0	0	0	66	23	0	0	382	471
Northern Pintail	3	0	0	24	42	0	0	576	645
Green-winged Teal	0	0	0	41	0	0	0	999	1,040
Canvasback	0	0	0	0	0	0	0	15	15
Greater Scaup	51	0	0	412	21	0	0	1,474	1,958
Unidentified scaup	0	0	0	13	18	5	0	0	36
Common Eider	8	OT	OT	17	13	0	0	31	69
Steller's Eider	0	OT	0	0	0	0	OT	0	OT
Harlequin Duck	475	130	264	1,217	497	178	143	905	3,809
Surf Scoter	404	5	3	248	141	1	2	49	853
White-winged Scoter	55	1	1	346	6	29	0	52	490
American Scoter	36	71	59	13	36	9	0	84	308
Unidentified scoter	0	0	64	0	0	2	0	4	70
Long-tailed Duck	0	246	175	934	1	113	62	183	1,714
Bufflehead	0	18	9	9	0	21	0	38	95
Common Goldeneye	0	63	1	3	0	2	3	6	78
Barrow's Goldeneye	0	146	233	20	0	430	96	215	1,140
Unidentified Goldeneye	0	101	0	0	0	21	0	0	122

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006 ^a	
Common Merganser	88	7	6	68	15	13	0	54	251
Red-breasted merganser	0	1	2	142	12	0	0	149	306
Unidentified merganser	0	4	0	25	0	0	0	9	38
Unidentified diving duck	0	0	0	0	0	3	0	0	3
Unidentified duck	0	34	6	0	0	0	0	0	40
WATERFOWL Total	1,182	831	854	3,768	893	830	332	5,887	14,577
WATERBIRDS									
Red-throated Loon	0	0	0	1	4	0	0	0	5
Pacific Loon	2	1	0	0	3	0	0	1	7
Common Loon	2	0	0	0	2	1	0	OT	5
Unidentified loon	0	3	0	1	0	0	0	0	4
Horned Grebe	0	1	0	0	0	0	0	100	101
Red-necked Grebe	0	0	0	3	0	1	0	0	4
WATERBIRDS Total	4	5	0	5	9	2	0	101	126
SEABIRDS (CORMORANTS)									
Double-crested Cormorant	52	0	0	392	74	0	0	145	663
Red-faced Cormorant	20	0	0	11	10	0	0	0	41
Pelagic Cormorant	117	4	13	278	130	121	12	72	747
Unidentified cormorant	0	10	0	0	1	0	0	1	12
SEABIRDS (CORMORANTS) Total	189	14	13	681	215	121	12	218	1,463
SEABIRDS (LARIDS & ALCIDS)									
Black-legged Kittiwake	125	0	0	6	9	0	0	3	143
Bonaparte's Gull	0	0	0	0	0	0	0	11	11
Mew Gull	25	19	28	87	74	45	9	1,411	1,698
Herring Gull	0	3	0	0	2	0	2	0	7

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006 ^a	
Glaucous-winged Gull	843	44	370	4,495	1,030	128	123	2,284	9,317
Unidentified gull	0	3	0	0	0	0	0	0	3
Caspian Tern	0	0	0	0	2	0	0	0	2
Common Murre	0	3	5	0	0	5	0	0	13
Pigeon Guillemot	95	0	0	197	77	0	0	185	554
Marbled Murrelet	2	12	1	26	OT	14	0	6	61
Unidentified murrelet	1	0	0	0	0	0	0	0	1
Horned Puffin	32	0	0	0	51	0	0	0	83
Tufted Puffin	49	0	0	3	84	0	0	19	155
SEABIRDS (LARIDS & ALCIDS) Total	1,172	84	404	4,814	1,329	192	134	3,919	12,048
RAPTORS									
Bald Eagle	19	10	26	34	38	5	2	22	156
Golden Eagle	1	0	0	1	0	1	0	0	3
Merlin	0	0	0	0	0	1	0	0	1
Peregrine Falcon	0	0	0	2	1	0	0	0	3
RAPTORS Total	20	10	26	37	39	7	2	22	163
SHOREBIRDS									
Black-bellied Plover	0	0	0	0	0	0	0	10	10
Semipalmated Plover	0	0	0	0	0	0	0	4	4
Black Oystercatcher	23	0	3	37	41	0	0	54	158
Spotted Sandpiper	1	0	0	0	0	0	0	0	1
Unidentified yellowlegs	0	0	0	0	0	0	0	2	2
Marbled Godwit	0	0	0	0	0	0	0	9	9
Ruddy Turnstone	0	0	0	0	0	0	0	2	2
Black Turnstone	0	0	0	48	0	0	0	24	72

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006 ^a	
Unidentified turnstone	0	0	0	7	0	0	0	0	7
Surfbird	0	0	0	23	0	0	0	0	23
Western Sandpiper	0	0	0	87	0	0	0	5,682	5,769
Unidentified sandpiper—small	0	0	0	26	0	1	0	2,300	2,327
Rock Sandpiper	0	172	9	1	0	136	0	53	371
Dunlin	0	0	0	0	0	0	0	2,157	2,157
Unidentified sandpiper—medium	0	0	0	0	0	0	0	15	15
Unidentified dowitcher	0	0	0	3	0	0	0	826	829
Red-Necked Phalarope	0	0	0	0	OT	0	0	0	OT
Unidentified shorebird	0	0	0	1	0	0	0	17,007	17,008
SHOREBIRDS Total	24	172	12	233	41	137	0	28,145	28,764
CORVIDS									
Gray Jay	0	0	0	0	0	1	0	0	1
Black-billed Magpie	2	14	5	3	3	32	9	10	78
Common Raven	8	4	9	14	6	12	0	2	55
CORVIDS Total	10	18	14	17	9	45	9	12	134
BIRDS TOTAL	2,601	1,134	1,323	9,555	2,535	1,334	489	38,304	57,275
<u>MAMMALS</u>									
CARNIVORES									
Sea Otter	1	66	101	5	0	94	33	1	301
Steller's Sea Lion	0	0	0	34	OT	0	0	3	37
Harbor Seal	457	21	175	259	606	105	1	326	1,950
CARNIVORES Total	458	87	276	298	606	199	34	330	2,288
CETACEANS									
Gray Whale	OT	0	0	0	0	0	0	0	OT

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006 ^a	
Harbor Porpoise	0	OT	OT	1	0	1	0	1	3
Dall's Porpoise	0	0	4	0	0	0	0	0	4
CETACEANS Total	0	0	4	1	0	1	0	1	7
MAMMALS TOTAL	458	87	280	299	606	200	34	331	2,295

Notes:

a. For the spring 2005 and 2006 surveys, numbers represent the higher of two results for each species from replicate surveys.

OT = Seen only off-transect outside survey zone during sampling or only during non-sampling periods.

APPENDIX 44C

Densities of Birds and Mammals Counted
during Boat-based Nearshore Marine Surveys,
Cook Inlet Marine Study Area, 2004-2006

Densities^a of Birds (birds/km²) and Mammals (mammals/km²) Counted during Boat-based Nearshore Marine Surveys, Cook Inlet Marine Study Area, 2004-2006

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
<u>BIRDS</u>								
WATERFOWL								
Greater White-fronted Goose	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3.73 (3.17)
Emperor Goose	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.03 (0.02)
Brant	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.20 (0.12)
Unidentified goose	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9.63 (9.63)	0 (0)
American Wigeon	0 (0)	0 (0)	0 (0)	0.30 (0.16)	0.04 (0.04)	0 (0)	0 (0)	1.50 (0.59)
Mallard	2.35 (2.09)	0.15 (0.15)	0.82 (0.74)	2.68 (1.37)	2.53 (2.23)	0.13 (0.13)	0 (0)	7.28 (2.79)
Northern Shoveler	0 (0)	0 (0)	0 (0)	1.02 (0.57)	0.87 (0.62)	0 (0)	0 (0)	7.51 (4.82)
Northern Pintail	0.07 (0.07)	0 (0)	0 (0)	0.44 (0.30)	1.58 (1.19)	0 (0)	0 (0)	10.42 (3.78)
Green-winged Teal	0 (0)	0 (0)	0(0)	0.71 (0.56)	0 (0)	0 (0)	0 (0)	20.93 (9.66)
Canvasback	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.32 (0.30)
Greater Scaup	1.87 (1.80)	0 (0)	0 (0)	6.25 (2.27)	0.82 (0.59)	0 (0)	0 (0)	25.64 (10.99)
Unidentified scaup	0 (0)	0 (0)	0 (0)	0.26 (0.18)	1.09 (0.93)	0.17 (0.09)	0 (0)	0 (0)
Common Eider	0.22 (0.22)	OT	OT	0.24 (0.24)	0.36 (0.36)	0 (0)	0 (0)	0.49 (0.42)
Steller's Eider	0 (0)	OT	0 (0)	0 (0)	0 (0)	0 (0)	OT	0 (0)
Harlequin Duck	17.97 (8.46)	4.75 (2.13)	10.62 (3.59)	26.81 (12.38)	19.08 (8.75)	7.99 (2.70)	7.99 (3.30)	20.07 (5.86)
Surf Scoter	17.53 (8.57)	0.24 (0.24)	0.14 (0.14)	4.77 (3.01)	5.25 (4.58)	0.05 (0.05)	0.12 (0.12)	1.21 (0.45)
White-winged Scoter	1.89 (0.83)	0.04 (0.04)	0.04 (0.04)	7.67 (4.69)	0.24 (0.15)	1.34 (1.09)	0 (0)	1.51 (0.55)
American Scoter	1.10 (0.66)	3.00 (3.00)	2.12 (1.45)	0.19 (0.10)	1.94 (1.37)	0.29 (0.16)	0 (0)	1.58 (0.65)
Unidentified scoter	0 (0)	0 (0)	1.80 (1.80)	0 (0)	0 (0)	0.10 (0.10)	0 (0)	0.16 (0.16)
Long-tailed Duck	0 (0)	8.48 (3.02)	6.80 (3.98)	19.24 (11.25)	0.04 (0.04)	3.45 (1.36)	9.74 (6.67)	4.12 (1.63)
Bufflehead	0 (0)	0.55 (0.38)	0.22 (0.22)	0.17 (0.17)	0 (0)	0.60 (0.43)	0 (0)	0.79 (0.37)
Common Goldeneye	0 (0)	2.21 (1.79)	0.02 (0.02)	0.06 (0.06)	0 (0)	0.08 (0.05)	1.11 (1.11)	0.09 (0.07)
Barrow's Goldeneye	0 (0)	4.79 (1.94)	7.83 (2.51)	0.35 (0.15)	0 (0)	14.98 (7.59)	11.75 (5.57)	4.43 (1.28)

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
Unidentified goldeneye	0 (0)	3.63 (2.20)	0 (0)	0 (0)	0 (0)	0.83 (0.62)	0 (0)	0 (0)
Common Merganser	3.21 (1.19)	0.27 (0.27)	0.21 (0.14)	1.11 (0.36)	0.64 (0.22)	0.55 (0.55)	0 (0)	1.26 (0.37)
Red-breasted Merganser	0 (0)	0.03 (0.03)	0.06 (0.06)	3.31 (0.86)	0.32 (0.22)	0 (0)	0 (0)	4.13 (1.04)
Unidentified merganser	0 (0)	0.14 (0.11)	0 (0)	0.36 (0.16)	0 (0)	0 (0)	0 (0)	0.18 (0.10)
Unidentified duck	0 (0)	0.91 (0.80)	0.15 (0.15)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unidentified diving duck	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)
WATERBIRDS								
Red-throated Loon	0 (0)	0 (0)	0 (0)	0.02 (0.02)	0.10 (0.10)	0 (0)	0 (0)	0 (0)
Pacific Loon	0.06 (0.06)	0.08 (0.08)	0 (0)	0 (0)	0.08 (0.06)	0 (0)	0 (0)	0.02 (0.02)
Common Loon	0.06 (0.04)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0.04 (0.04)	0 (0)	OT
Unidentified loon	0 (0)	0.14 (0.10)	0 (0)	0.07 (0.07)	0 (0)	0 (0)	0 (0)	0 (0)
Horned Grebe	0 (0)	0.04 (0.04)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2.21 (0.61)
Red-necked Grebe	0 (0)	0 (0)	0 (0)	0.09 (0.08)	0 (0)	0.03 (0.03)	0 (0)	0 (0)
SEABIRDS (CORMORANTS)								
Double-crested Cormorant	2.85 (1.41)	0 (0)	0 (0)	7.16 (2.8)	3.19 (1.36)	0 (0)	0 (0)	2.54 (1.14)
Red-faced Cormorant	2.66 (2.5)	0 (0)	0 (0)	0.15 (0.15)	0.31 (0.23)	0 (0)	0 (0)	0 (0)
Pelagic Cormorant	7.80 (4.88)	0.22 (0.15)	0.55 (0.26)	6.31 (2.48)	4.73 (2.94)	7.09 (4.63)	1.13 (0.44)	2.32 (0.98)
Unidentified cormorant	0 (0)	0.45 (0.26)	0 (0)	0 (0)	0.03 (0.03)	0 (0)	0 (0)	0.02 (0.02)
SEABIRDS (LARIDS & ALCIDS)								
Black-legged Kittiwake	6.17 (3.24)	0 (0)	0 (0)	0.09 (0.06)	0.46 (0.23)	0 (0)	0 (0)	0.05 (0.04)
Bonaparte's Gull	0 (0)	0(0)	0 (0)	0 (0)	0 (0)	0(0)	0(0)	0.26 (0.14)
Mew Gull	0.96 (0.46)	1.07 (0.82)	1.27 (0.88)	1.53 (0.68)	2.71 (2.02)	1.86 (1.33)	0.51 (0.30)	29.06 (9.40)
Herring Gull	0 (0)	0.19 (0.16)	0 (0)	0 (0)	0.05 (0.05)	0 (0)	0.26 (0.26)	0 (0)

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
Glaucous-winged Gull	49.27 (26.25)	2.61 (1.15)	11.39 (6.04)	115.82 (40.94)	42.52 (14.39)	5.21 (2.20)	24.11 (19.76)	49.24 (13.41)
Unidentified gull	0 (0)	0.15 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Caspian Tern	0 (0)	0 (0)	0 (0)	0 (0)	0.08 (0.08)	0 (0)	0 (0)	0 (0)
Common Murre	0 (0)	0.38 (0.26)	0.23 (0.14)	0 (0)	0 (0)	0.18 (0.14)	0 (0)	0 (0)
Pigeon Guillemot	4.73 (0.93)	0 (0)	0 (0)	5.95 (1.90)	3.73 (0.91)	0 (0)	0 (0)	3.88 (1.70)
Marbled Murrelet	0.15 (0.15)	0.47 (0.21)	0.04 (0.04)	0.68 (0.37)	OT	0.59 (0.33)	0 (0)	0.17 (0.08)
Unidentified murrelet	0.04 (0.04)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Horned Puffin	1.23 (0.88)	0 (0)	0 (0)	0 (0)	2.02 (0.86)	0 (0)	0 (0)	0 (0)
Tufted Puffin	1.97 (1.39)	0 (0)	0 (0)	0.04 (0.03)	8.95 (8.11)	0 (0)	0 (0)	0.30 (0.30)
RAPTORS								
Bald Eagle	0.71 (0.18)	0.35 (0.13)	1.16 (0.30)	0.66 (0.17)	1.78 (0.50)	0.17 (0.10)	0.08 (0.08)	0.44 (0.13)
Golden Eagle	0.04 (0.04)	0 (0)	0 (0)	0.04 (0.04)	0 (0)	0.02 (0.02)	0 (0)	0 (0)
Merlin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.04 (0.04)	0 (0)	0 (0)
Peregrine Falcon	0 (0)	0 (0)	0 (0)	0.04 (0.03)	0.03 (0.03)	0 (0)	0 (0)	0 (0)
SHOREBIRDS								
Black-bellied Plover	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.12)
Semipalmated Plover	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.08 (0.06)
Black Oystercatcher	1.06 (0.47)	0 (0)	0.10 (0.07)	0.83 (0.19)	1.43 (0.54)	0 (0)	0 (0)	1.07 (0.36)
Spotted Sandpiper	0.02 (0.02)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unidentified yellowlegs	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Marbled Godwit	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.19 (0.13)
Ruddy Turnstone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.03 (0.03)
Black Turnstone	0 (0)	0 (0)	0 (0)	3.50 (3.48)	0 (0)	0 (0)	0 (0)	0.36 (0.25)
Unidentified turnstone	0 (0)	0 (0)	0 (0)	0.17 (0.17)	0 (0)	0 (0)	0 (0)	0 (0)
Surfbird	0 (0)	0 (0)	0 (0)	1.33 (0.98)	0 (0)	0 (0)	0 (0)	0 (0)
Western Sandpiper	0 (0)	0 (0)	0 (0)	1.48 (1.14)	0 (0)	0 (0)	0 (0)	114.22 (46.59)

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
Unidentified sandpiper— small	0 (0)	0 (0)	0 (0)	0.53 (0.43)	0 (0)	0.04 (0.04)	0 (0)	48.93 (35.64)
Rock Sandpiper	0 (0)	9.01 (6.05)	1.33 (1.33)	0.07 (0.07)	0 (0)	6.97 (4.30)	0 (0)	0.84 (0.84)
Dunlin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	37.92 (19.54)
Unidentified sandpiper— medium	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.32 (0.32)
Red-necked Phalarope	0 (0)	0 (0)	0 (0)	0 (0)	OT	0 (0)	0 (0)	0 (0)
Unidentified dowitcher	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	14.43 (9.11)
Unidentified shorebird	0 (0)	0 (0)	0 (0)	0.01 (0.01)	0 (0)	0 (0)	0 (0)	340.67 (237.00)
CORVIDS								
Gray Jay	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.02 (0.02)	0 (0)	0 (0)
Black-billed Magpie	0.10 (0.07)	0.49 (0.20)	0.23 (0.15)	0.05 (0.03)	0.22 (0.16)	1.18 (0.44)	0.72 (0.31)	0.16 (0.09)
Common Raven	0.28 (0.13)	0.11 (0.09)	0.30 (0.18)	0.31 (0.08)	0.22 (0.13)	0.60 (0.34)	0.19 (0.19)	0.03 (0.03)
<u>MAMMALS</u>								
CARNIVORES								
Sea otter	0.15 (0.15)	4.45 (2.94)	3.24 (2.66)	0.08 (0.05)	0 (0)	9.79 (8.50)	2.57 (1.09)	0.08 (0.08)
Steller's sea lion	0 (0)	0 (0)	0 (0)	0.48 (0.46)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Harbor seal	19.48 (11.89)	0.89 (0.27)	5.04 (4.60)	4.51 (2.03)	24.85 (11.16)	4.22 (1.88)	0.06 (0.06)	6.19 (1.93)
CETACEANS								
Gray whale	OT	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Harbor porpoise	0 (0)	OT	OT	0.02 (0.02)	0 (0)	0.04 (0.04)	0 (0)	0.02 (0.02)
Dall's porpoise	0 (0)	0 (0)	0.17 (0.17)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Notes:

a. Data are presented as mean animals per square kilometer (1 standard error).

OT = Seen only off transect outside of survey zone during sampling or only during non-sampling periods.

APPENDIX 44D

Numbers of Birds and Mammals Counted
during Boat-based Offshore Marine Surveys,
Cook Inlet Marine Study Area, 2004-2006

Numbers of Birds and Mammals Counted during Boat-based Offshore Marine Surveys, Cook Inlet Marine Study Area, 2004-2006

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005 ^a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006a	
BIRDS									
WATERFOWL									
Unidentified goose	0	0	0	0	0	0	1	0	1
Trumpeter Swan	0	0	0	0	0	0	0	1	1
Greater Scaup	0	0	0	5	0	0	0	0	5
Unidentified scaup	0	0	0	0	0	2	0	0	2
Common Eider	0	1	0	0	0	5	0	0	6
Harlequin Duck	0	0	0	2	0	0	0	0	2
Surf Scoter	7	0	0	4	OT	0	0	0	11
White-winged Scoter	150	5	0	78	12	0	3	108	356
American Scoter	0	0	15	0	0	1	0	2	18
Unidentified scoter	0	0	0	0	0	4	0	0	4
Long-tailed Duck	0	9	122	13	0	24	1	3	172
Red-breasted Merganser	0	0	0	0	0	0	0	5	5
WATERFOWL Total	157	15	137	102	12	36	5	119	583
WATERBIRDS									
Pacific Loon	0	0	0	0	0	0	0	3	3
Common Loon	0	0	0	0	0	2	0	0	2
Horned Grebe	0	0	0	0	0	0	0	OT	OT
Red-necked Grebe	0	0	0	4	0	2	0	0	6
Western Grebe	0	0	0	0	0	0	0	1	1
WATERBIRDS Total	0	0	0	4	0	4	0	4	12
SEABIRDS (SHEARWATERS & CORMORANTS)									
Short-tailed Shearwater	1	0	0	0	0	0	0	0	1

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005 ^a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006a	
Double-crested Cormorant	7	0	0	3	1	0	0	2	13
Red-faced Cormorant	1	0	0	0	0	0	0	0	1
Pelagic Cormorant	4	0	1	2	1	2	0	1	11
Unidentified cormorant	0	12	0	0	0	0	0	0	12
SEABIRDS (SHEARWATERS & CORMORANTS) Total	13	12	1	5	2	2	0	3	38
SEABIRDS (LARIDS, JAEGER, & ALCIDS)									
Black-legged Kittiwake	64	1	2	22	8	0	0	10	107
Mew Gull	0	3	2	0	0	52	10	0	67
Glaucous-winged Gull	77	14	5	105	16	13	14	19	263
Pomarine Jaeger	0	0	0	10	0	0	0	0	10
Parasitic Jaeger	1	0	0	0	0	0	0	0	1
Common Murre	20	0	3	5	5	0	0	0	33
Pigeon Guillemot	4	0	0	7	0	0	0	0	11
Marbled Murrelet	6	0	0	33	0	10	0	4	53
Horned Puffin	14	0	0	1	5	0	0	0	20
Tufted Puffin	12	0	0	18	3	0	0	3	36
SEABIRDS (LARIDS, JAEGER, & ALCIDS) Total	198	18	12	201	37	75	24	36	601
RAPTORS									
Bald Eagle	0	0	0	OT	0	0	0	0	OT
RAPTORS Total	0	0	0	OT	0	0	0	0	OT

SPECIES-GROUP/ Species	SEASON/YEAR								Total
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005 ^a	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006a	
SHOREBIRDS									
Dunlin	0	0	0	0	0	0	0	1	1
Red-necked Phalarope	0	0	0	9	0	0	0	0	9
SHOREBIRDS Total	0	0	0	9	0	0	0	1	10
BIRDS TOTAL	368	45	150	321	51	117	29	163	1,244
<u>MAMMALS</u>									
CARNIVORES									
Sea otter	1	18	39	2	0	23	12	0	95
Steller's sea lion	0	0	0	5	1	0	0	0	6
Harbor seal	0	0	0	1	7	1	9	0	18
CARNIVORES Total	1	18	39	8	8	24	21	0	119
CETACEANS									
Harbor porpoise	0	0	OT	4	0	3	1	4	12
Dall's porpoise	1	0	0	0	0	0	0	0	1
CETACEANS Total	1	0	0	4	0	3	1	4	13
MAMMALS TOTAL	2	18	39	12	8	27	22	4	132

Notes:

- a. For the spring 2005 and 2006 surveys, numbers represent the higher of two results for each species from replicate surveys.
OT = Seen only off transect outside of survey zone during sampling or only during non-sampling periods.

APPENDIX 44E

Densities of Birds and Mammals Counted
during Boat-based Offshore Marine Surveys,
Cook Inlet Marine Study Area, 2004-2006

Densities^a of Birds (birds/km²) and Mammals (mammals/km²) Counted during Boat-based Offshore Marine Surveys, Cook Inlet Marine Study Area, 2004-2006

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
<u>BIRDS</u>								
WATERFOWL								
Unidentified goose	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.07 (0.07)	0 (0)
Trumpeter Swan	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.07 (0.07)
Greater Scaup	0 (0)	0 (0)	0 (0)	0.16 (0.16)	0 (0)	0 (0)	0 (0)	OT
Unidentified scaup	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.14 (0.14)	0 (0)	0 (0)
Common Eider	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0.32 (0.32)	0 (0)	0 (0)
Harlequin Duck	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Surf Scoter	0.44 (0.28)	0 (0)	0 (0)	0.13 (0.09)	OT	0 (0)	0 (0)	0 (0)
White-winged Scoter	9.47 (9.20)	0.55 (0.37)	0 (0)	2.73 (1.73)	0.96 (0.96)	0 (0)	0.21 (0.15)	8.09 (5.44)
American Scoter	0 (0)	0 (0)	1.28 (1.28)	0.74 (0.61)	0 (0)	0.06 (0.06)	0 (0)	0.15 (0.15)
Unidentified scoter	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.25 (0.20)	0 (0)	0 (0)
Long-tailed Duck	0 (0)	0.98 (0.76)	9.76 (6.56)	0.42 (0.25)	0 (0)	1.52 (0.74)	0.07 (0.07)	0.22 (0.22)
Red-breasted Merganser	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.37 (0.37)
Unidentified merganser	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
WATERBIRDS								
Pacific Loon	0 (0)	0 (0)	0 (0)	0 (0)	OT	0 (0)	0 (0)	0.22 (0.16)
Common Loon	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.13 (0.09)	0 (0)	0 (0)
Horned Grebe	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	OT
Red-necked Grebe	0 (0)	0 (0)	0 (0)	0.13 (0.13)	0 (0)	0.13 (0.13)	0 (0)	0 (0)
Western Grebe	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.07 (0.07)
SEABIRDS (SHEARWATERS & CORMORANTS)								
Short-tailed Shearwater	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Double-crested Cormorant	0.44 (0.25)	0 (0)	0 (0)	0.10 (0.05)	0.08 (0.08)	0 (0)	0 (0)	0.16 (0.11)

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
Red-faced Cormorant	0.07 (0.07)	0 (0)	0 (0)	0 (0)	OT	0 (0)	0 (0)	0 (0)
Pelagic Cormorant	0.26 (0.12)	0 (0)	0.07 (0.07)	0.6 (0.06)	0.08 (0.08)	0.13 (0.09)	0 (0)	0.07 (0.07)
Unidentified cormorant	0 (0)	1.31 (0.83)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SEABIRDS (LARIDS, JAEGERS, & ALCIDS)								
Black-legged Kittiwake	4.10 (0.66)	0.11 (0.11)	0.15 (0.10)	0.72 (0.17)	0.64 (0.28)	0 (0)	0 (0)	0.75 (0.31)
Mew Gull	0 (0)	0.36 (0.26)	0.15 (0.10)	0 (0)	0 (0)	3.30 (1.58)	0.71 (0.56)	OT
Glaucous-winged Gull	4.91 (1.34)	1.57 (0.39)	0.37 (0.18)	3.43 (0.57)	1.29 (0.34)	0.82 (0.32)	1.03 (0.41)	1.44 (0.58)
Pomarine Jaeger	0 (0)	0 (0)	0 (0)	0.32 (0.21)	0 (0)	0 (0)	0 (0)	0 (0)
Parasitic Jaeger	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Common Murre	1.28 (0.29)	0 (0)	0.22 (0.12)	0.16 (0.12)	0.40 (0.22)	0 (0)	0 (0)	OT
Pigeon Guillemot	0.27 (0.16)	0 (0)	0 (0)	0.23 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)
Marbled Murrelet	0.38 (0.21)	0 (0)	0 (0)	1.10 (0.30)	0 (0)	0.67 (0.32)	0 (0)	0.30 (0.30)
Horned Puffin	0.91 (0.47)	0 (0)	0 (0)	0.03 (0.03)	0.42 (0.24)	0 (0)	0 (0)	0 (0)
Tufted Puffin	0.76 (0.32)	0 (0)	0 (0)	0.58 (0.25)	0.24 (0.17)	0 (0)	0 (0)	0.22 (0.16)
RAPTORS								
Bald Eagle	0 (0)	0 (0)	0 (0)	OT	0 (0)	0 (0)	0 (0)	0 (0)
SHOREBIRDS								
Dunlin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.07 (0.07)
Red-necked Phalarope	0 (0)	0 (0)	0 (0)	0.29 (0.29)	0 (0)	0 (0)	0 (0)	0 (0)
<u>MAMMALS</u>								
CARNIVORES								
Sea otter	0.06 (0.06)	1.96 (0.87)	2.94 (0.93)	0.06 (0.04)	0 (0)	1.39 (0.41)	0.80 (0.22)	0 (0)
Steller's sea lion	0 (0)	0 (0)	0 (0)	0.15 (0.12)	0.07 (0.07)	0 (0)	0 (0)	0 (0)
Harbor seal	0 (0)	0 (0)	0 (0)	0.06 (0.04)	0.51 (0.24)	0.12 (0.08)	0.60 (0.31)	0.21 (0.21)

SPECIES-GROUP/ Species	SEASON/YEAR							
	Summer 2004	Early Winter 2004	Late Winter 2005	Spring 2005	Summer 2005	Early Winter 2005	Late Winter 2006	Spring 2006
CETACEANS								
Harbor porpoise	0 (0)	0 (0)	OT	0.12 (0.07)	0 (0)	0.18 (0.13)	0.07 (0.07)	0.29 (0.17)
Dall's porpoise	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Notes:

a. Data are presented as mean animals per square kilometer (1 standard error).

OT = Seen only off transect outside of survey zone during sampling or only during non-sampling periods.

APPENDIX 44F

Numbers of Birds Counted
during Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area, 2004

Numbers of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2004

SPECIES-GROUP/ Species	SEASON									Total
	Spring				Fall					
	Apr 21	May 3	May 13	May 22	Sep 3	Sep 14	Sep 24	Oct 6	Oct 21 ^a	
WATERFOWL										
Unidentified goose	0	5	0	0	0	0	0	0	0	5
American Wigeon	0	20	3	8	0	0	0	0	0	0
Mallard	264	10	7	14	0	75	1	50	0	421
Northern Pintail	30	0	2	2	0	0	0	0	0	34
Green-winged Teal	0	0	4	3	0	0	0	0	0	7
Unidentified dabbling duck	0	0	0	7	0	0	0	0	0	7
Unidentified scaup	0	172	67	67	0	0	22	0	0	328
Unidentified eider	0	2	0	0	0	0	0	0	0	2
Harlequin Duck	0	12	10	0	0	30	44	18	0	114
Surf Scoter	0	27	66	15	334	75	127	26	0	670
White-winged Scoter	0	59	19	54	0	0	0	1	0	133
American Scoter	0	20	20	18	0	0	232	120	0	410
Unidentified scoter	0	784	4	2	1,120	946	3	83	0	2,942
Long-tailed Duck	0	34	0	0	0	0	0	0	0	34
Bufflehead	0	0	5	0	0	0	0	0	0	5
Unidentified goldeneye	0	0	0	11	20	60	0	0	0	91
Common Merganser	0	2	0	0	0	0	0	0	0	2
Red-breasted merganser	0	25	9	0	0	0	0	0	0	34
Unidentified merganser	0	7	12	0	295	63	48	41	0	466
Unidentified diving duck	0	12	0	2	150	0	0	0	0	164
Unidentified duck	84	87	2	0	104	42	1	17	0	337
WATERFOWL Total	378	1,278	230	203	2,023	1,291	478	356	0	6,237

SPECIES-GROUP/ Species	SEASON									Total	
	Spring				Fall						
	Apr 21	May 3	May 13	May 22	Sep 3	Sep 14	Sep 24	Oct 6	Oct 21 ^a		
WATERBIRDS											
Horned Grebe	0	2	0	0	0	0	0	0	0	0	2
Red-necked Grebe	0	9	0	0	2	0	0	0	0	0	11
WATERBIRDS Total	0	11	0	0	2	0	0	0	0	0	13
SEABIRDS (CORMORANTS)											
Pelagic Cormorant	0	0	0	11	0	0	0	0	0	0	11
Unidentified cormorant	25	43	38	22	49	61	11	0	0	0	249
SEABIRDS (CORMORANTS) Total	25	43	38	33	49	61	11	0	0	0	260
SEABIRDS (LARIDS & ALCIDS)											
Mew Gull	0	0	3	1	0	0	0	0	1	0	5
Glaucous-winged Gull	54	33	271	52	351	409	123	124	40	0	1,457
Unidentified gull	150	200	550	250	500	800	1,056	150	0	0	3,656
Pigeon Guillemot	0	10	0	0	0	0	0	0	0	0	10
SEABIRDS (LARIDS & ALCIDS) Total	204	243	824	303	851	1,209	1,179	274	41	0	5,128
SHOREBIRDS											
Black Oystercatcher	0	0	0	0	5	4	0	0	0	0	9
Unid. sandpiper–small	0	40	0	0	0	0	0	0	0	0	40
SHOREBIRDS Total	0	40	0	0	5	4	0	0	0	0	49
TOTAL	607	1,615	1,092	539	2,930	2,565	1,668	630	41	0	11,687

Notes:

- a. Only a partial survey was flown because of turbulent conditions.

APPENDIX 44G

Numbers of Birds Counted
during Fixed-wing Marine Surveys,
Cook Inlet Marine Study Area, 2005

Numbers of Birds Counted during Fixed-wing Marine Surveys, Cook Inlet Marine Study Area, 2005

SPECIES-GROUP/ Species	Spring				Fall							Total
	Apr 24	May 3	May 15 ^a	May 21	Aug 18	Aug 30	Sep 7	Sep 13	Sep 29	Oct 6	Oct 11	
WATERFOWL												
Greater White-fronted Goose	0	35	0	0	0	0	0	0	0	0	0	35
Unidentified goose	1	0	0	0	0	0	0	0	0	0	0	1
Unidentified swan	0	0	0	2	1	6	0	9	0	0	0	18
American Wigeon	0	0	0	0	160	0	375	0	0	0	0	535
Mallard	150	4	0	33	372	180	466	365	353	871	454	3,248
Northern Shoveler	0	44	0	12	14	75	173	0	0	0	15	333
Northern Pintail	50	64	0	0	38	36	45	50	125	40	120	568
Green-winged Teal	8	48	0	2	250	150	235	0	0	68	398	1,159
Unidentified dabbling duck	460	30	0	0	0	0	0	95	0	0	1,020	1,605
Unidentified scaup	2	446	499	358	1,640	1,189	150	80	0	66	0	4,430
Common Eider	0	0	2	0	0	0	0	0	8	0	0	10
Unidentified eider	2	0	0	0	0	0	0	0	0	0	0	2
Harlequin Duck	0	151	48	82	33	4	38	0	0	15	0	371
Surf Scoter	13	22	25	0	12	3,772	4,281	1,431	288	240	0	10,084
White-winged Scoter	4	15	10	5	0	1,690	455	0	10	46	2	2,237
American Scoter	6	14	40	0	10	0	0	0	98	56	91	315
Unidentified scoter	80	303	1,051	927	3,660	992	24	1,514	228	3	22	8,804
Long-tailed Duck	14	350	228	30	0	0	0	0	0	2	4	628
Bufflehead	18	0	6	0	0	0	0	0	1	0	0	25
Unidentified goldeneye	32	23	0	0	0	0	0	0	0	6	35	96

SPECIES-GROUP/ Species	Spring				Fall							Total
	Apr 24	May 3	May 15 ^a	May 21	Aug 18	Aug 30	Sep 7	Sep 13	Sep 29	Oct 6	Oct 11	
Common Merganser	2	4	8	21	0	0	0	0	0	0	14	49
Red-breasted Merganser	6	49	4	0	0	0	0	0	0	20	0	79
Unidentified merganser	37	43	18	44	200	554	0	137	53	0	33	1,119
Unidentified diving duck	0	0	0	0	0	0	0	0	0	1	0	1
Unidentified duck	252	173	14	22	0	0	0	23	153	3	26	666
WATERFOWL Total	1,137	1,818	1,953	1,538	6,390	8,648	6,302	3,704	1,317	1,437	2,238	36,482
WATERBIRDS												
Common Loon	0	1	0	2	0	2	0	0	0	0	0	5
Unidentified loon	0	0	1	0	0	0	0	0	0	0	0	1
Red-necked Grebe	0	0	0	0	0	0	0	0	0	9	12	21
Unidentified grebe	0	0	2	0	0	0	0	0	0	0	2	4
WATERBIRDS Total	0	1	3	2	0	2	0	0	0	9	14	31
SEABIRDS (CORMORANTS)												
Double-crested Cormorant	0	0	0	0	212	63	13	0	0	0	0	288
Unidentified cormorant	30	102	115	76	0	48	17	61	5	4	19	477
SEABIRDS (CORMORANTS) Total	30	102	115	76	212	111	30	61	5	4	19	765
SEABIRDS (LARIDS & ALCIDS)												
Mew Gull	0	0	0	1	0	32	11	0	20	0	80	144
Herring Gull	3	1	0	0	0	0	0	0	0	0	0	4

SPECIES-GROUP/ Species	Spring				Fall							Total
	Apr 24	May 3	May 15 ^a	May 21	Aug 18	Aug 30	Sep 7	Sep 13	Sep 29	Oct 6	Oct 11	
Glaucous-winged Gull	55	62	56	267	425	147	142	0	105	556	74	1,889
Unidentified gull	730	696	396	416	1,000	3,811	3,950	1,890	1,030	470	1,010	15,399
Pigeon Guillemot	0	0	7	0	0	0	0	0	0	0	0	7
Unidentified puffin	0	0	20	34	0	0	0	0	0	0	0	54
SEABIRDS (LARIDS & ALCIDS) Total	788	759	479	718	1,425	3,990	4,103	1,890	1,155	1,026	1,164	17,497
SHOREBIRDS												
Black Oystercatcher	0	1	6	3	0	0	0	0	0	4	0	14
Unidentified yellowlegs	0	1	0	0	0	0	0	0	0	0	0	1
Unidentified sandpiper—small	0	5,214	0	0	0	0	0	0	0	0	0	5,214
Unidentified shorebird—small	0	0	2	100	0	0	0	0	0	0	0	102
SHOREBIRDS Total	0	5,216	8	103	0	0	0	0	0	4	0	5,331
TOTAL	1,955	7,896	2,558	2,437	8,027	12,751	10,435	5,655	2,477	2,480	3,435	60,106

Note:

a. Iniskin Bay survey data were lost because of tape-recorder malfunction.

APPENDIX 44H

Numbers of Birds and Mammals Counted
during Helicopter-based Marine Surveys
in and near Iliamna and Iniskin Bays,
Cook Inlet Marine Study Area, 2006

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys in and near Iliamna and Iniskin Bays, Cook Inlet Marine Study Area, 2006

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Feb 2006	Mid-Mar 2006	Mid-Apr 2006	Mid-Oct 2006	Mid- Nov 2006	Early Dec 2006	
BIRDS							
WATERFOWL							
Greater White-fronted Goose	0	0	0	0	0	0	0
American Wigeon	0	0		0	0	0	0
Mallard	20	16	168	86	49	0	339
Northern Shoveler	0	0	0	0	0	0	0
Northern Pintail	0	0	50	0	0	0	50
Green-winged Teal	0	0	0	20	0	0	20
Unidentified dabbling duck	0	0	0	0	0	0	0
Greater Scaup	0	0	0	0	0	0	0
Unidentified scaup	0	0	28	3	0	0	31
Steller's Eider	250	240	0	0	0	300	790
King Eider	0	0	0	0	0	0	0
Common Eider	0	0	0	0	0	0	0
Unidentified eider	0	0	0	0	0	0	0
Harlequin Duck	82	251	30	74	103	127	667
Surf Scoter	0	0	80	62	33	0	175
White-winged Scoter	0	12	37	36	12	0	97
American Scoter	13	200	0	11	0	114	338
Unidentified scoter	180	0	0	86	0	1	267
Long-tailed Duck	626	769	10	6	0	640	2,051
Bufflehead	2	9	0	0	8	0	19
Common Goldeneye	0	0	0	0	0	0	0
Barrow's Goldeneye	295	19	0	0	0	62	376
Unidentified goldeneye	0	23	72	0	6	131	232
Common Merganser	0	0	0	0	0	0	0
Red-breasted Merganser	0	0	0	0	0	0	0
Unidentified merganser	0	0	1	16	6	0	23
Unidentified diving duck	0	0	0	0	0	0	0
Unidentified duck	0	0	5	0	0	0	5
WATERFOWL Total	1,468	1,539	481	400	217	1,375	5,480
WATERBIRDS							
Red-throated Loon	0	0	0	0	0	0	0
Common Loon	0	0	0	0	0	0	0
Unidentified loon—large	0	0	0	0	0	0	0
Unidentified loon	0	0	0	0	0	0	0

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Feb 2006	Mid-Mar 2006	Mid-Apr 2006	Mid-Oct 2006	Mid- Nov 2006	Early Dec 2006	
Horned Grebe	0	0	0	0	0	0	0
Red-necked Grebe	0	0	0	0	0	0	0
WATERBIRDS Total	0	0	0	0	0	0	0
SEABIRDS (CORMORANTS)							
Pelagic Cormorant	0	1	0	0	0	0	1
Unidentified cormorant	13	1	24	15	13	3	69
SEABIRDS (CORMORANTS) Total	13	2	24	15	13	3	70
SEABIRDS (LARIDS & ALCIDS)							
Mew Gull	0	0	5	65	0	105	175
Herring Gull	0	1	0	0	0	0	1
Glaucous-winged Gull	284	197	753	289	18	163	1,704
Glaucous Gull	0	0	0	0	0	0	0
Unidentified gull—large	0	0	0	0	33	0	33
Unidentified gull	39	0	0	0	0	125	164
Pigeon Guillemot	2	0	0	0	0	0	2
Horned Puffin	0	0	0	0	0	0	0
Tufted Puffin	0	0	0	0	0	0	0
Unidentified alcid	0	0	0	0	0	0	0
SEABIRDS (LARIDS & ALCIDS) Total	325	198	758	354	51	393	2,079
RAPTORS							
Bald Eagle	15	1	3	3	3	0	25
RAPTORS Total	15	1	3	3	3	0	25
SHOREBIRDS							
Black Oystercatcher	0	0	4	0	0	0	4
Unidentified sandpiper—small	0	0	0	0	0	175	175
Rock Sandpiper	0	0	0	0	406	0	406
Unidentified shorebird—small	0	0	0	0	0	0	0
Unidentified shorebird	35	0	0	0	0	0	35
SHOREBIRDS Total	35	0	4	0	406	175	620

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Feb 2006	Mid-Mar 2006	Mid-Apr 2006	Mid-Oct 2006	Mid- Nov 2006	Early Dec 2006	
CORVIDS							
Common Raven	0	0	1	0	0	4	5
CORVIDS Total	0	0	1	0	0	4	5
BIRDS TOTAL	1,856	1,740	1,271	772	690	1,950	8,279
<u>MAMMALS</u>							
CARNIVORES							
Sea Otter	586	20	149	8	197	490	1,450
Steller's Sea Lion	0	0	0	0	0	0	0
Harbor Seal	86	190	141	0	0	8	425
CARNIVORES Total	672	210	290	8	197	498	1,875
CETACEANS							
Beluga	0	0	0	0	0	0	0
Harbor Porpoise	0	0	0	0	0	2	2
Unidentified porpoise	0	0	0	0	0	0	0
CETACEANS Total	0	0	0	0	0	2	2
MAMMALS TOTAL	672	210	290	8	197	500	1,877

APPENDIX 44I

Numbers of Birds and Mammals Counted
during Helicopter-based Marine Surveys
in and near Iliamna and Iniskin Bays,
Cook Inlet Marine Study Area, 2007

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys in and near Iliamna and Iniskin Bays, Cook Inlet Marine Study Area, 2007

SPECIES-GROUP/ Species	SEASON/YEAR														Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Early Sep 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid-Nov 2007	Late Nov 2007	Mid-Dec 2007	
BIRDS															
WATERFOWL															
Greater White-fronted Goose	0	0	0	0	0	10	0	0	0	0	0	0	196	0	206
American Wigeon	0	0	0	0	2	16	10	0	0	0	0	0	0	0	28
Mallard	0	0	0	0	164	62	110	0	50	3	121	16	52	13	591
Northern Shoveler	0	0	0	0	0	74	0	0	0	0	0	0	0	0	74
Northern Pintail	0	0	0	0	0	49	0	0	0	0	0	0	0	0	49
Green-winged Teal	0	0	0	0	115	116	0	25	0	0	0	0	0	0	256
Unidentified dabbling duck	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5
Greater Scaup	0	0	0	0	59	0	0	0	0	0	0	0	0	0	59
Unidentified scaup	0	0	0	0	20	151	275	287	16	0	0	2	111	0	862
Steller's Eider	0	320	676	450	0	0	0	0	0	0	0	0	40	150	1,636
King Eider	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Common Eider	0	0	0	2	0	14	20	16	0	0	0	9	0	0	61
Unidentified eider	0	0	0	0	0	0	0	0	7	0	0	0	0	0	7
Harlequin Duck	0	134	135	64	105	269	158	93	137	12	240	53	78	25	1,503
Surf Scoter	0	0	0	0	12	7	1,344	1,553	138	6	0	0	0	0	3,060
White-winged Scoter	0	5	0	90	76	91	14	587	137	15	6	4	250	3	1,278
American Scoter	30	355	262	190	158	34	157	0	17	31	30	175	729	0	2,168
Unidentified scoter	3	0	0	0	222	833	707	1,068	225	100	73	24	20	1	3,276
Long-tailed Duck	127	529	486	1,322	89	382	0	0	0	0	100	459	1,948	122	5,564
Bufflehead	0	30	0	3	0	0	0	0	0	0	0	21	4	6	64
Common Goldeneye	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Barrow's Goldeneye	11	127	0	0	2	0	0	0	0	0	0	0	158	22	320
Unidentified goldeneye	3	128	97	82	44	6	0	25	0	6	94	84	6	4	579
Common Merganser	0	0	0	0	31	0	0	0	0	0	0	3	0	0	34
Red-breasted Merganser	0	0	0	0	0	9	0	0	140	0	9	0	0	0	158
Unidentified merganser	0	0	0	0	0	6	96	335	10	0	0	0	18	0	465
Unidentified diving duck	0	21	1	9	0	0	0	0	0	0	0	0	0	1	32
Unidentified duck	0	3	18	40	16	7	0	0	0	5	44	0	3	0	136
WATERFOWL Total	174	1,653	1,675	2,252	1,120	2,136	2,891	4,079	877	178	717	850	3,620	347	22,569
WATERBIRDS															
Red-throated Loon	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
Common Loon	0	0	0	0	0	2	0	0	0	0	0	1	1	0	4
Unidentified loon—large	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Unidentified loon	0	0	0	0	0	1	4	0	3	0	1	1	0	0	10

SPECIES-GROUP/ Species	SEASON/YEAR														Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Early Sep 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid-Nov 2007	Late Nov 2007	Mid-Dec 2007	
Horned Grebe	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
Red-necked Grebe	0	0	0	0	0	0	2	0	3	0	0	1	0	0	6
WATERBIRDS Total	0	0	0	0	0	10	6	0	6	0	1	3	1	0	27
SEABIRDS (CORMORANTS)															
Pelagic Cormorant	0	0	0	0	4	21	0	0	0	0	0	2	0	0	27
Unidentified cormorant	1	2	0	6	7	65	277	163	72	13	17	18	4	0	645
SEABIRDS (CORMORANTS) Total	1	2	0	6	11	86	277	163	72	13	17	20	4	0	672
SEABIRDS (LARIDS & ALCIDS)															
Mew Gull	3	0	0	0	75	28	528	104	250	29	25	0	1	0	1,043
Herring Gull	0	50	30	50	4	0	0	84	0	56	1	6	0	0	281
Glaucous-winged Gull	11	258	56	145	2	90	573	195	0	0	3	0	68	26	1,427
Glaucous Gull	0	0	0	0	29	0	0	0	0	0	0	6	0	0	35
Unidentified gull—large	0	0	0	0	77	297	0	655	140	0	0	0	0	0	1,169
Unidentified gull	1	415	151	235	487	1,097	740	2	326	436	226	7	0	36	4,159
Pigeon Guillemot	0	0	0	0	10	0	0	1	1	0	0	0	0	0	12
Horned Puffin	0	0	0	0	0	0	32	14	0	0	0	0	0	0	46
Tufted Puffin	0	0	0	1	0	0	3	1	0	0	0	0	0	0	4
Unidentified alcid	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
SEABIRDS (LARIDS & ALCIDS) Total	15	723	237	431	684	1,512	1,876	1,059	717	521	255	19	69	62	8,180
RAPTORS															
Bald Eagle	0	1	1	2	7	5	10	3	5	0	2	1	2	0	39
RAPTORS Total	0	1	1	2	7	5	10	3	5	0	2	1	2	0	39
SHOREBIRDS															
Black Oystercatcher	0	0	0	0	20	20	38	0	1	0	0	0	0	0	79
Unidentified sandpiper—small	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock Sandpiper	0	0	0	0	0	0	0	0	0	0	30	158	130	75	393
Unidentified shorebird—small	6	32	0	0	0	0	0	0	0	0	0	0	0	0	38
Unidentified shorebird	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
SHOREBIRDS Total	6	32	0	0	20	20	38	0	1	1	30	158	130	75	511
CORVIDS															
Common Raven	1	2	0	0	0	1	0	0	0	0	0	0	0	0	4
CORVIDS Total	1	2	0	0	0	1	0	0	0	0	0	0	0	0	4
BIRDS TOTAL	197	2,413	1,913	2,691	1,842	3,770	5,098	5,304	1,678	713	1,022	1,051	3,826	484	32,002
MAMMALS															
CARNIVORES															
Sea Otter	313	755	922	878	7	42	0	4	10	45	15	210	131	617	3,949

SPECIES-GROUP/ Species	SEASON/YEAR														Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Early Sep 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid-Nov 2007	Late Nov 2007	Mid-Dec 2007	
Steller's Sea Lion	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Harbor Seal	0	15	0	68	36	18	570	260	19	36	5	125	375	55	1,582
CARNIVORES Total	313	770	922	946	43	60	570	264	29	81	20	338	506	672	5,534
CETACEANS															
Beluga	0	0	0	0	0	0	0	0	1	0	3	0	0	0	4
Harbor Porpoise	0	1	0	0	1	7	0	1	0	0	0	0	0	0	10
Unidentified porpoise	0	0	0	0	0	8	0	0	0	0	0	0	0	0	8
CETACEANS Total	0	1	0	0	1	15	0	1	1	0	3	0	0	0	22
MAMMALS TOTAL	313	771	922	946	44	75	570	265	30	81	23	338	506	672	5,556

APPENDIX 44J

Numbers of Birds and Mammals Counted
during Helicopter-based Marine Surveys
in and near Iliamna and Iniskin Bays,
Cook Inlet Marine Study Area, 2008

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys in and near Iliamna and Iniskin Bays, Cook Inlet Marine Study Area, 2008

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Jan 2008	Late Feb 2008	Early Mar 2008	Mid-Mar 2008	Early Apr 2008	Mid-Apr 2008	
BIRDS							
WATERFOWL							
Greater White-fronted Goose	0	0	0	0	0	0	0
American Wigeon	0	0	0	0	0	0	0
Mallard	4	0	0	6	0	37	47
Northern Shoveler	0	0	0	0	0	0	0
Northern Pintail	0	0	0	0	0	0	0
Green-winged Teal	0	0	0	0	0	47	47
Unidentified dabbling duck	0	0	0	0	0	0	0
Greater Scaup	0	0	0	0	0	0	0
Unidentified scaup	0	0	0	24	200	117	341
Steller's Eider	136	172	275	0	225	0	808
King Eider	1	0	0	0	0	0	1
Common Eider	0	0	0	0	0	2	2
Unidentified eider	0	0	0	0	0	0	0
Harlequin Duck	28	434	174	90	154	51	931
Surf Scoter	9	0	0	0	2	0	11
White-winged Scoter	0	0	4	11	92	29	136
American Scoter	320	1	283	6	243	127	980
Unidentified scoter	0	0	80	5	85	34	204
Long-tailed Duck	240	651	1,228	150	766	21	3,056
Bufflehead	8	0	0	0	20	0	28
Common Goldeneye	0	0	0	10	0	0	10
Barrow's Goldeneye	0	2	2	0	0	0	4
Unidentified goldeneye	96	132	67	73	73	2	443
Common Merganser	0	0	0	0	0	2	2
Red-breasted Merganser	0	0	0	0	0	2	2
Unidentified merganser	0	0	0	0	3	0	3
Unidentified diving duck	0	0	0	0	0	1	1
Unidentified duck	47	3	17	0	3	5	75
WATERFOWL Total	891	1,395	2,130	375	1,866	477	7,134
WATERBIRDS							
Red-throated Loon	0	0	0	0	0	0	0
Common Loon	0	1	0	0	0	0	1
Unidentified loon—large	0	0	0	0	0	0	0

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Jan 2008	Late Feb 2008	Early Mar 2008	Mid-Mar 2008	Early Apr 2008	Mid-Apr 2008	
Unidentified loon	0	0	0	0	0	0	0
Horned Grebe	0	0	0	0	0	0	0
Red-necked Grebe	0	0	0	0	0	0	0
WATERBIRDS Total	0	1	0	0	0	0	1
SEABIRDS (CORMORANTS)							
Pelagic Cormorant	0	0	0	0	0	16	16
Unidentified cormorant	1	1	0	4	6	1	13
SEABIRDS (CORMORANTS) Total	1	1	0	4	6	17	29
SEABIRDS (LARIDS & ALCIDS)							
Mew Gull	77	0	0	0	0	6	83
Herring Gull	0	0	0	0	0	0	0
Glaucous-winged Gull	129	264	130	96	473	22	1,114
Glaucous Gull	0	0	0	0	0	0	0
Unidentified gull—large	0	0	0	0	0	0	0
Unidentified gull	786	100	120	1	320	405	1,732
Pigeon Guillemot	0	0	0	0	0	6	6
Horned Puffin	0	0	0	0	0	0	0
Tufted Puffin	0	0	0	0	0	0	0
Unidentified alcid	0	0	0	0	0	0	0
SEABIRDS (LARIDS & ALCIDS) Total	992	364	250	97	793	439	2,935
RAPTORS							
Bald Eagle	0	0	4	2	2	1	9
RAPTORS Total	0	0	4	2	2	1	9
SHOREBIRDS							
Black Oystercatcher	0	0	0	0	8	0	8
Unidentified sandpiper— small	0	0	0	0	0	0	0
Rock Sandpiper	120	0	70	0	0	30	220
Unidentified shorebird— small	0	0	0	0	0	0	0
Unidentified shorebird	0	0	0	0	0	0	0
SHOREBIRDS Total	120	0	70	0	8	30	228

SPECIES-GROUP/ Species	SEASON/YEAR						Total
	Late Jan 2008	Late Feb 2008	Early Mar 2008	Mid-Mar 2008	Early Apr 2008	Mid-Apr 2008	
CORVIDS							
Common Raven	1	1	1	4	0	0	7
CORVIDS Total	1	1	1	4	0	0	7
BIRDS TOTAL	2,005	1,762	2,455	482	2,675	964	10,343
<u>MAMMALS</u>							
CARNIVORES							
Sea Otter	1,433	403	123	20	52	157	2,188
Steller's Sea Lion	1	0	0	7	13	0	21
Harbor Seal	67	140	0	18	261	10	496
CARNIVORES Total	1,501	543	123	45	326	167	2,705
CETACEANS							
Beluga	0	0	0	0	0	0	0
Harbor Porpoise	0	0	0	0	1	1	2
Unidentified porpoise	0	0	0	0	0	0	0
CETACEANS Total	0	0	0	0	1	1	2
MAMMALS TOTAL	1,501	543	123	45	327	168	2,707

APPENDIX 44K

Numbers of Birds and Mammals Counted during
Helicopter-based Marine Surveys in Chinitna Bay,
Cook Inlet Marine Study Area, 2007

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys in Chinitna Bay, Cook Inlet Marine Study Area, 2007

SPECIES-GROUP/ Species	SEASON/YEAR												Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid- Nov 2007	Mid- Dec 2007	
<u>BIRDS</u>													
WATERFOWL													
Cackling/Canada Goose	0	0	0	0	0	0	160	0	0	0	0	0	160
Mallard	0	20	0	0	3	0	276	32	292	215	607	OT	1,445
Northern Shoveler	0	0	0	0	0	5	0	0	0	0	0	0	5
Northern Pintail	0	0	0	0	0	4	0	0	71	0	0	0	75
Green-winged Teal	0	0	0	0	45	0	75	0	0	0	0	0	120
Unidentified dabbling duck	0	0	0	0	3	6	0	0	166	0	0	0	175
Unidentified scaup	0	0	0	0	0	65	0	0	0	0	13	0	78
Common Eider	0	0	0	0	16	30	7	0	0	0	0	0	53
Harlequin Duck	0	16	4	12	12	31	48	65	0	19	17	0	224
Surf Scoter	5	0	0	0	85	17	446	73	0	0	0	0	626
White-winged Scoter	0	0	0	50	25	62	0	11	0	14	23	0	185
American Scoter	0	83	110	107	318	37	14	0	15	67	79	705	1,535
Unidentified scoter	3	0	0	0	227	545	1,148	37	3	0	14	0	1,977
Long-tailed Duck	13	291	244	425	45	17	0	0	0	0	357	350	1,742
Barrow's Goldeneye	2	2	0	0	0	0	0	0	0	0	0	0	4
Unidentified goldeneye	0	75	70	101	91	0	0		5	38	0	24	404
Common Merganser	0	0	0	0	0	0	0	0	0	0	15	0	15
Red-breasted Merganser	0	0	0	0	0	6	0	0	0	2	0	0	8
Unidentified merganser	0	0	0	0	0	1	0	0	3	0	0	0	4
Unidentified diving duck	0	20	0	2	0	0	0	0	0	0	0	0	22
Unidentified duck	0	0	0	5	5	0	0	0	0	54	0	0	64
WATERFOWL Total	23	507	428	702	875	826	2,174	218	555	409	1,125	1,079	8,921

SPECIES-GROUP/ Species	SEASON/YEAR												Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid- Nov 2007	Mid- Dec 2007	
WATERBIRDS													
Pacific Loon	0	2	0	0	0	0	0	0	0	0	0	0	2
Unidentified loon	0	0	0	2	0	1	0	0	0	0	1	0	4
WATERBIRDS Total	0	2	0	2	0	1	0	0	0	0	1	0	6
SEABIRDS (CORMORANTS)													
Pelagic Cormorant	0	0	0	0	2	8	0	0	0	0	1	0	11
Unidentified cormorant	0	0	0	0	6	21	6	3	0	0	0	0	36
SEABIRDS (CORMORANTS) Total	0	0	0	0	8	29	6	3	0	0	1	0	47
SEABIRDS (LARIDS & ALCIDS)													
Mew Gull	0	0	0	0	0	0	144	0	0	0	20	0	164
Herring Gull	0	0	0	0	0	0	0	0	18	0	5	0	23
Glaucous-winged Gull	0	632	0	50	0	6	24	0	0	0	0	195	907
Glaucous Gull	0	0	0	0	0	0	0	0	0	0	6	0	6
Unidentified gull–small	0	0	0	0	0	0	0	0	50	0	0	0	50
Unidentified gull–large	0	0	0	0	1	6	0	0	3	0	17	0	27
Unidentified gull	0	125	365	160	290	576	36	73	95	0	31	55	1,806
Pigeon Guillemot	0	0	0	0	0	13	0	0	0	0	0	0	13
Horned Puffin	0	0	0	0	0	0	24	0	0	0	0	0	24
Tufted Puffin	0	0	0	1	0	0	16	0	0	0	0	0	17
SEABIRDS (LARIDS & ALCIDS) Total	0	757	365	211	291	601	244	73	166	0	79	250	3,037
RAPTORS													
Bald Eagle	0	2	0	1	3	2	0	0	0	0	0	0	8
Peregrine Falcon	0	0	0	0	0	0	1	0	0	0	0	0	1
RAPTORS Total	0	2	0	1	3	2	1	0	0	0	0	0	9

SPECIES-GROUP/ Species	SEASON/YEAR												Total
	Late Jan 2007	Mid-Feb 2007	Early Mar 2007	Late Mar 2007	Mid-Apr 2007	Early May 2007	Late Aug 2007	Late Sep 2007	Early Oct 2007	Late Oct 2007	Mid- Nov 2007	Mid- Dec 2007	
SHOREBIRDS													
Black Oystercatcher	0	0	0	0	4	0	0	0	0	0	0	0	4
Unidentified shorebird— small	5	20	0	0	0	0	0	0	0	0	0	0	25
Unidentified shorebird— large	0	0	25	15	0	0	0	0	0	0	0	0	40
Unidentified shorebird	0	21	1	0	0	0	0	0	0	0	0	0	22
SHOREBIRDS Total	5	41	26	15	4	0	0	0	0	0	0	0	91
CORVIDS													
Black-billed Magpie	0	0	1	0	0	0	0	0	0	0	0	0	1
Common Raven	0	2	0	0	0	0	0	0	0	0	0	0	2
CORVIDS Total	0	2	1	0	0	0	0	0	0	0	0	0	3
BIRDS TOTAL	28	1,311	820	931	1,181	1,459	2,425	294	721	409	1,206	1,329	12,114
<u>MAMMALS</u>													
CARNIVORES													
Sea Otter	0	0	0	0	0	1	0	0	0	2	12	0	15
Harbor Seal	0	50	0	0	45	11	24	70	108	83	141	320	852
CARNIVORES Total	0	50	0	0	45	12	24	70	108	85	153	320	867
CETACEANS													
Harbor Porpoise	0	0	0	0	0	0	0	0	0	0	0	2	2
CETACEANS Total	0	0	0	0	0	0	0	0	0	0	0	2	2
MAMMALS TOTAL	0	50	0	0	45	12	24	70	108	85	153	322	869

APPENDIX 44L

Numbers of Birds and Mammals Counted during
Helicopter-based Marine Surveys in Chinitna Bay,
Cook Inlet Marine Study Area, 2008

Numbers of Birds and Mammals Counted during Helicopter-based Marine Surveys in Chinitna Bay,
Cook Inlet Marine Study Area, 2008

SPECIES-GROUP/ Species	SEASON/YEAR ^a					Total
	Late Feb 2008	Early Mar 2008	Mid-Mar 2008	Early Apr 2008	Mid-Apr 2008	
<u>BIRDS</u>						
WATERFOWL						
Cackling/Canada Goose	0	0	0	0	0	0
Mallard	0	0	13	12	2	27
Northern Shoveler	0	0	0	0	0	0
Northern Pintail	0	0	0	0	30	30
Green-winged Teal	0	0	0	0	232	232
Unidentified dabbling duck	0	0	0	0	0	0
Unidentified scaup	0	0	57	55	0	112
Common Eider	0	0	0	0	7	7
Harlequin Duck	0	0	25	3	9	37
Surf Scoter	0	0	0	30	0	30
White-winged Scoter	0	0	89	346	12	447
American Scoter	0	225	88	673	154	1,140
Unidentified scoter	0	0	106	402	36	544
Long-tailed Duck	425	665	85	560	15	1,750
Barrow's Goldeneye	0	0	0	0	0	0
Unidentified goldeneye	80	0	17	76	0	173
Common Merganser	0	0	10	0	0	10
Red-breasted Merganser	0	0	0	0	0	0
Unidentified merganser	0	0	2	0	0	2
Unidentified diving duck	0	0	0	0	0	0
Unidentified duck	2	0	0	1	25	28
WATERFOWL Total	507	890	492	2,158	522	4,569
WATERBIRDS						
Pacific Loon	0	0	0	0	0	0
Unidentified loon	0	0	0	0	0	0
WATERBIRDS Total	0	0	0	0	0	0
SEABIRDS (CORMORANTS)						
Pelagic Cormorant	0	0	0	0	0	0
Unidentified cormorant	0	0	3	1	0	4
SEABIRDS (CORMORANTS) Total	0	0	3	1	0	4
SEABIRDS (LARIDS & ALCIDS)						
Mew Gull	0	0	0	325	43	368
Herring Gull	0	0	0	0	0	0

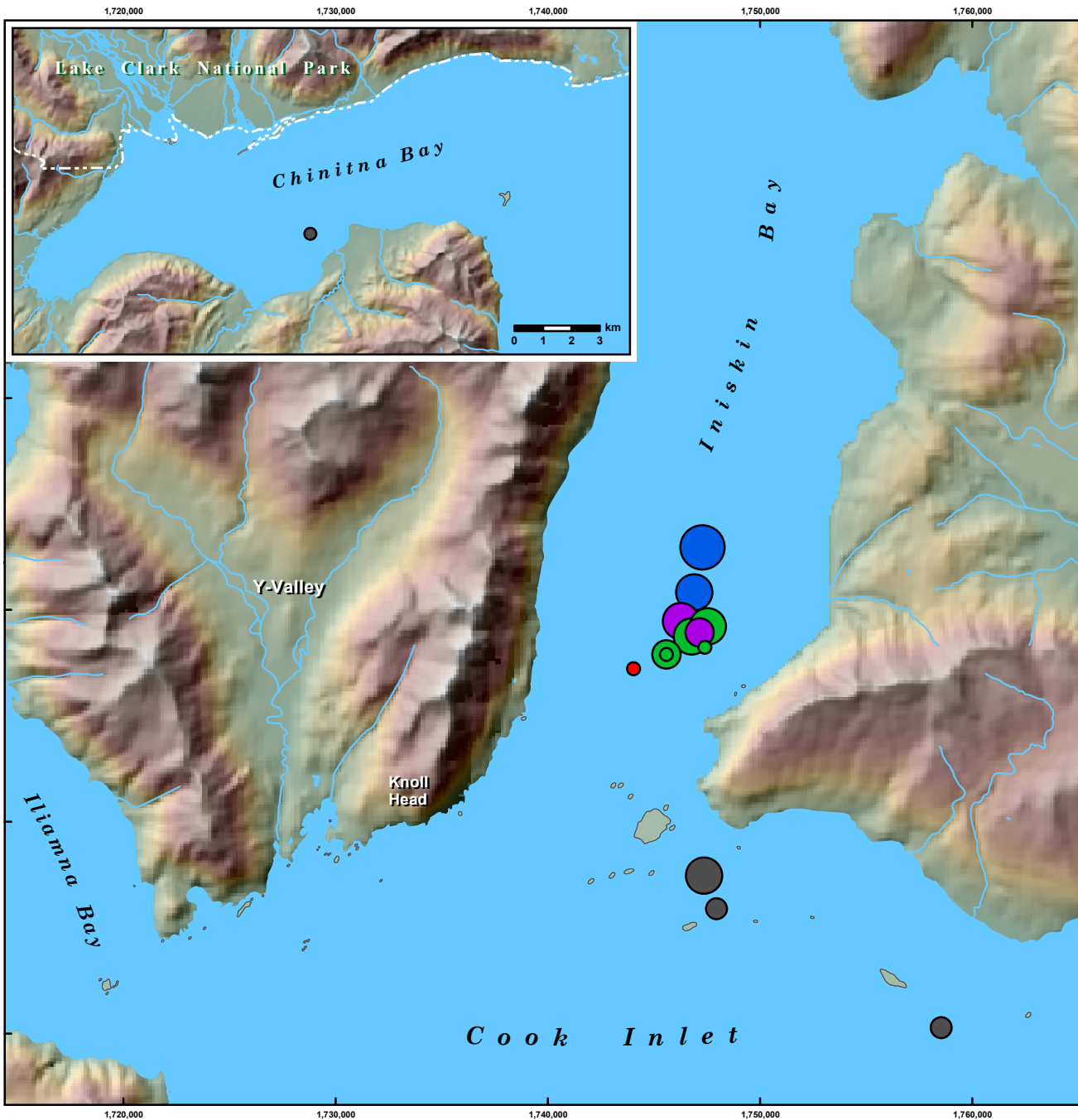
SPECIES-GROUP/ Species	SEASON/YEAR ^a					Total
	Late Feb 2008	Early Mar 2008	Mid-Mar 2008	Early Apr 2008	Mid-Apr 2008	
Glaucon-winged Gull	0	118	175	450	1	744
Glaucon Gull	0	0	0	0	0	0
Unidentified gull–small	0	0	3	0	0	3
Unidentified gull–large	0	0	26	0	0	26
Unidentified gull	0	200	20	420	218	858
Pigeon Guillemot	0	0	0	0	0	0
Horned Puffin	0	0	0	0	0	0
Tufted Puffin	0	0	0	0	0	0
SEABIRDS (LARIDS & ALCIDS) Total	0	318	224	1,195	262	1,999
RAPTORS						
Bald Eagle	0	0	2	0	1	3
Peregrine Falcon	0	0	0	0	0	0
RAPTORS Total	0	0	2	0	1	3
SHOREBIRDS						
Black Oystercatcher	0	0	0	0	0	0
Unidentified shorebird–small	0	0	0	0	0	0
Unidentified shorebird–large	0	0	0	0	0	0
Unidentified shorebird	0	0	0	0	0	0
SHOREBIRDS Total	0	0	0	0	0	0
CORVIDS						
Black-billed Magpie	0	0	0	0	0	0
Common Raven	0	0	2	0	0	2
CORVIDS Total	0	0	2	0	0	2
BIRDS TOTAL	507	1,208	723	3,354	785	6,577
<u>MAMMALS</u>						
CARNIVORES						
Sea Otter	0	0	0	0	2	2
Harbor Seal	0	1	150	180	40	371
CARNIVORES Total	0	1	150	180	42	373
CETACEANS						
Harbor Porpoise	0	0	0	0	0	0
CETACEANS Total	0	0	0	0	0	0
MAMMALS TOTAL	0	1	150	180	42	373

Note:

a. Researchers were unable to conduct a survey in Chinitna Bay in late January 2008.

APPENDIX 44M

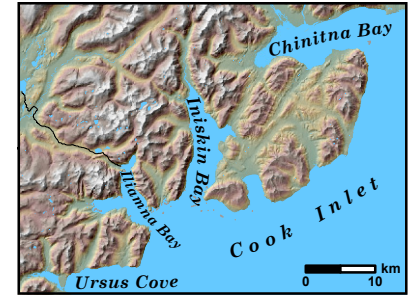
Distribution and Abundance of Steller's Eiders Counted
during U.S. Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area, 2004-2005



Appendix 44M
Distribution and Abundance of
Steller's Eiders Counted During
U.S. Fish and Wildlife Service
Surveys, Cook Inlet Marine
Study Area, 2004–2005

Legend

Number of Individuals	Month
5 – 10	October
11 – 50	December
51 – 200	February
201 – 400	March
520	April
	Existing Road



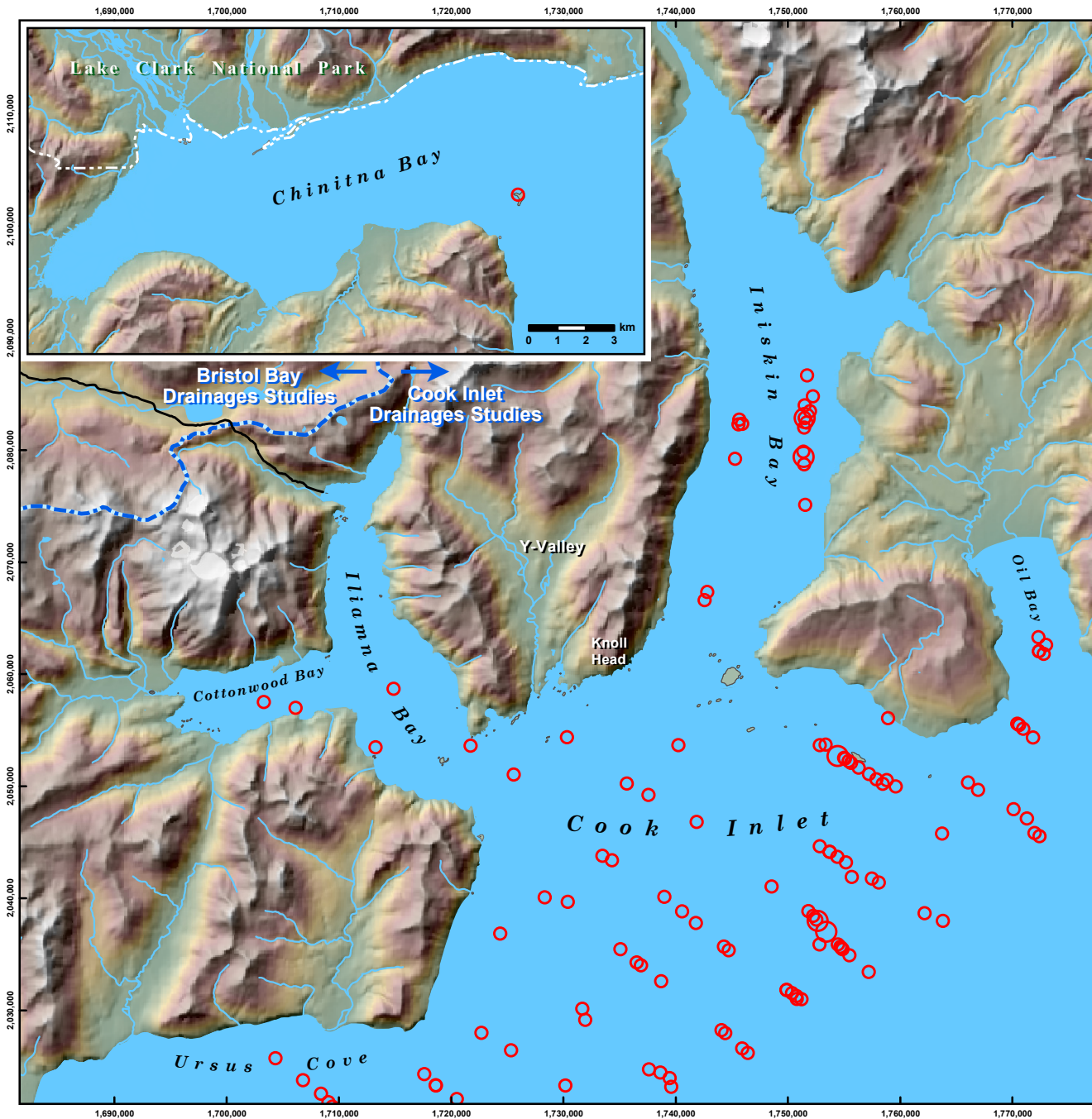
Alaska State Plane Zone 5 (units feet) Scale: 1:90,000
 1983 North American Datum

File: App44M_STEIDist_FWS0405_PLP_EBD_v02.mxd Date: Nov 20, 2010

Version: 2 Author: ABR-AZC

APPENDIX 44N

Distribution and Abundance of Sea Otters Counted
during U.S. Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area, Fall 2004 and 2005



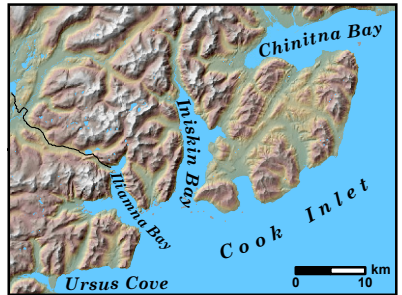
Appendix 44N
Distribution and Abundance
of Sea Otters Counted During U.S.
Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area,
Fall 2004 and 2005

Legend

Number of Individuals

- 1 – 10
- 11 – 25

— Existing Road

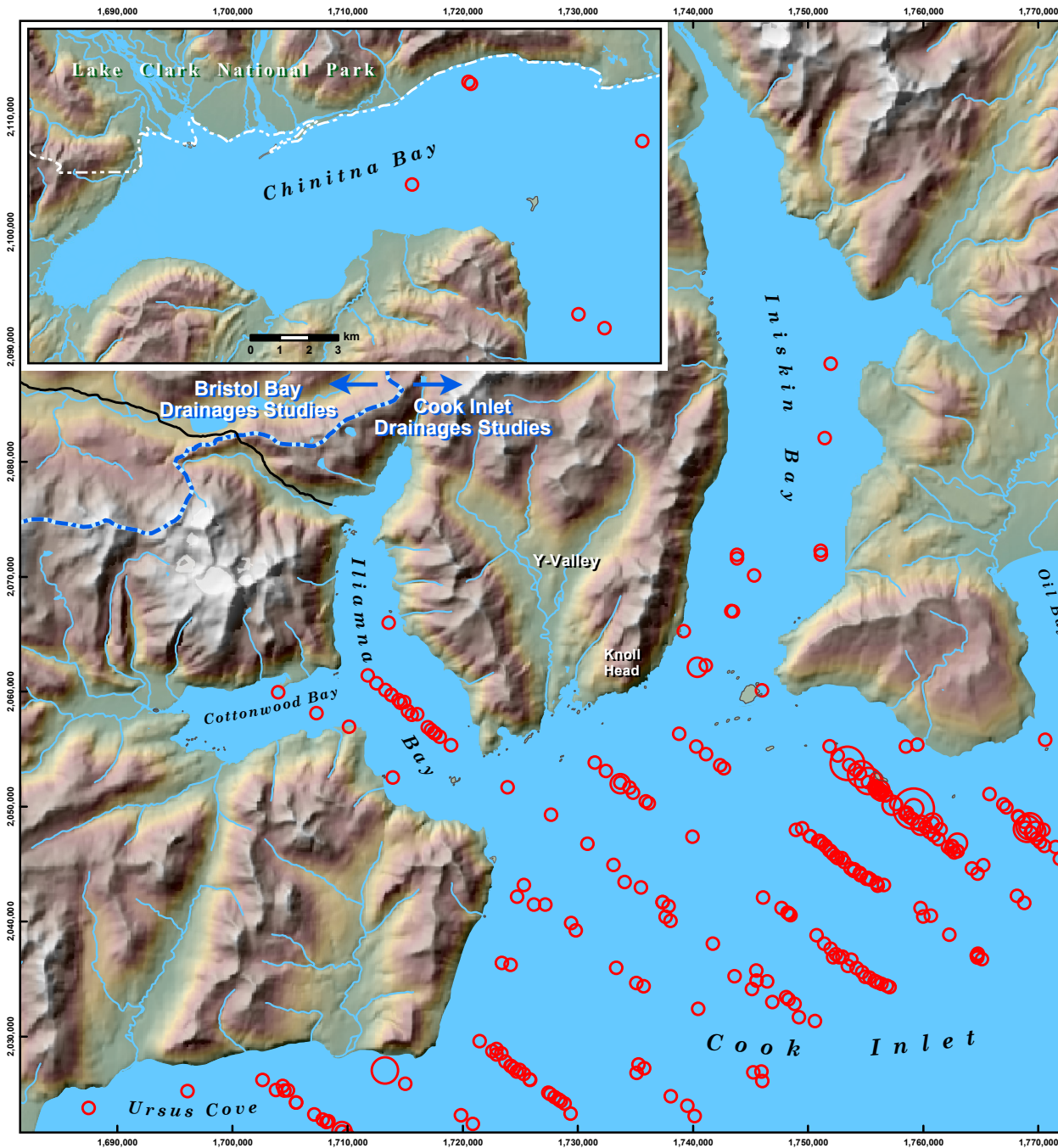


Alaska State Plane Zone 5 (units feet)
 1983 North American Datum Scale 1:170,000

File: App44N_SEOTDistFall_FWS0405_PLP_EBD_v02.mxd	Date: Nov 20, 2010
Version: 2	Author: ABR-AZC

APPENDIX 440

Distribution and Abundance of Sea Otters Counted
during U.S. Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area, Mid-winter 2004 and 2005



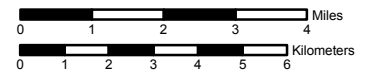
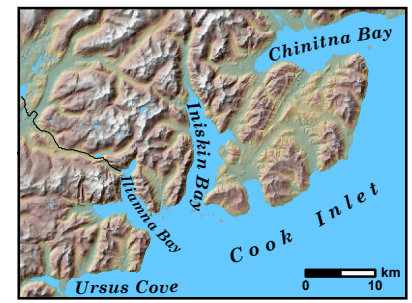
Appendix 440
Distribution and Abundance
of Sea Otters Counted During U.S.
Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area,
Mid-winter 2004 and 2005

Legend

Number of Individuals

- 1 – 10
- 11 – 25
- 26 – 50
- 51 – 100
- 101 – 220

Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

APPENDIX 44P

Distribution and Abundance of Sea Otters Counted
during U.S. Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area,
Late Winter-Spring 2004 and 2005



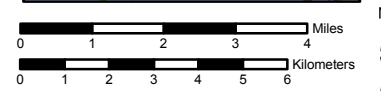
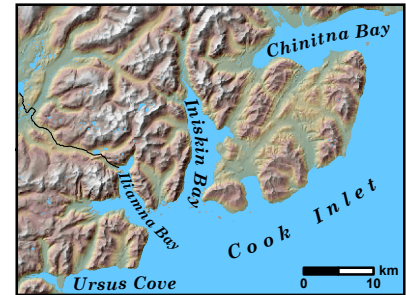
Appendix 44P
Distribution and Abundance
of Sea Otters Counted During U.S.
Fish and Wildlife Service Surveys,
Cook Inlet Marine Study Area,
Late Winter–Spring 2004 and 2005

Legend

Number of Individuals

- 1 – 10
- 11 – 25

— Existing Road



Alaska State Plane Zone 5 (units feet) 1983 North American Datum Scale 1:170,000

File: App44P_SEOTDistLWnSp_FWS0405_PLP_EBD_v02.mxd Date: Nov 22, 2010

Version: 2 Author: ABR-AZC

APPENDIX 44Q

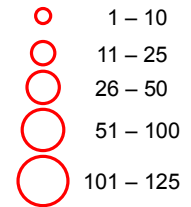
Distribution and Abundance of Sea Otters Counted
during Alaska Department of Fish and Game Herring Surveys,
Cook Inlet Marine Study Area,
April-June, 1978-2002



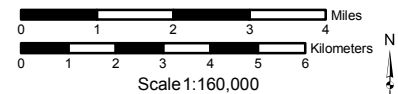
**Appendix 44Q
Distribution and Abundance
of Sea Otters Counted During
Alaska Department of Fish
and Game Herring Surveys,
Cook Inlet Marine Study Area,
April–June, 1978–2002**

Legend

Number of Individuals



— Existing Road



Alaska State Plane Zone 5 (units feet)
1983 North American Datum

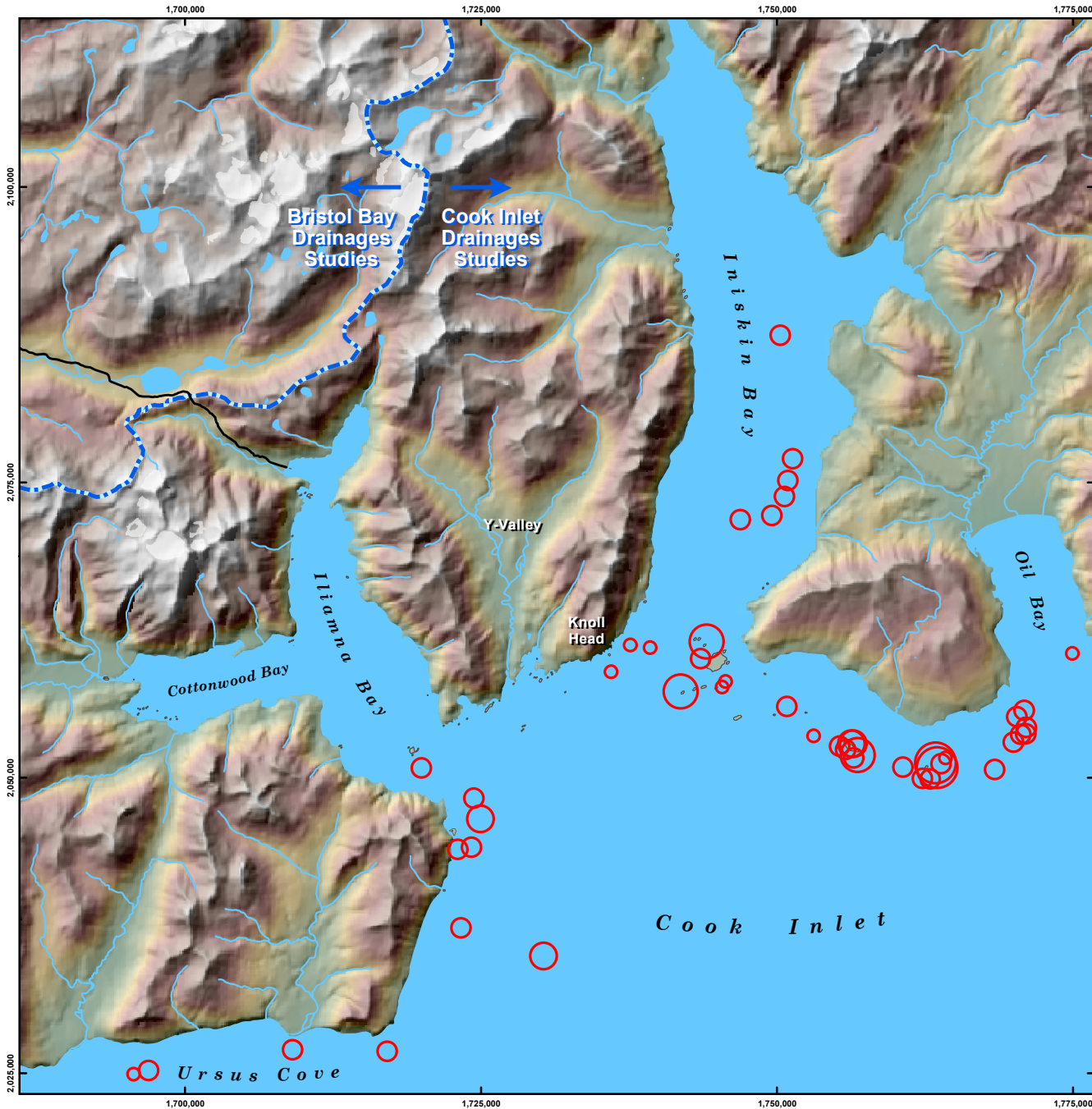
File: App44Q_SEOTDist_ADFG7802_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2

Author: ABR-AZC

APPENDIX 44R

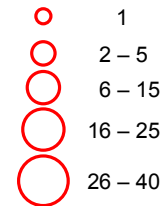
Distribution and Abundance of Steller's Sea Lions Counted during
Alaska Department of Fish and Game Herring Surveys,
Cook Inlet Marine Study Area,
April-June, 1978-2002



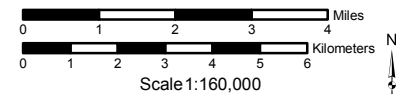
Appendix 44R
Distribution and Abundance of
Steller's Sea Lions Counted During
Alaska Department of Fish
and Game Herring Surveys,
Cook Inlet Marine Study Area,
April–June, 1978–2002

Legend

Number of Individuals



— Existing Road



Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

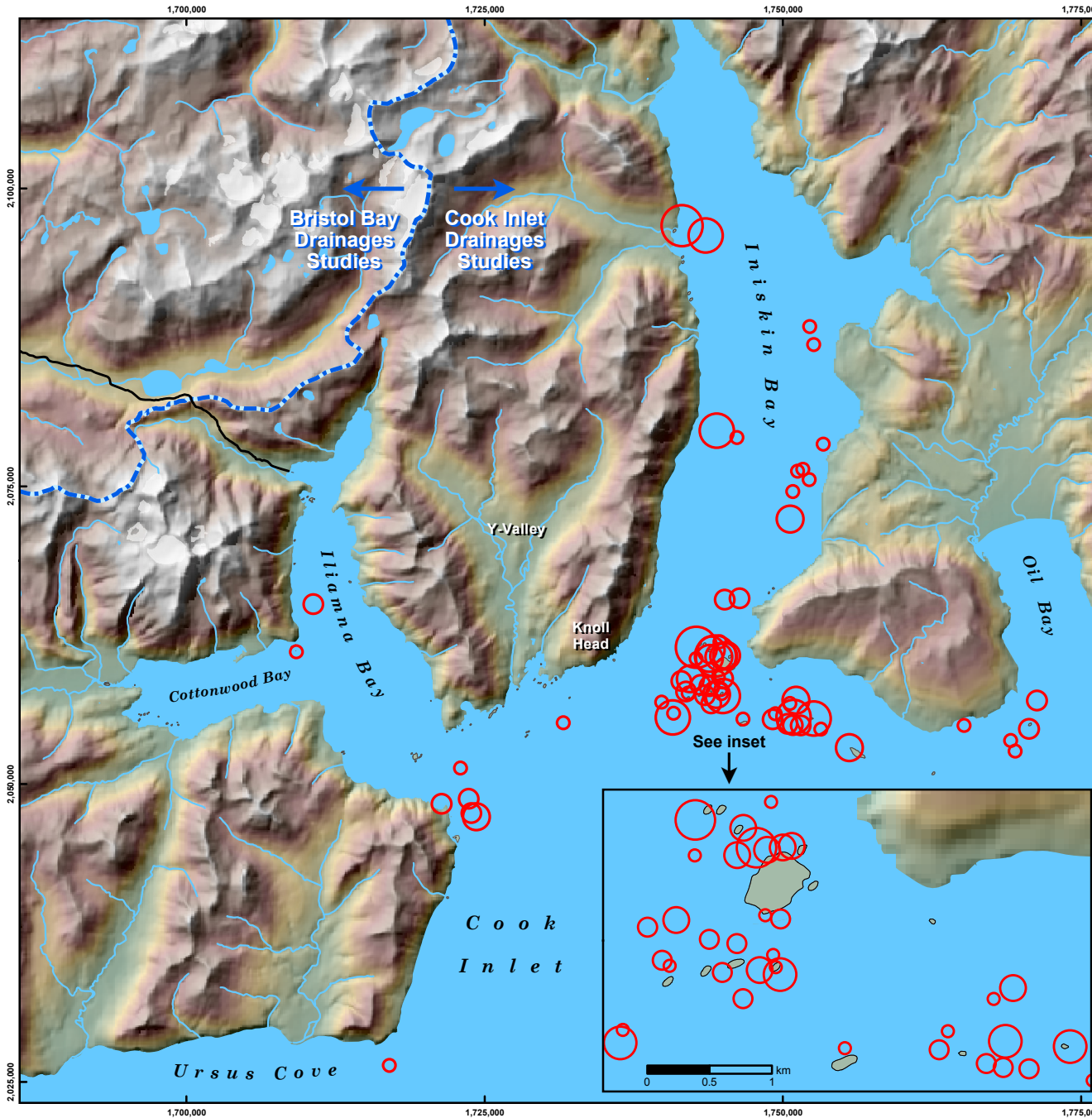
File: App44R_STSLDist_ADFG7802_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2

Author: ABR-AZC

APPENDIX 44S

Distribution and Abundance of Harbor Seals Counted during
Alaska Department of Fish and Game Herring Surveys,
Cook Inlet Marine Study Area,
April-June, 1978-2002



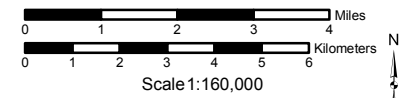
Appendix 44S
Distribution and Abundance of
Harbor Seals Counted During
Alaska Department of Fish
and Game Herring Surveys,
Cook Inlet Marine Study Area,
April–June, 1978–2002

Legend

Number of Individuals

- 1 – 10
- 11 – 25
- 26 – 50
- 51 – 100
- 101 – 200

Existing Road



Scale 1:160,000
 Alaska State Plane Zone 5 (units feet)
 1983 North American Datum

APPENDIX 44T

Distribution and Abundance of Belugas Counted during Alaska
Department of Fish and Game Herring Surveys,
Cook Inlet Marine Study Area,
April-June, 1978-2002



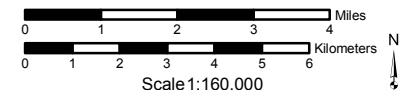
**Appendix 44T
Distribution and Abundance
of Belugas Counted During
Alaska Department of Fish
and Game Herring Surveys,
Cook Inlet Marine Study Area,
April–June, 1978–2002**

Legend

Number of Individuals

- 2
- 3 – 20
- 21 – 40
- 41 – 50
- 51 – 60

Existing Road



Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: App44T_BELUdist_ADFG7802_PLP_EBD_v02.mxd Date: Nov. 22, 2010

Version: 2 Author: ABR-AZC