Terrestrial Mammal Surveys for the Proposed Pebble Project

Brian Lawhead
Alex Prichard

Environmental Baseline
Agency Information Meeting
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ABR inc.
environmental research & services

Acknowledgments

- Mulchatna Caribou Herd Technical Working Group:
  Alaska Department of Fish & Game, U.S. Fish & Wildlife Service, National Park Service, Bureau of Land Management, especially Jim Woolington (ADFG), Andy Aderman (USFWS), Judy Putera (NPS)
- ADFG: Lem Butler, Earl Becker, Becky Strauch, Rob DeLong, Bob Small, Steve Schwartz, Grant Hilderbrand, Bruce Dale, Sean Farley
- NMFS NMML: Dave Withrow
- UAMN: Steve MacDonald & Brandy Jacobsen
- Local observers: Carl Jensen (Pedro Bay); Raymond Wassillie & James Lamont (Newhalen)
- Mark & Sandy Lang (Lake Clark Inn & Air)
- Fixed-wing pilots: Josh Goertzen, Mike Meekin, Harley McMahan, Andy Greenblatt, David Filkill, Mike Litzen
- Helicopter pilots: Brent Fedirchuk, Bruce Andrews, Pascal Fischer, Tim Varnadoe, Mark Stanton

Objectives: Mammals

- Review existing information from agencies & literature on mammal species in project area
- Assess seasonal distribution & abundance of selected species through field surveys in mine area & transportation corridor, to provide background for impact analyses
- Summarize existing population survey & telemetry data, and collaborate on field surveys as needed to update data
- Engage local participants in surveys
- Compile incidental observations from other wildlife surveys, project personnel, & contractors

Mammal Species List

- Cinereus shrew, masked shrew
- Pygmy shrew
- Dusky shrew, montane shrew
- Water shrew
- Tundra shrew
- Alaska tiny shrew
- Little brown bat
- Coyote
- Wolf
- Red fox
- Lynx
- River otter
- Wolverine
- Marten
- Ermine, short-tailed weasel
- Least weasel
- Mink
- Harbor seal
- Black bear
- Brown bear
- Moose
- Caribou
- Dall's sheep
- Hoary marmot
- Arctic ground squirrel
- Red squirrel
- Beaver
- Meadow jumping mouse
- Northern red-backed vole
- Collared lemming
- Brown lemming
- Singing vole
- Tundra vole, root vole
- Meadow vole
- Muskrat
- Northern bog lemming
- Porcupine
- Collared pika
- Snowshoe hare
- Tundra hare, Alaska hare

Methods: Mammals

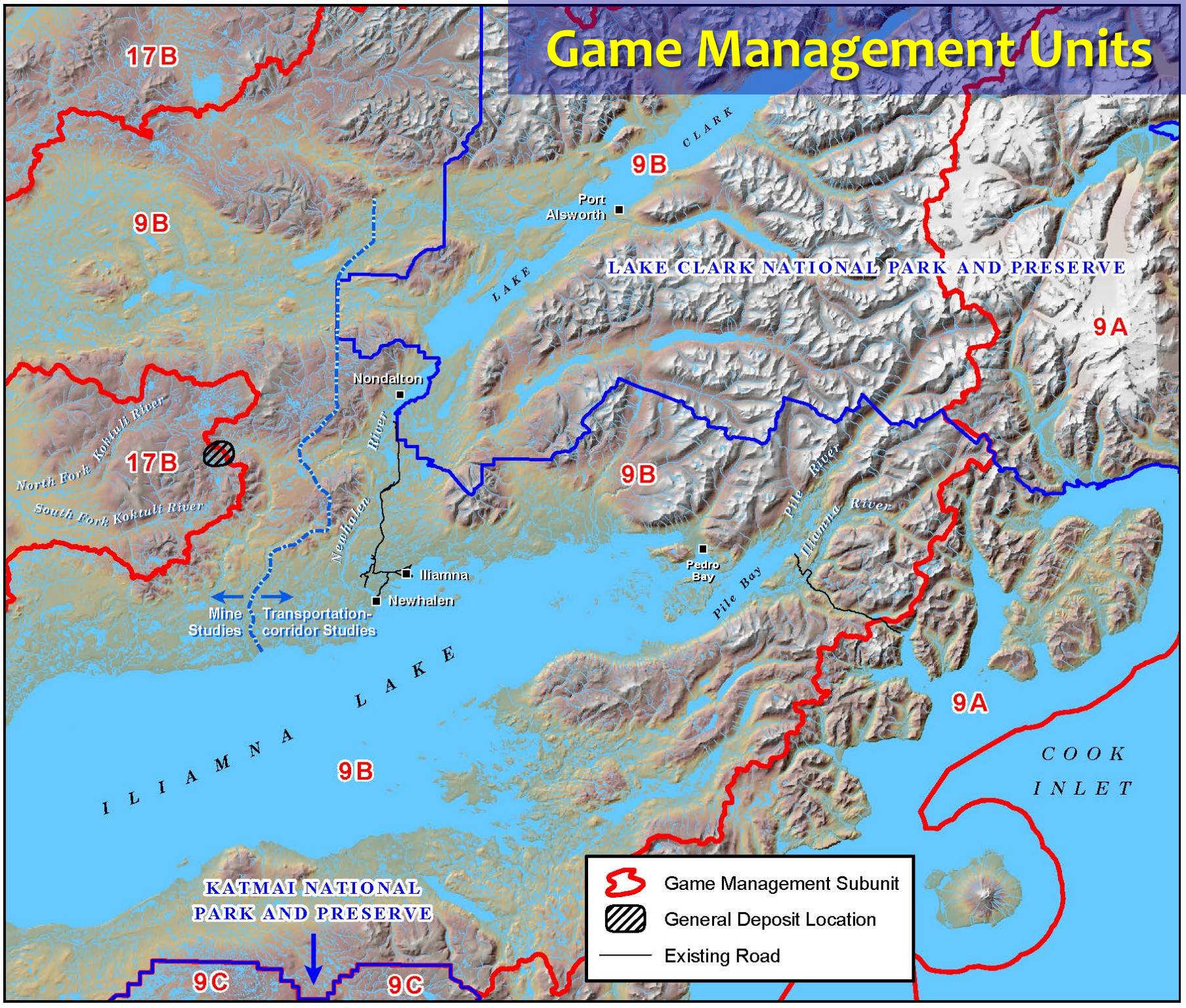
- Species of primary interest for field surveys: caribou, brown bear, moose, harbor seal, beaver; but all species included in literature review & baseline report
- Aerial transect & reconnaissance surveys by fixed-wing airplane (~500 ft agl) over mine area & transportation corridor:

  2004 : Apr., May, June, July, Oct., Nov.
  2005 : Mar., May, June, July, Oct., Dec.
  2006 : (mine area) May, June, July, Dec.
  2007 : (mine area) June, July

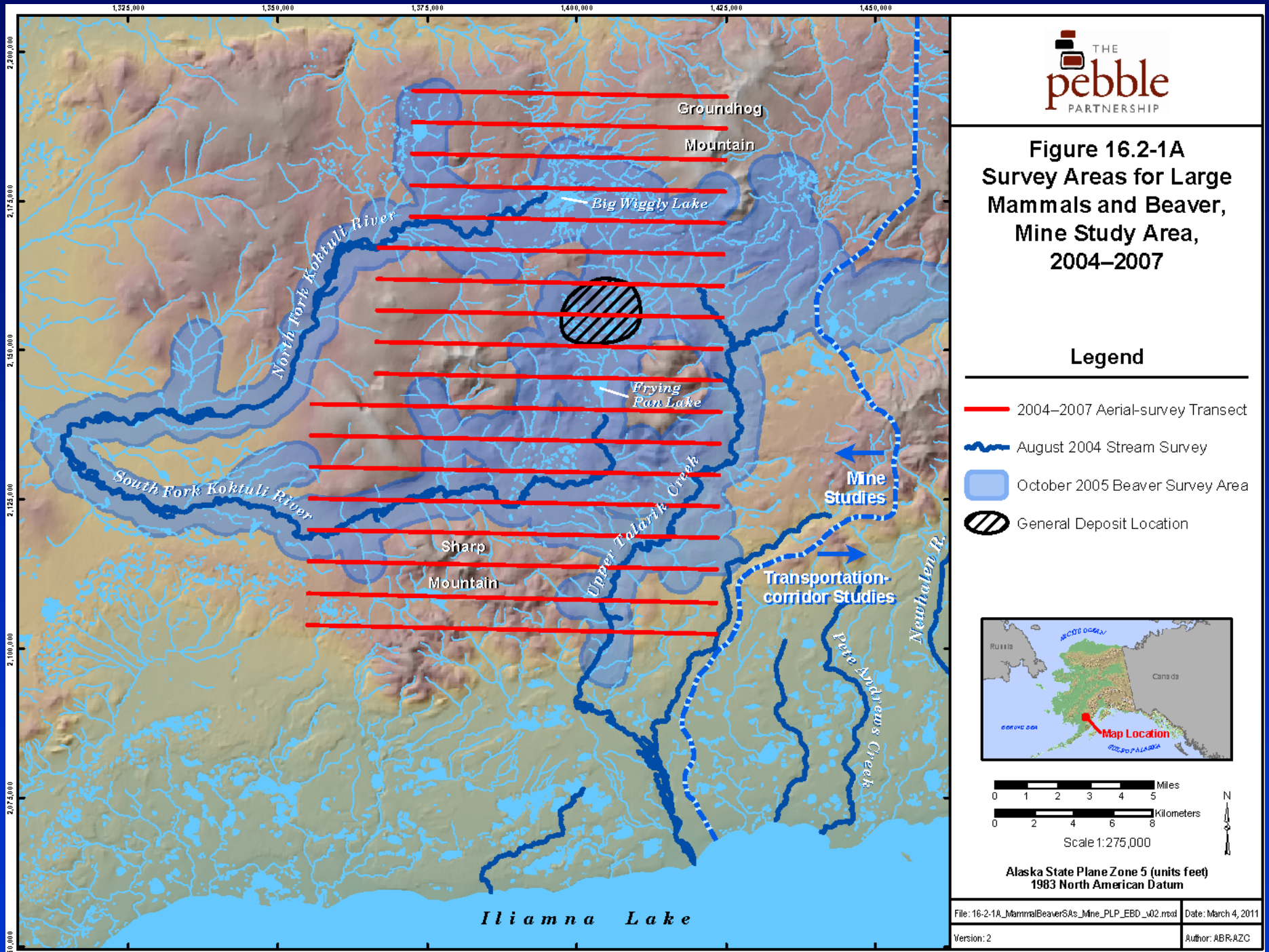
- Systematic strip transects in mine area (50–100% coverage) & western/central transportation corridor (12.5% coverage), with double-count detectability assessment
- Reconnaissance overflights in eastern transportation corridor (east of Canyon Creek)

Methods: Mammals (continued)

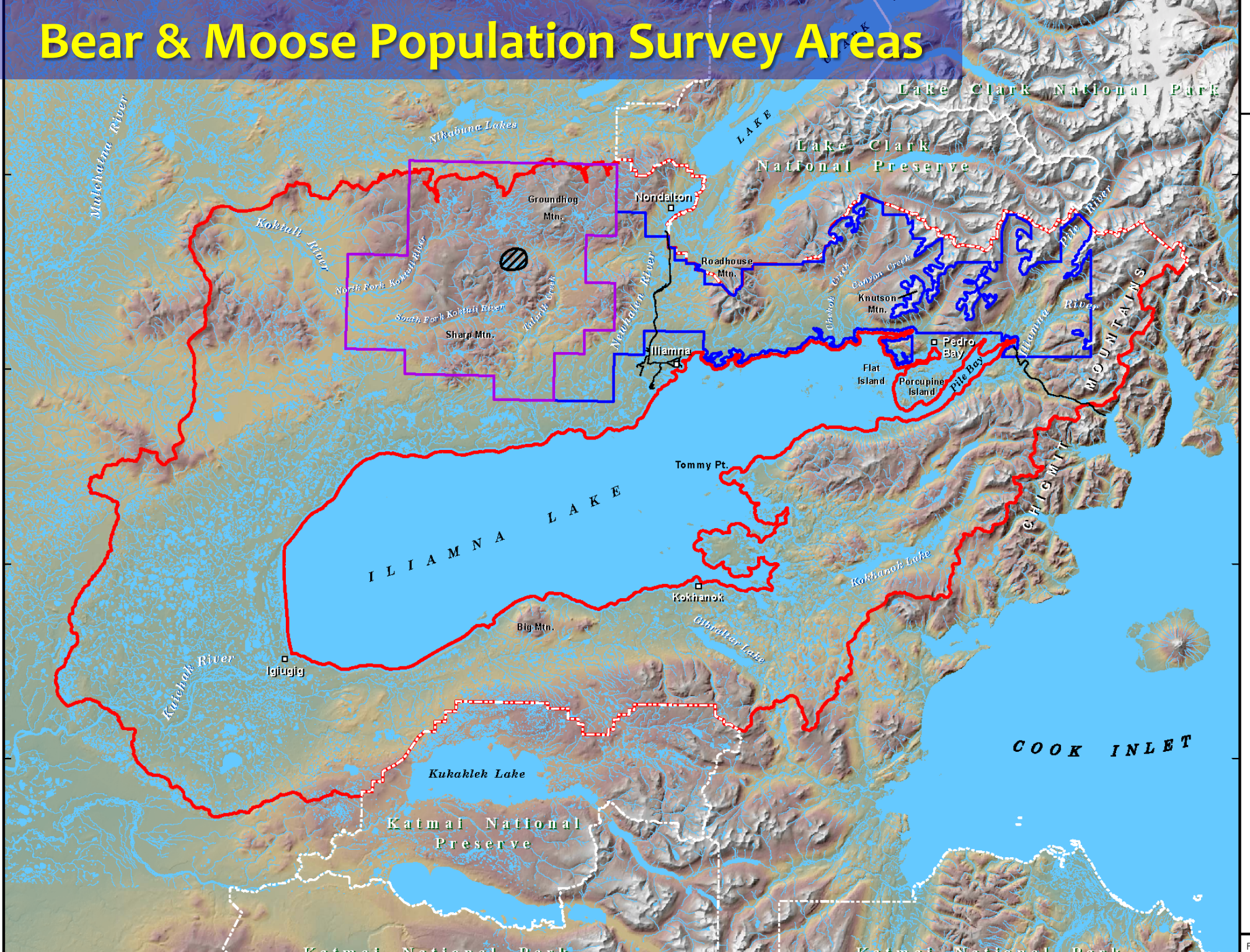
- Moose population survey: Apr. 2010
- Bear population survey with ADFG: May 2009
- Helicopter survey of bears along salmon-spawning streams in Aug. 2004; similar data collected incidental to Harlequin Duck surveys in 2005
- Bear den checks by helicopter:
  Aug. 2004, May & Aug. 2005, May 2006
- Helicopter surveys of active beaver colonies:
  Oct. 2005 (mine) & Oct. 2006 (transportation corridor)
- Photographic surveys of harbor seal haulouts in Iliamna Lake (& coastal bays) by fixed-wing airplane (1,000 ft agl):
  Mar.–Dec. 2005, May–Oct. 2007, Aug. 2008


Game Management Units
17B
9B
9B
CLARK
LAKE
Port Alsworth
LAKE CLARK NATIONAL PARK AND PRESERVE
9A
Nondalton
17B
North Fork Kokhuli River
South Fork Kokhuli River
Newhalen River
9B
Pile River
Iliamna River
Pedro Bay
Pile Bay
Iliamna
Newhalen
Mine Studies
Transportation-corridor Studies
ILIAMNA LAKE
9A
COOK INLET
9B
KATMAI NATIONAL PARK AND PRESERVE
9C
9C
Game Management Subunit
General Deposit Location
Existing Road

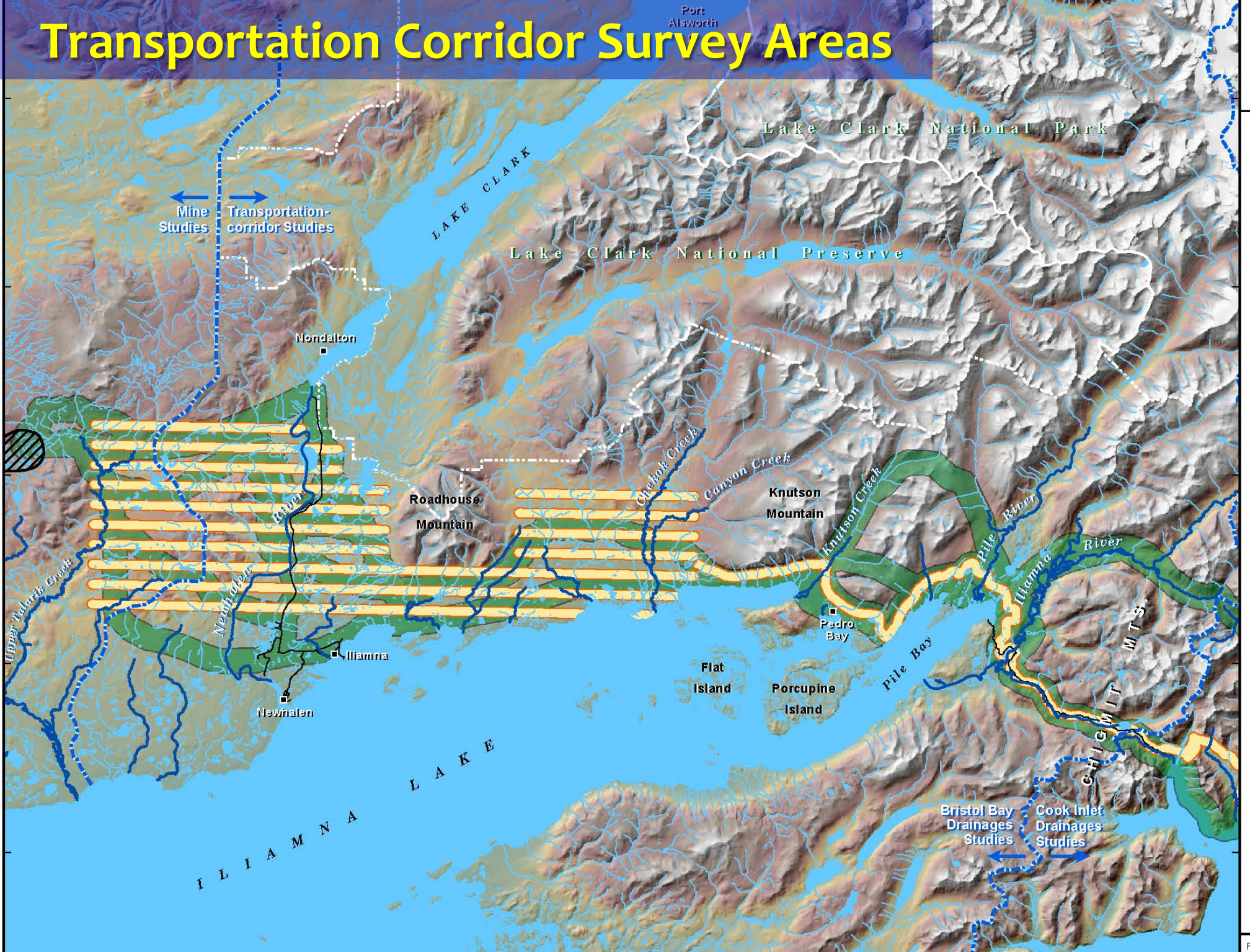
Mine Study Area



Bear & Moose Population Survey Areas



Transportation Corridor Survey Areas



Survey Areas in Cook Inlet Drainages

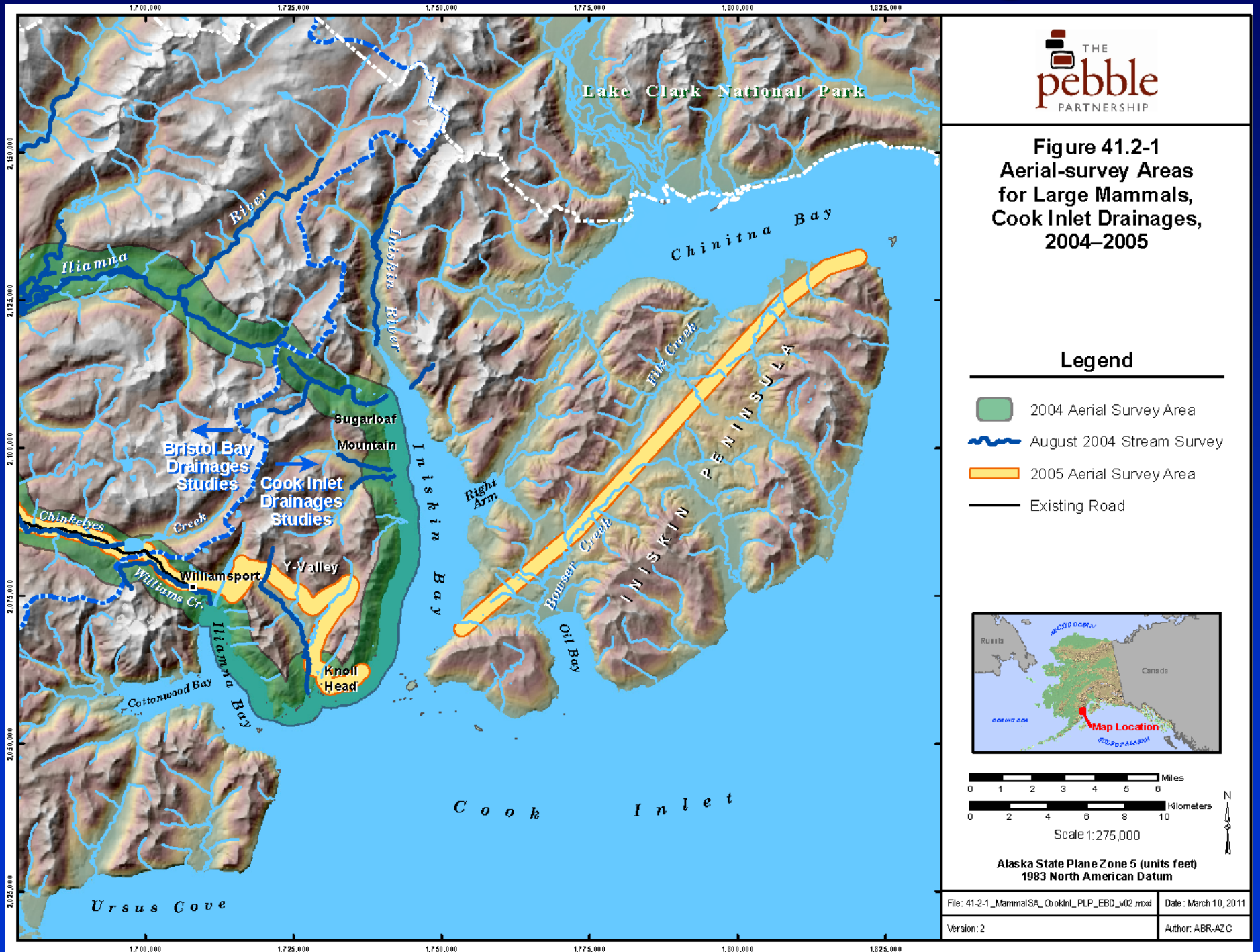


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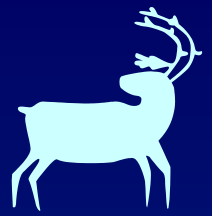
Figure 41.2-1
Aerial-survey Areas for Large Mammals, Cook Inlet Drainages, 2004–2005

Legend

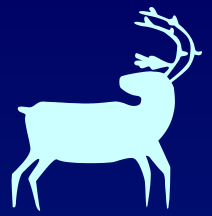
- 2004 Aerial Survey Area
- August 2004 Stream Survey
- 2005 Aerial Survey Area
- Existing Road

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

File: 41-2-1_MammalSA_CookInl_PLP_EBD_v02.mxd	Date: March 10, 2011
Version: 2	Author: ABR-AZC



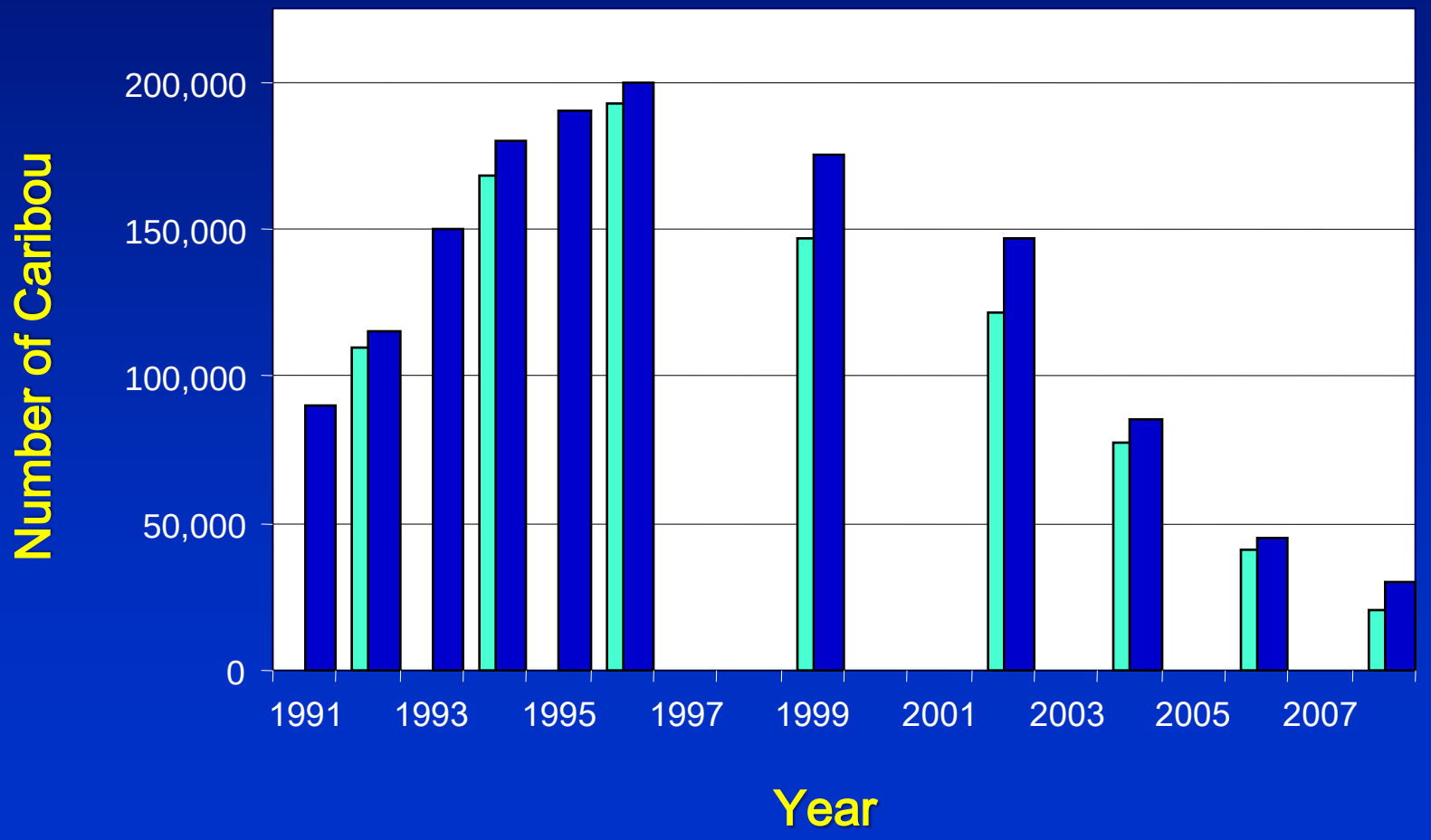
Caribou



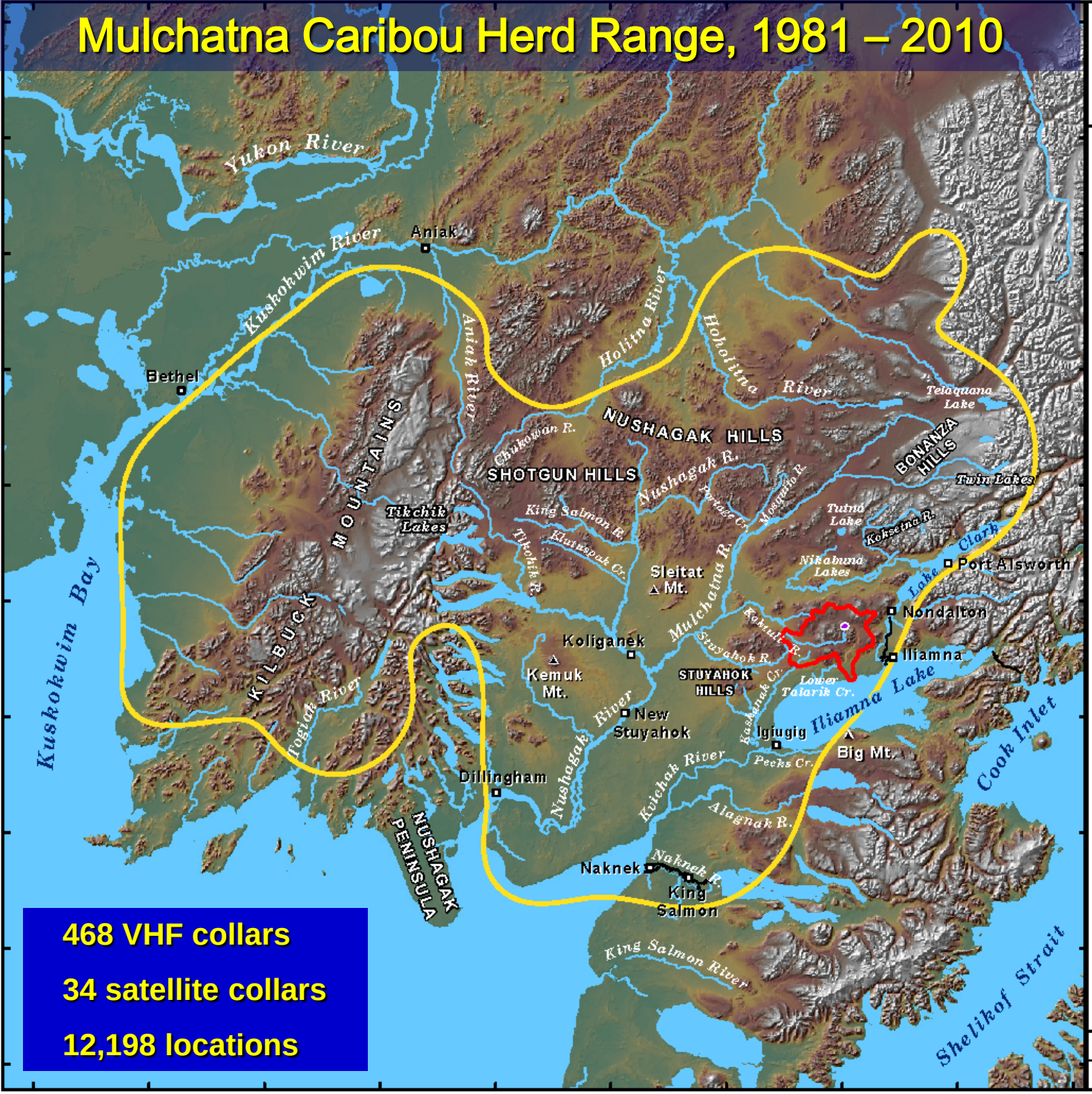
- Mulchatna Herd peaked at ~200,000 in 1996, then subsequently declined to ~30,000 by 2008
- Under a cooperative agreement, the MCHTWG provided its 29-year radiotelemetry data set for Pebble analyses
- MCH notable for highly variable range use over large areas of southwest Alaska since mid-1990s, accompanied by dramatic population fluctuation
- Past use of mine area (including early 1990s telemetry):
  - Wintering
  - Calving
  - Postcalving aggregations (summer insect season)
- Recent use primarily during postcalving period (late June–early July)
- Very little range use in transportation corridor east of Newhalen River

Mulchatna Caribou Herd size, 1991 – 2008

dark blue = ADFG estimate
turquoise = ADFG photocensus count



Mulchatna Caribou Herd Range, 1981 – 2010



468 VHF collars

34 satellite collars

12,198 locations

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Figure 16.2-2.
Mulchatna Caribou Herd Range, Southwestern Alaska, 1981–2010

Legend

- Mulchatna Caribou Herd Range
- Greater Mine Study Area
- General Deposit Location
- Existing Road
- Town or Village
- Summit

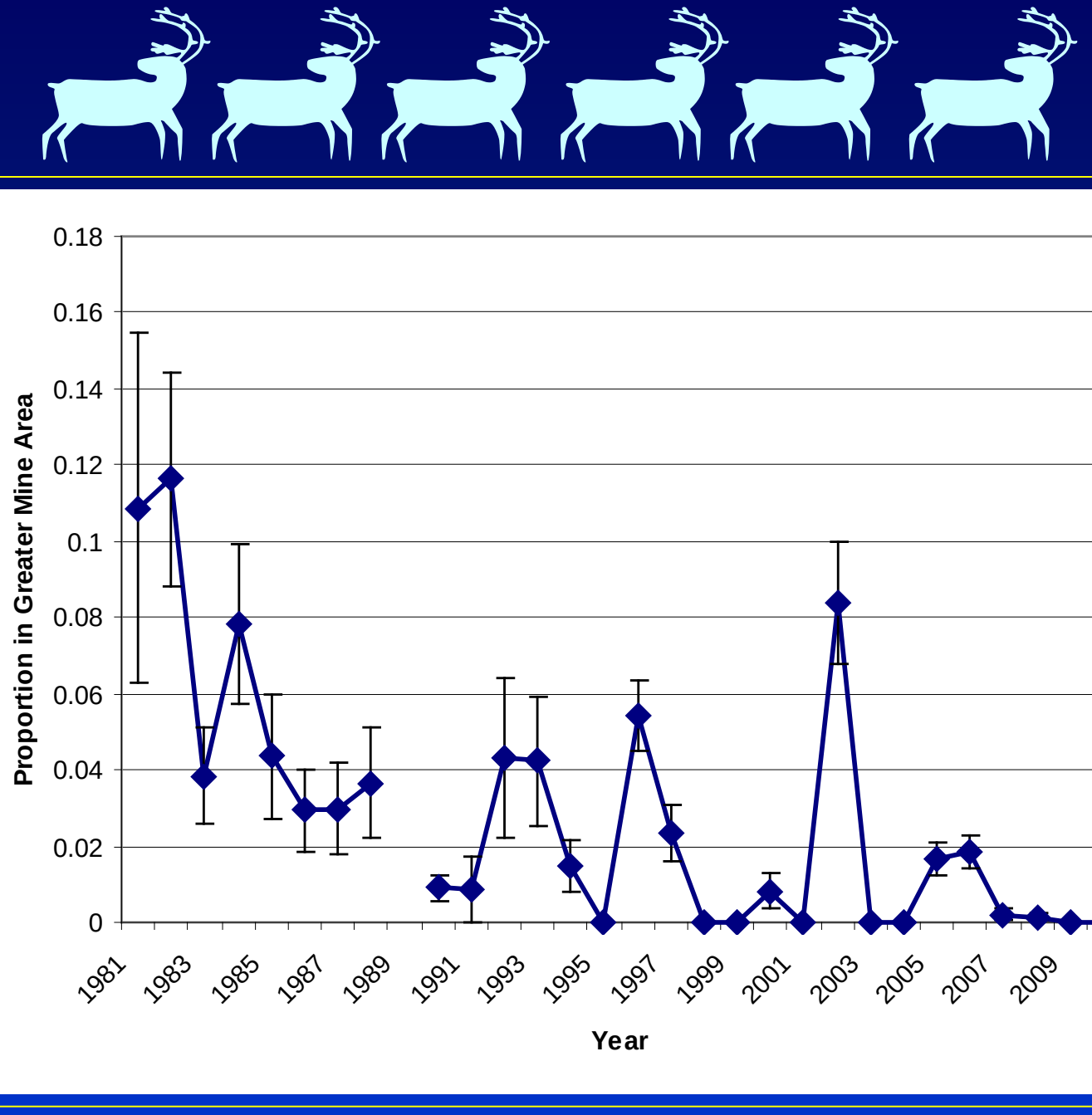
Data source: MCHTWG telemetry data set (from ADF&G and Togiak and Yukon Delta National Wildlife Refuges), March 1981–March 2010.

Miles
0 25 50 75
Kilometers
0 25 50 75 100 125
N
Scale 1:3,300,000

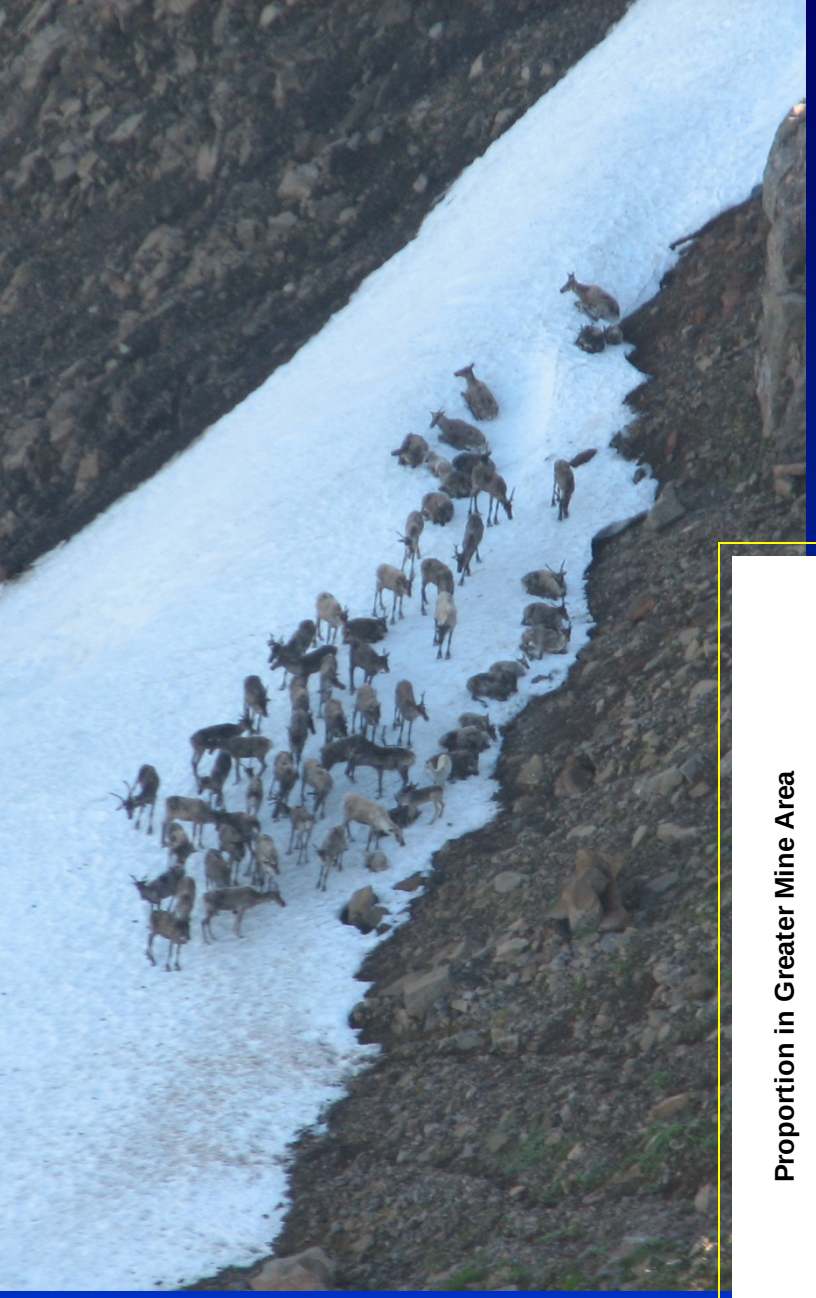
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-2_MHerdSA_PLP_EBD_v02.mxd	Date: March 7, 2011
Version: 2	Author: ABR-AZC

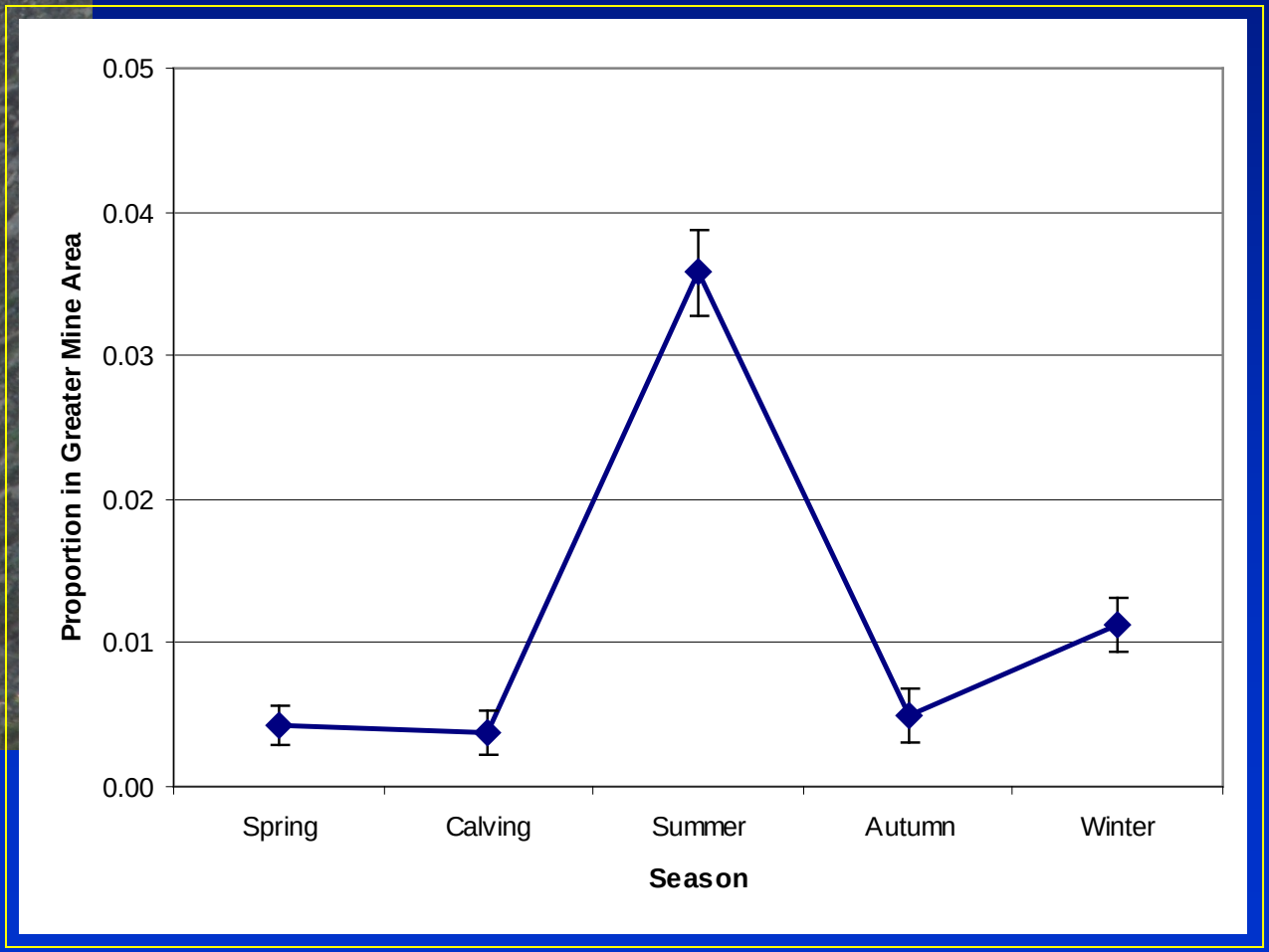
0 200,000 400,000 600,000 800,000 1,000,000 1,200,000 1,400,000 1,600,000 1,800,000



Proportion of radio-collared caribou locations in the greater mine study area, by year, Mulchatna Caribou Herd, 1981–2010



Proportion of radio-collared caribou locations in the greater mine study area, by season, Mulchatna Caribou Herd, 1981–2010



Caribou Spring Range: Apr. 1 – May 14

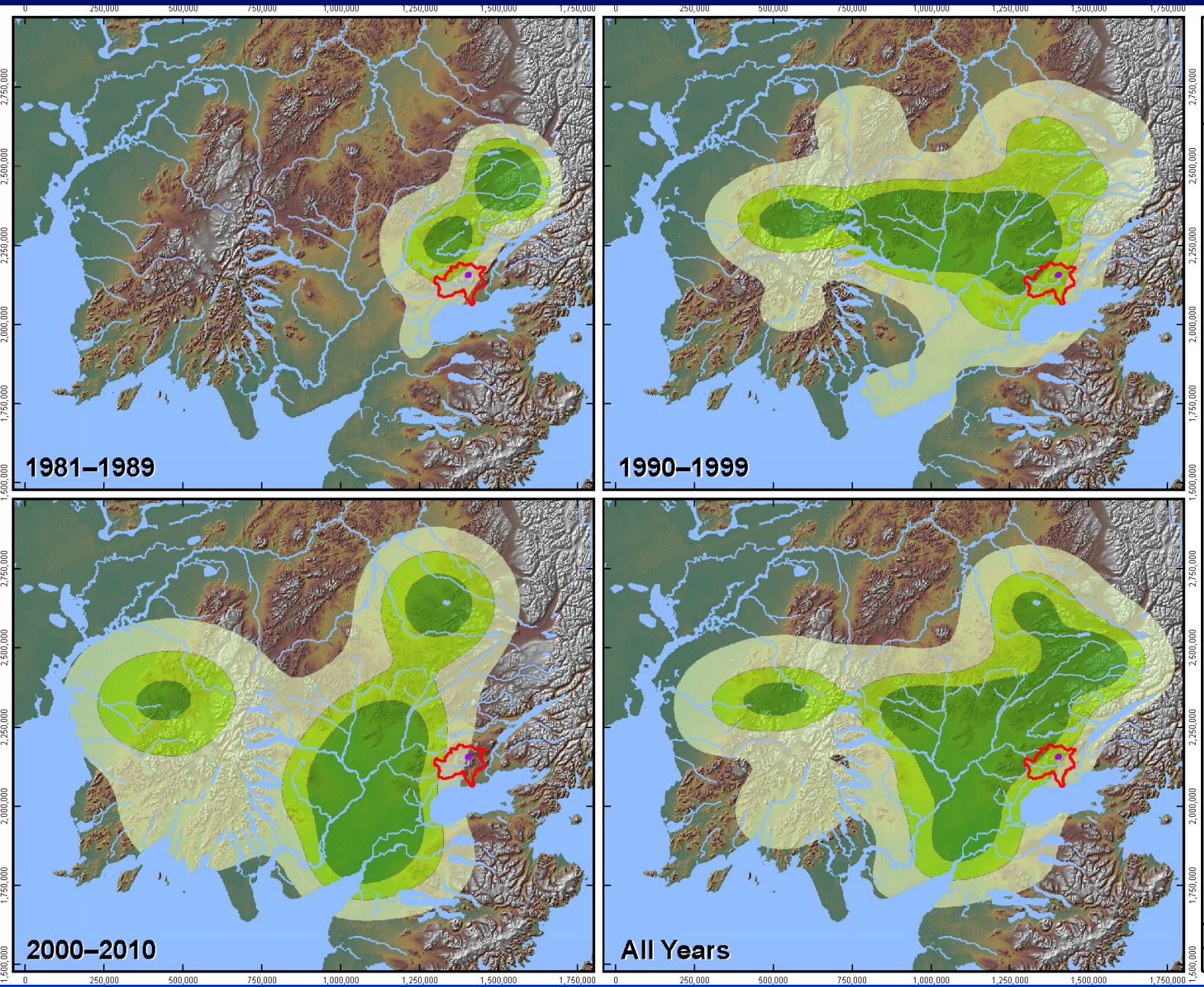


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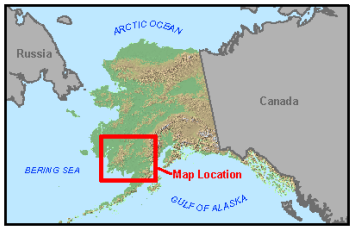
Figure 16.2-4
Mulchatna Caribou Herd, Seasonal Range Use, Southwestern Alaska, Spring 1981–2010

Spring (April 1–May 14) Areas of Concentrated Use

- High Density
- Medium Density
- Low Density

- Greater Mine Study Area
- General Deposit Location

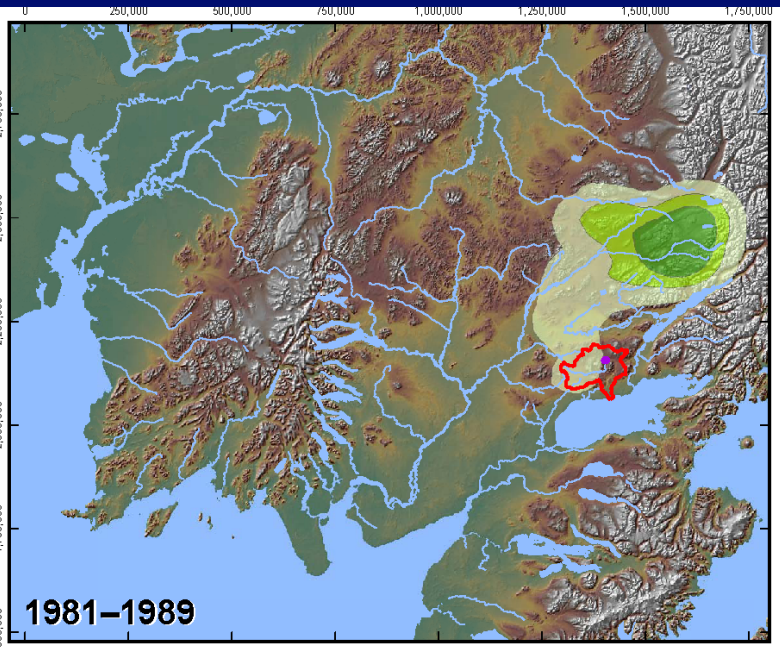
Data source: Utilization distribution contours from fixed-kernel analysis of locations of radio-collared caribou (telemetry database from ADF&G, Togiak and Yukon Delta National Wildlife Refuges). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively.

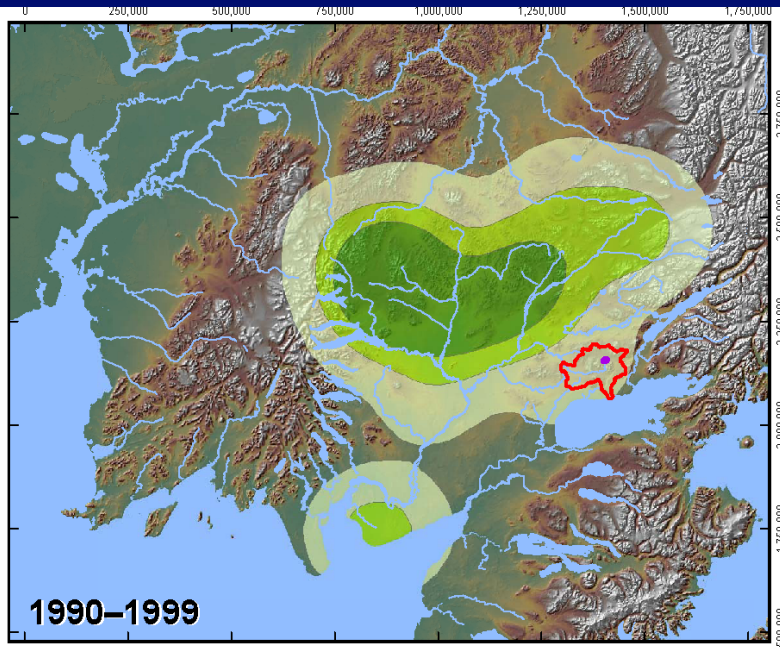


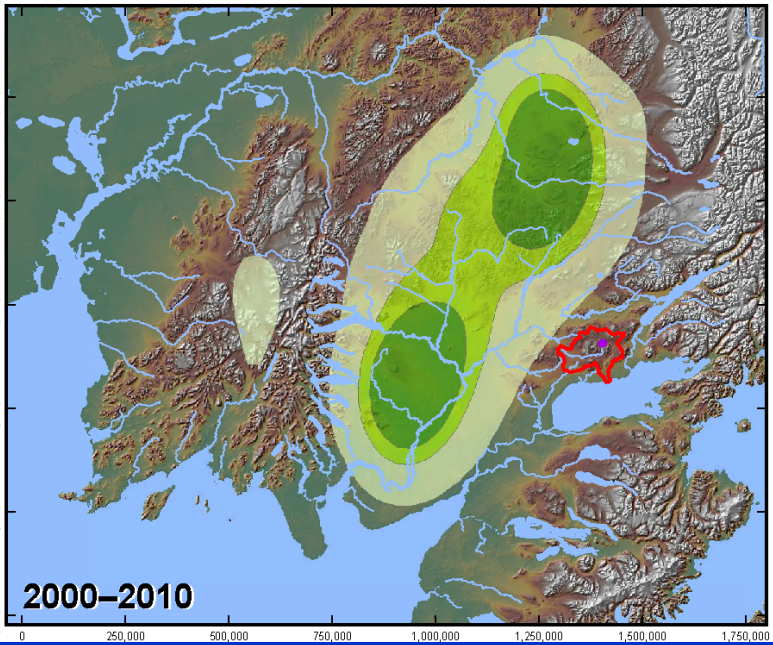
Miles: 0 25 50 75 100 125
Kilometers: 0 50 100 150 200
N
Scale 1:3,750,000
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-4_MHerdSpringUse_PLP_EBD_v02.mxd	Date: March 7, 2011
Version: 2	Author: ABR-AZC

Caribou Calving: May 5 – June 10 (females only)







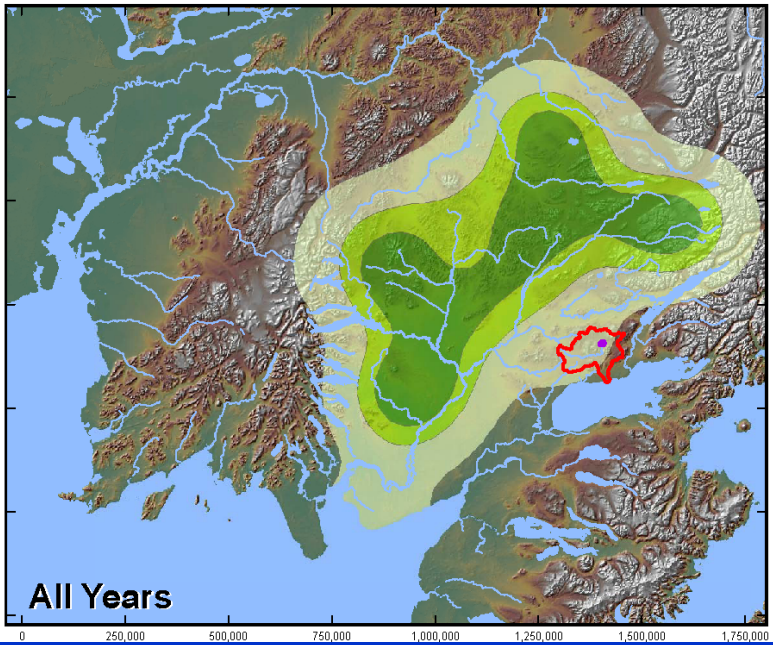


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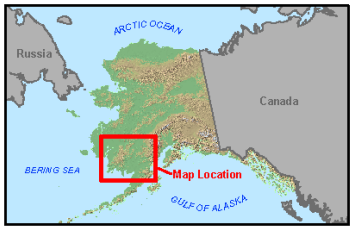
Figure 16.2-5
Mulchatna Caribou Herd, Seasonal Range Use, Southwestern Alaska, Calving 1981–2010

Calving (May 15–June 10)
Areas of Concentrated Use

- High Density
- Medium Density
- Low Density

- Greater Mine Study Area
- General Deposit Location

Data source: Utilization distribution contours from fixed-kernel analysis of locations of radio-collared female caribou (telemetry database from ADF&G, Togiak and Yukon Delta National Wildlife Refuges). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively.



Miles
0 25 50 75 100 125
Kilometers
0 50 100 150 200
N
Scale 1:3,750,000
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-5_MHerdCalvingUse_PLP_EBD_v02.mxd	Date: March 7, 2011
Version: 2	Author: ABR-AZC

Caribou Summer Range: June 11 – Sep. 7

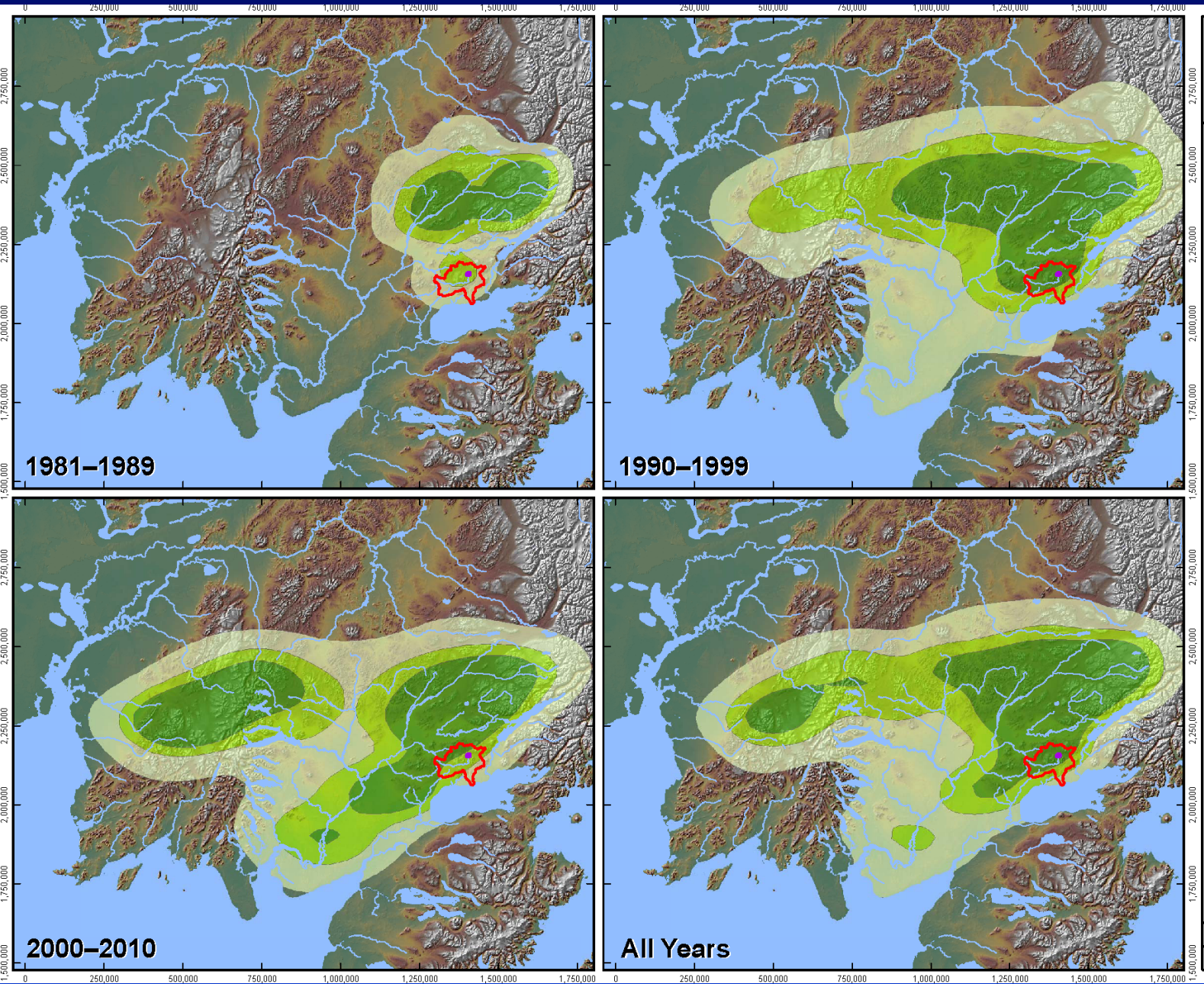


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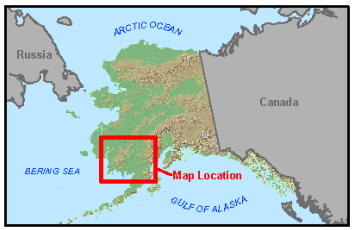
Figure 16.2-6
Mulchatna Caribou Herd, Seasonal Range Use, Southwestern Alaska, Summer 1981–2010

Summer (June 11–September 7)
Areas of Concentrated Use

- High Density
- Medium Density
- Low Density

- Greater Mine Study Area
- General Deposit Location

Data source: Utilization distribution contours from fixed-kernel analysis of locations of radio-collared caribou (telemetry database from ADF&G, Togiak and Yukon Delta National Wildlife Refuges). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively.

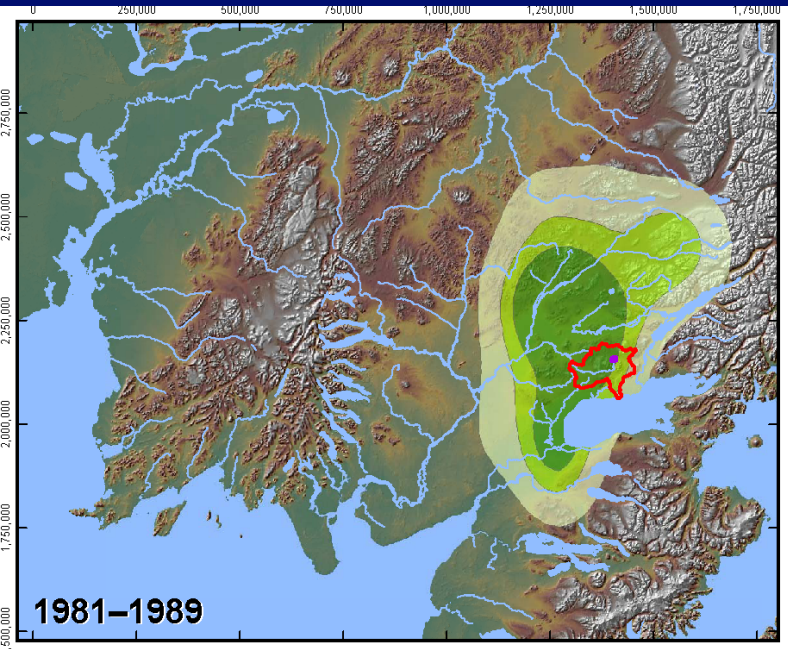


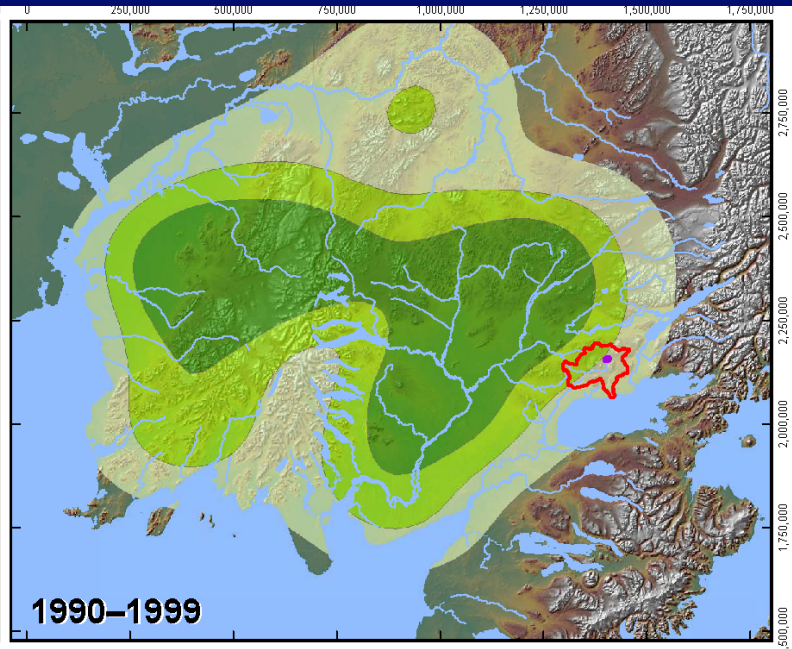
Miles
0 25 50 75 100 125
Kilometers
0 50 100 150 200
Scale 1:3,750,000
N

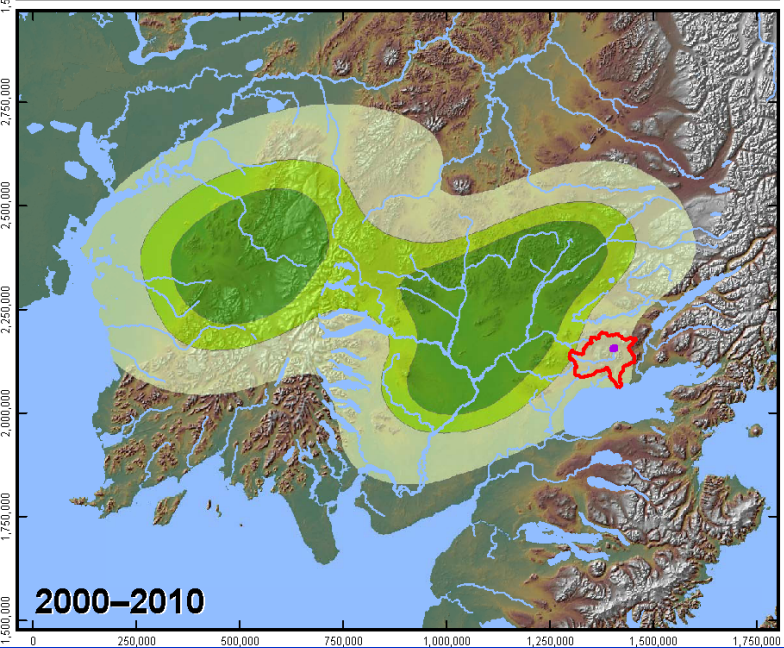
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-6_MHerdSummerUse_PLP_EBD_v02.mxd	Date: March 7, 2011
Version: 2	Author: ABR-AZC

Caribou Autumn Range: Sep. 8 – Oct. 31







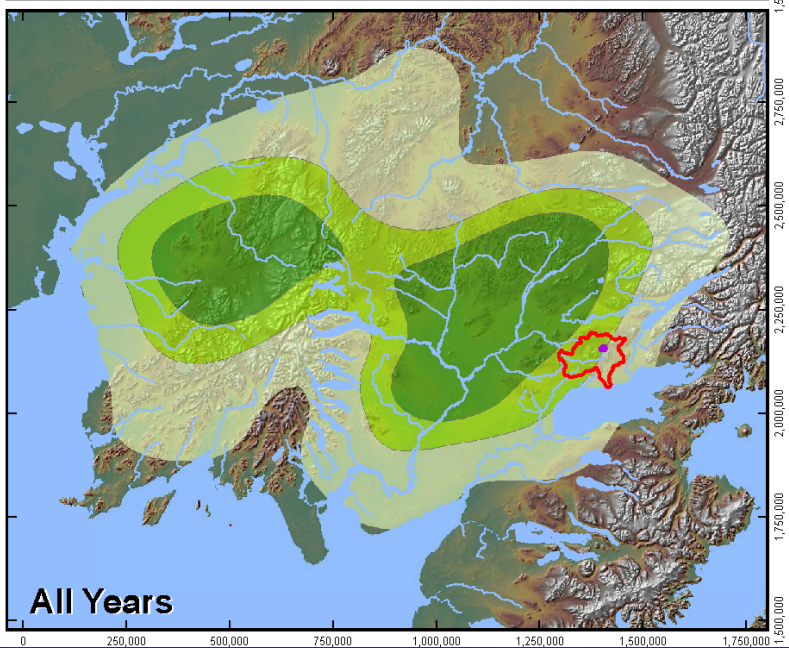


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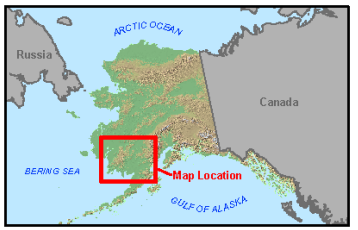
Figure 16.2-7
Mulchatna Caribou Herd, Seasonal Range Use, Southwestern Alaska, Autumn 1981–2010

Autumn (September 8–October 31)
Areas of Concentrated Use

- High Density
- Medium Density
- Low Density

- Greater Mine Study Area
- General Deposit Location

Data source: Utilization distribution contours from fixed-kernel analysis of locations of radio-collared caribou (telemetry database from ADF&G, Togiak and Yukon Delta National Wildlife Refuges). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively.

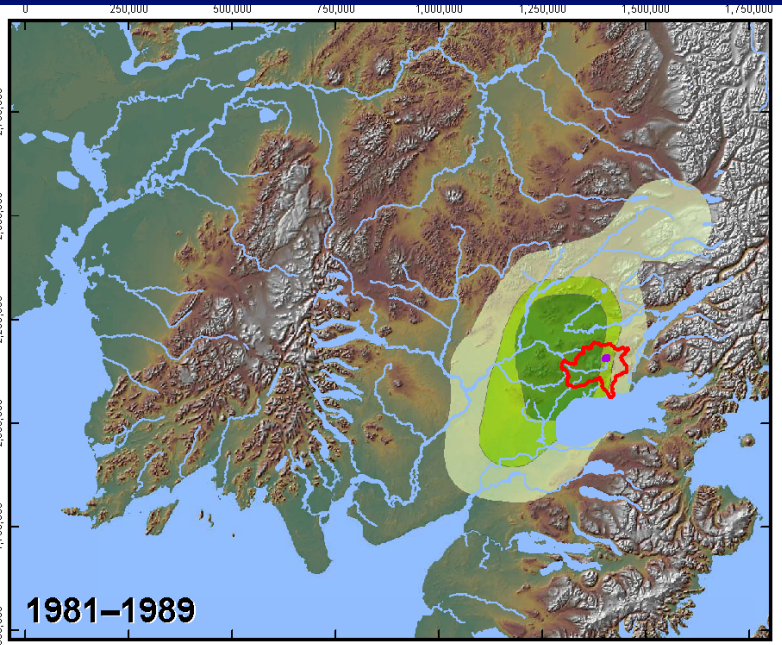


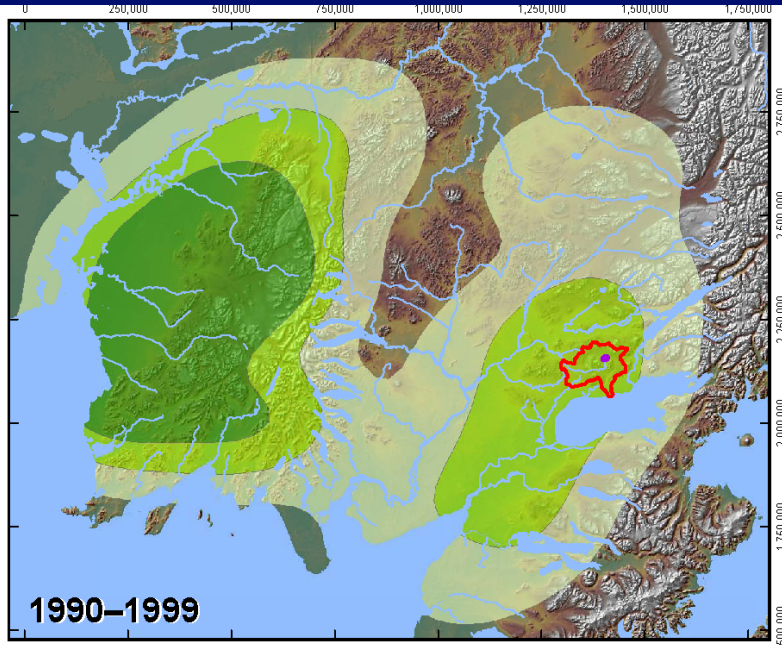
Miles
0 25 50 75 100 125
Kilometers
0 50 100 150 200
Scale 1:3,750,000
N

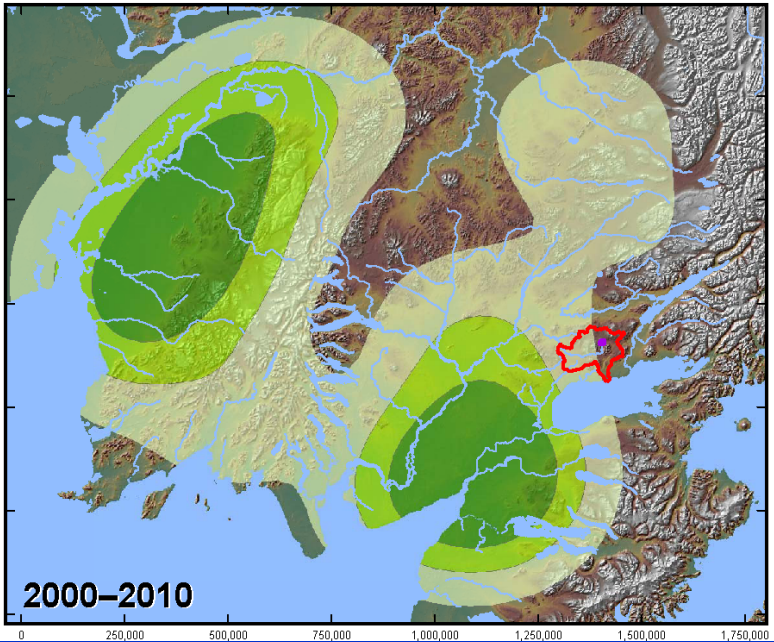
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-7_MHerdAutumnUse_PLP_EBD_v02.mxd	Date: March 8, 2011
Version: 2	Author: ABR-AZC

Caribou Winter Range: Nov. 1 – Mar. 31







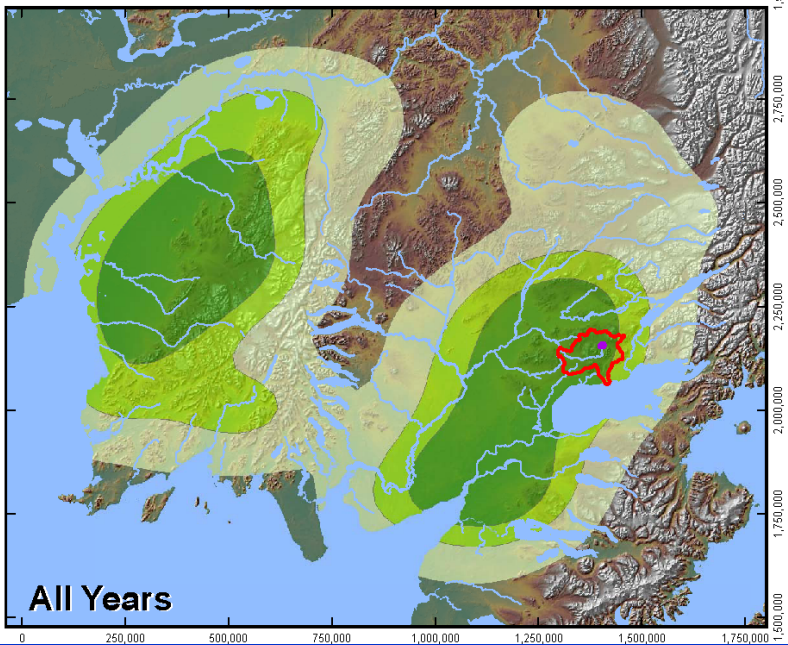


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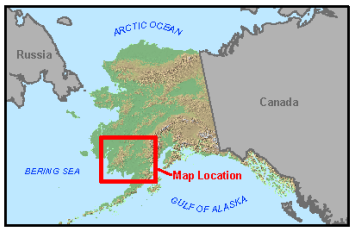
Figure 16.2-8
Mulchatna Caribou Herd, Seasonal Range Use, Southwestern Alaska, Winter 1981–2010

Winter (November 1–March 31)
Areas of Concentrated Use

- High Density
- Medium Density
- Low Density

- Greater Mine Study Area
- General Deposit Location

Data source: Utilization distribution contours from fixed-kernel analysis of locations of radio-collared caribou (telemetry database from ADF&G, Togiak and Yukon Delta National Wildlife Refuges). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively.



Miles
0 25 50 75 100 125
Kilometers
0 50 100 150 200
Scale 1:3,750,000
N

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

File: 16-2-8_MHerdWinterUse_PLP_EBD_v02.mxd	Date: March 8, 2011
Version: 2	Author: ABR-AZC

Caribou Locations & Aggregations near the Pebble Deposit, 1981–2010

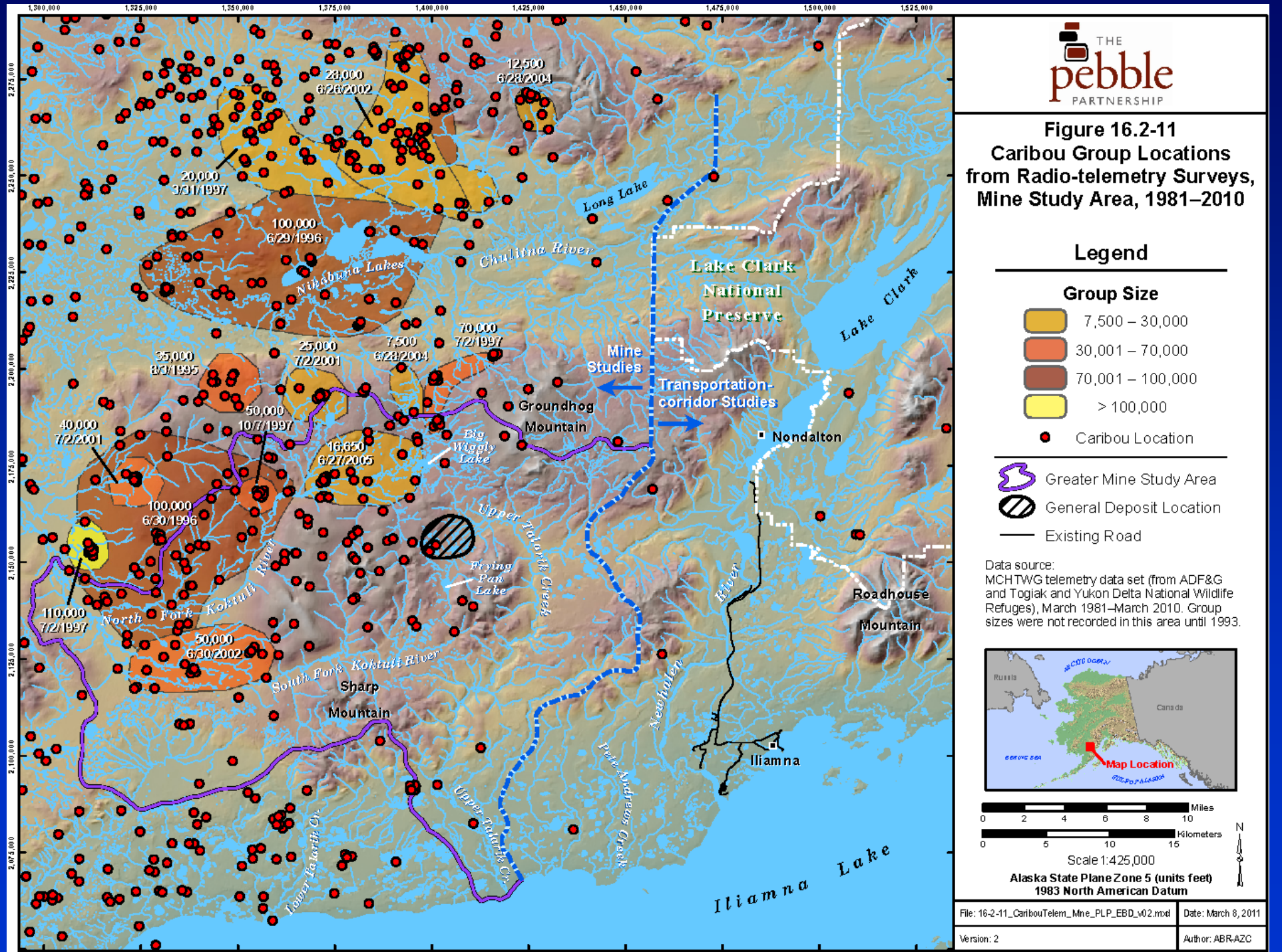


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Figure 16.2-11
Caribou Group Locations from Radio-telemetry Surveys, Mine Study Area, 1981–2010

Legend

Group Size

- 7,500 – 30,000
- 30,001 – 70,000
- 70,001 – 100,000
- > 100,000

Caribou Location

Greater Mine Study Area

General Deposit Location

Existing Road

Data source:
MCHTWG telemetry data set (from ADF&G and Togiak and Yukon Delta National Wildlife Refuges), March 1981–March 2010. Group sizes were not recorded in this area until 1993.

Miles 0 2 4 6 8 10
Kilometers 0 5 10 15

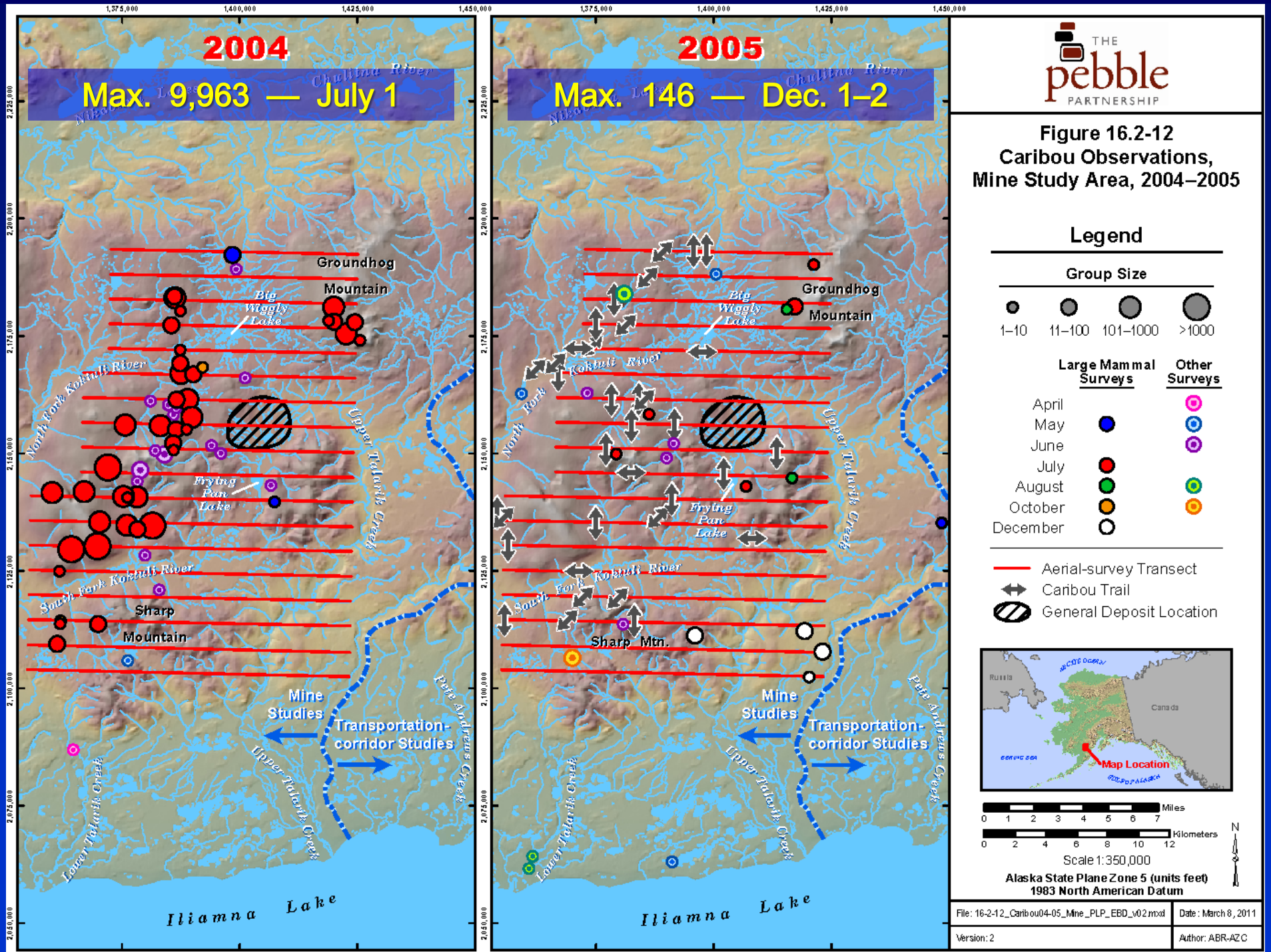
N

Scale 1:425,000

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

File: 16-2-11_CaribouTelem_Mne_PLP_EBD_v02.mxd	Date: March 8, 2011
Version: 2	Author: ABR-AZC

Caribou Survey Observations — Mine Study Area, 2004 & 2005



Caribou Survey Observations — Mine Study Area, 2006 & 2007

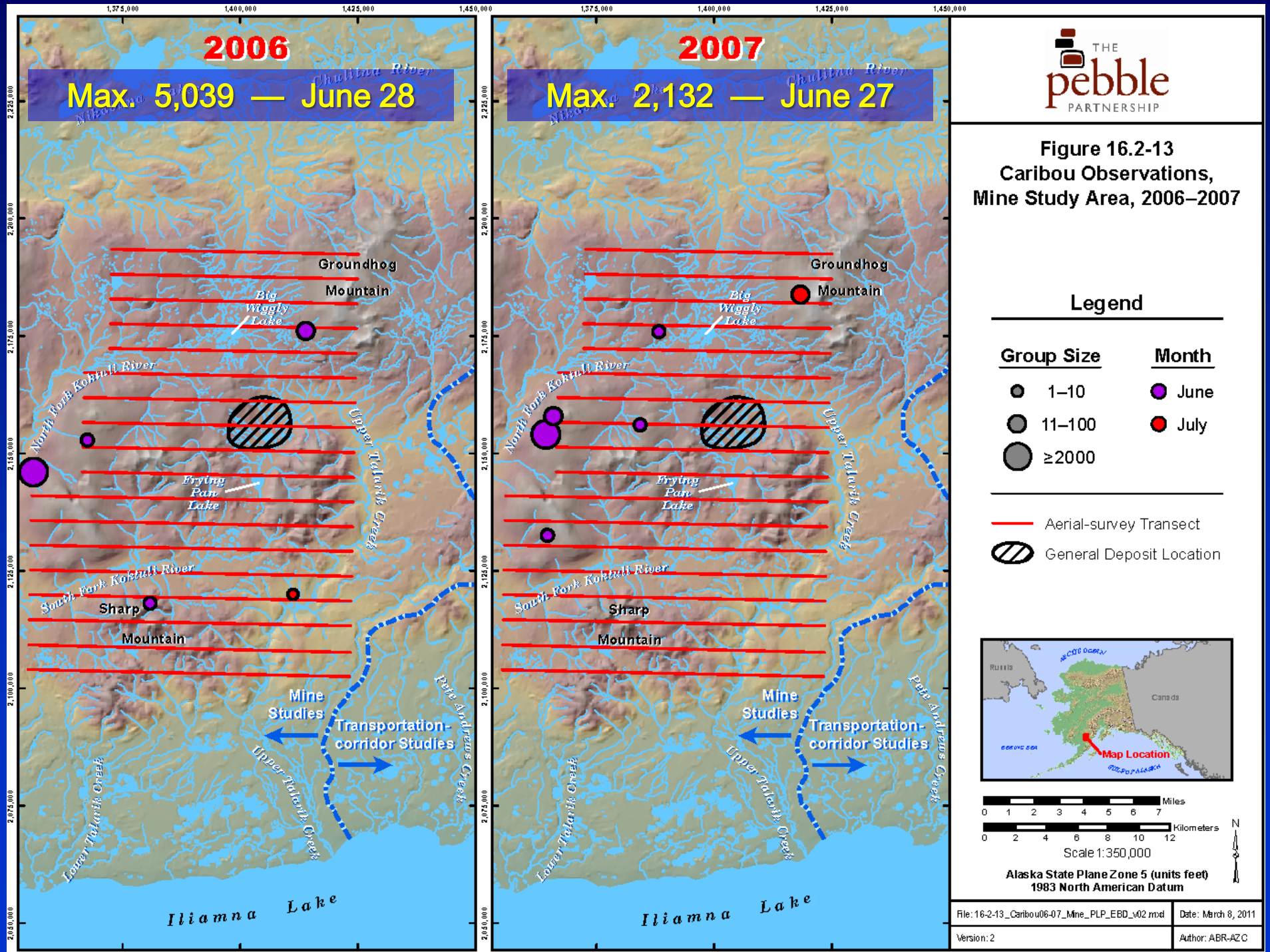


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Figure 16.2-13
Caribou Observations, Mine Study Area, 2006–2007

Legend

Group Size	Month
1–10	June
11–100	July
≥2000	

Aerial-survey Transect

General Deposit Location

Miles 0 1 2 3 4 5 6 7

Kilometers 0 2 4 6 8 10 12

Scale 1:350,000

N

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

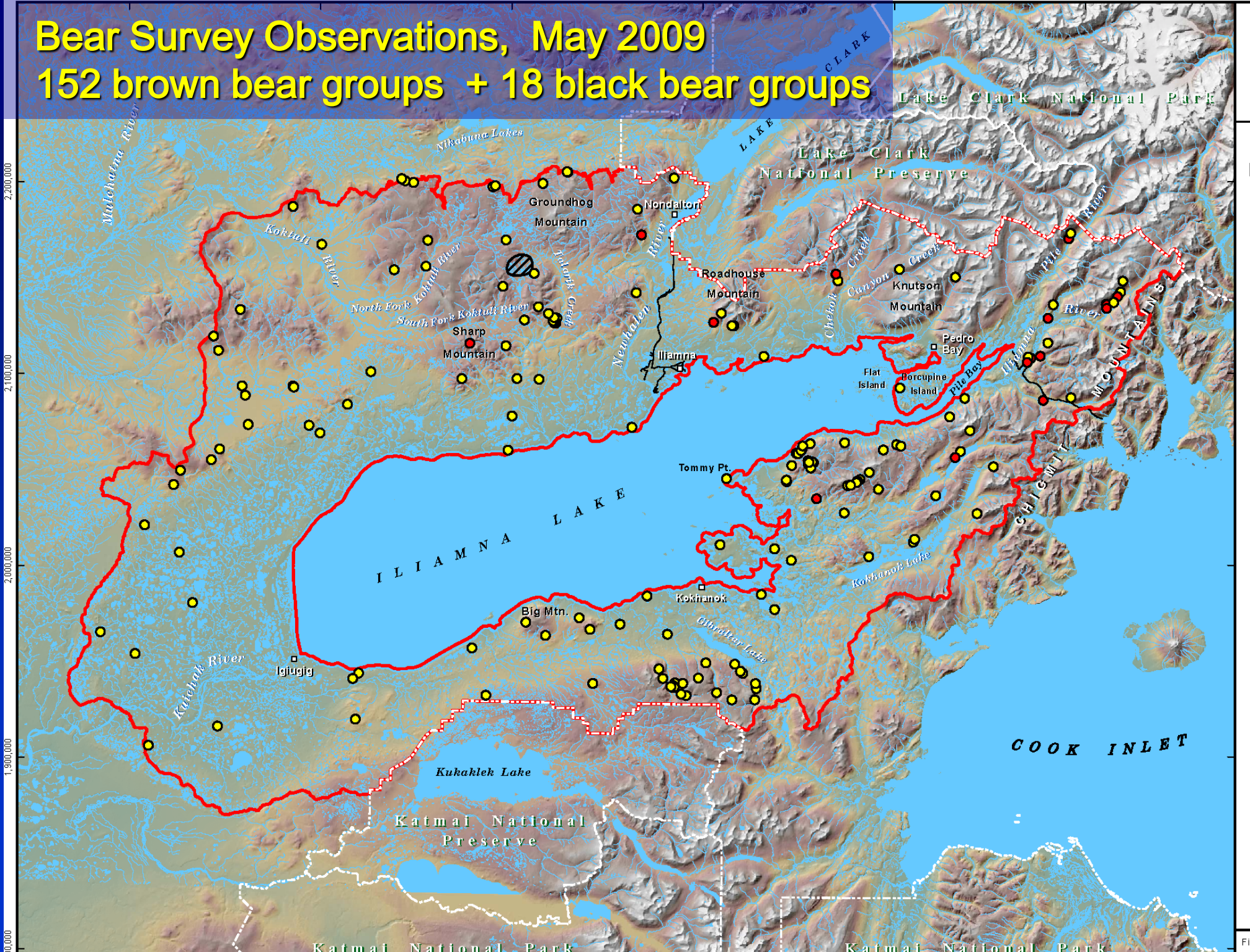
File: 16-2-13_Caribou06-07_Mine_PLP_EBD_v02.mxd	Date: March 8, 2011
Version: 2	Author: ABR-AZC

Brown Bear

- Important for both hunting & viewing opportunities (GMU 9A/B state hunting season open only in odd-year falls & even-year springs)
- Gradient from moderate-density inland population (39–50/1,000 km²) to high-density coastal population (150/1,000 km²); reportedly stable or increasing slowly
- Potential for attraction to areas of human activity = concern for safety of humans & bears
- Low reproductive rate = concern over effects of human-caused mortality & disturbance
- Notable seasonal concentrations in coastal bays and at salmon spawning streams

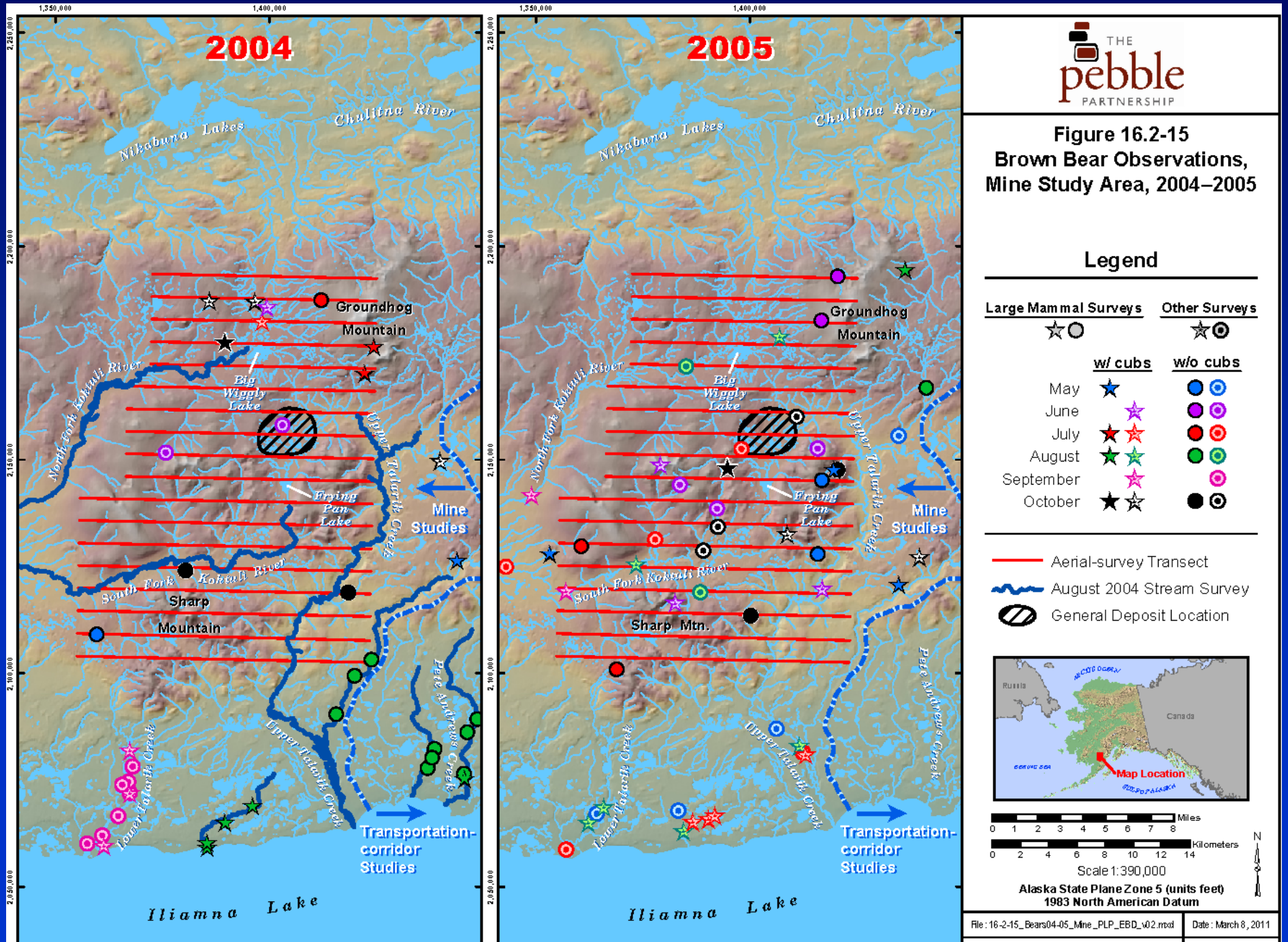
Bear Population Survey — May 2009

- Collaborative cost-sharing effort between PLP & ADFG
- Used line-transect sampling to estimate density of bears in region surrounding Iliamna Lake (GMU 9B South and southeastern GMU 17B)
- Standard ADFG survey method (Becker & Quang):
  blind double-counts with GPS-based
  distance estimation on randomly selected,
  20-km transects, along elevation contours
- 5 survey airplanes (Super Cubs) & crews, based at Iliamna
- 1,004 transects during May 16–29 (9,800 km^2 of bear habitat)
- Bear density: 48–58 brown bears/1,000 km^2 (using 2 different sightability models); black bear sample too small for estimate
- Comparable ADFG–NPS survey data from GMU 9A:
  150 brown bears/1,000 km^2; 85 black bears/1,000 km^2


Bear Survey Observations, May 2009
152 brown bear groups + 18 black bear groups
Lake Clark National Park
Lake Clark National Preserve
Nikabuna Lakes
Groundhog Mountain
Nondaltoni
Kokiuli River
North Fork Kokiuli River
South Fork Kokiuli River
Talarik Creek
Sharp Mountain
Newhalen River
Iliamna
Roadhouse Mountain
Oberbok Creek
Canyon Creek
Knutson Mountain
Pile River
Pedro Bay
Flat Island
Porcupine Island
Pile Bay
Iliamna River
ALASKA RANGE MOUNTAINS
ILIAMNA LAKE
Tommy Pt.
Kokhanok
Kokhanok Lake
Big Mtn.
Gibraltor Lake
Kuichak River
Igiugig
Kukaklek Lake
Katmai National Preserve
Katmai National Park
COOK INLET
2,200,000
2,100,000
2,000,000
1,900,000

Bear Population Survey by NPS, May 2007

Brown Bear Observations — Mine Area, 2004 & 2005



THE pebble PARTNERSHIP

Figure 16.2-15
Brown Bear Observations, Mine Study Area, 2004–2005

Legend

	Large Mammal Surveys	Other Surveys
	w/ cubs	w/o cubs
May	★	● ◎
June	☆	● ◎
July	★ ☆	● ◎
August	★ ☆	● ◎
September	☆	◎
October	★ ☆	● ◎

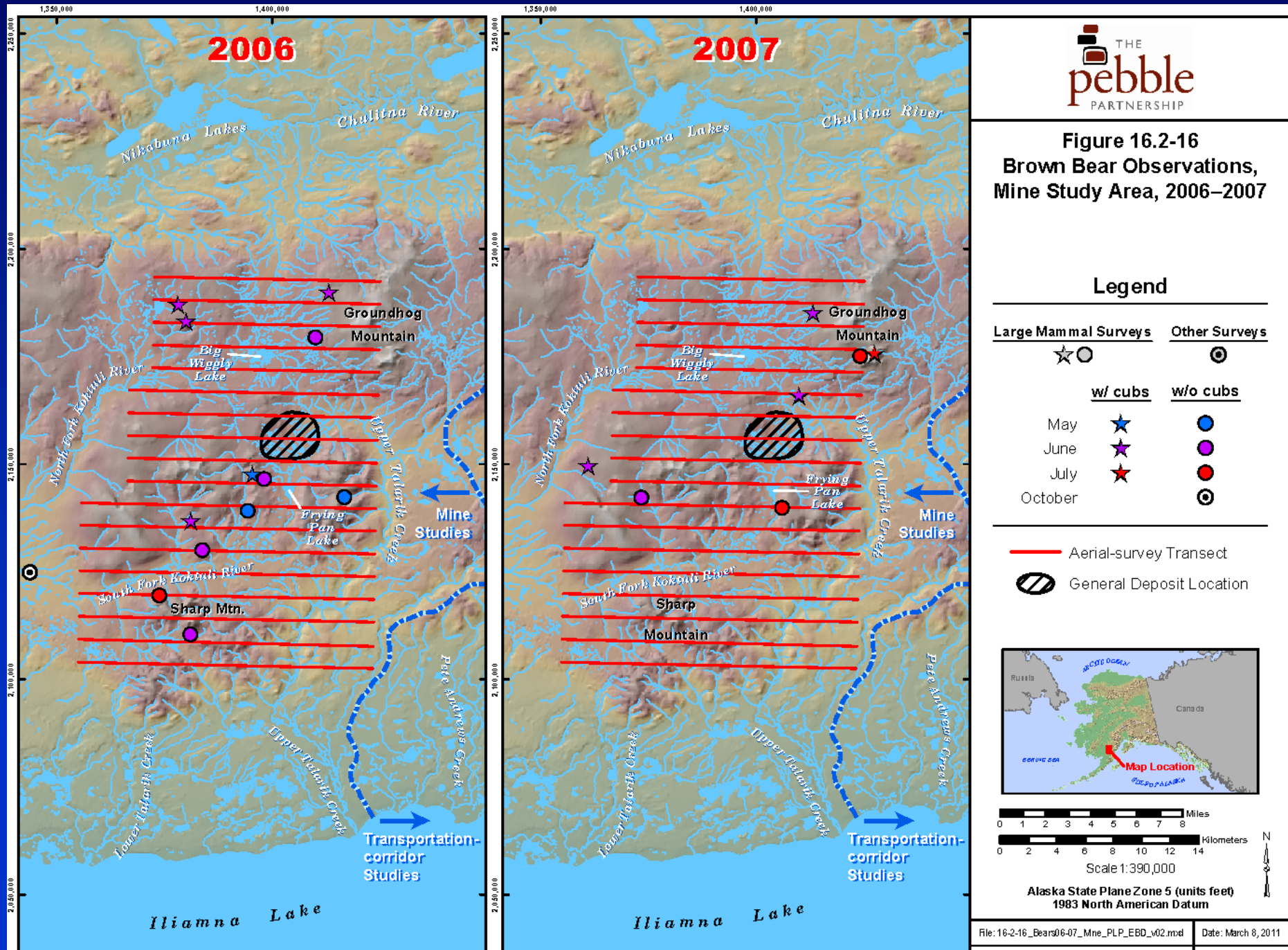
- Aerial-survey Transect
- August 2004 Stream Survey
- General Deposit Location

Miles 0 1 2 3 4 5 6 7 8
Kilometers 0 2 4 6 8 10 12 14
Scale 1:390,000

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

File: 16-2-15_Bears04-05_Mine_PLP_EBD_v02.mxd | Date: March 8, 2011

Brown Bear Observations — Mine Area, 2006 & 2007



THE pebble PARTNERSHIP

Figure 16.2-16
Brown Bear Observations, Mine Study Area, 2006–2007

Legend

Large Mammal Surveys		Other Surveys
	w/ cubs	w/o cubs
May	★	●
June	★	●
July	★	●
October		◉

Aerial-survey Transect

General Deposit Location

Miles 0 1 2 3 4 5 6 7 8

Kilometers 0 2 4 6 8 10 12 14

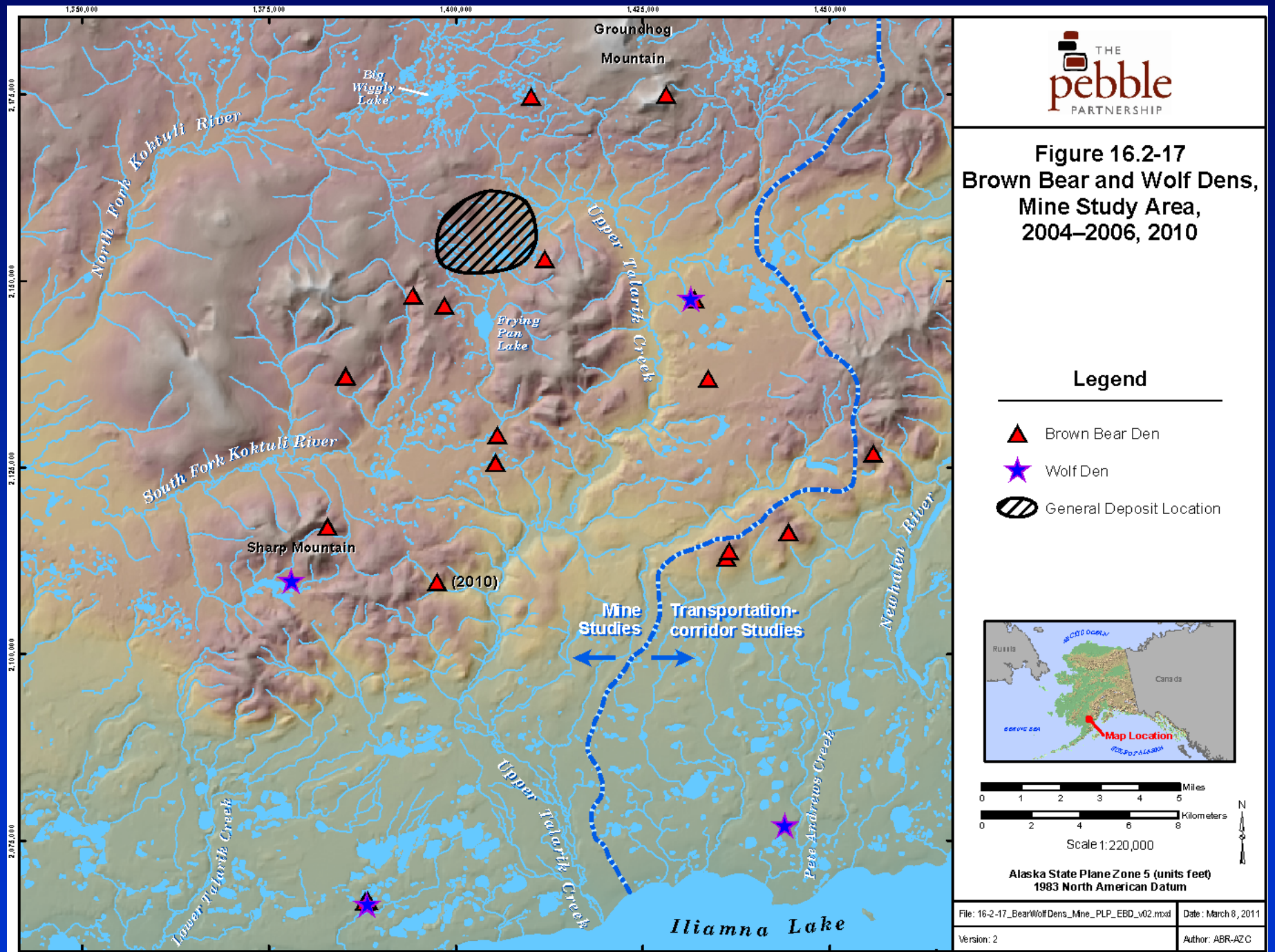
Scale 1:390,000

N

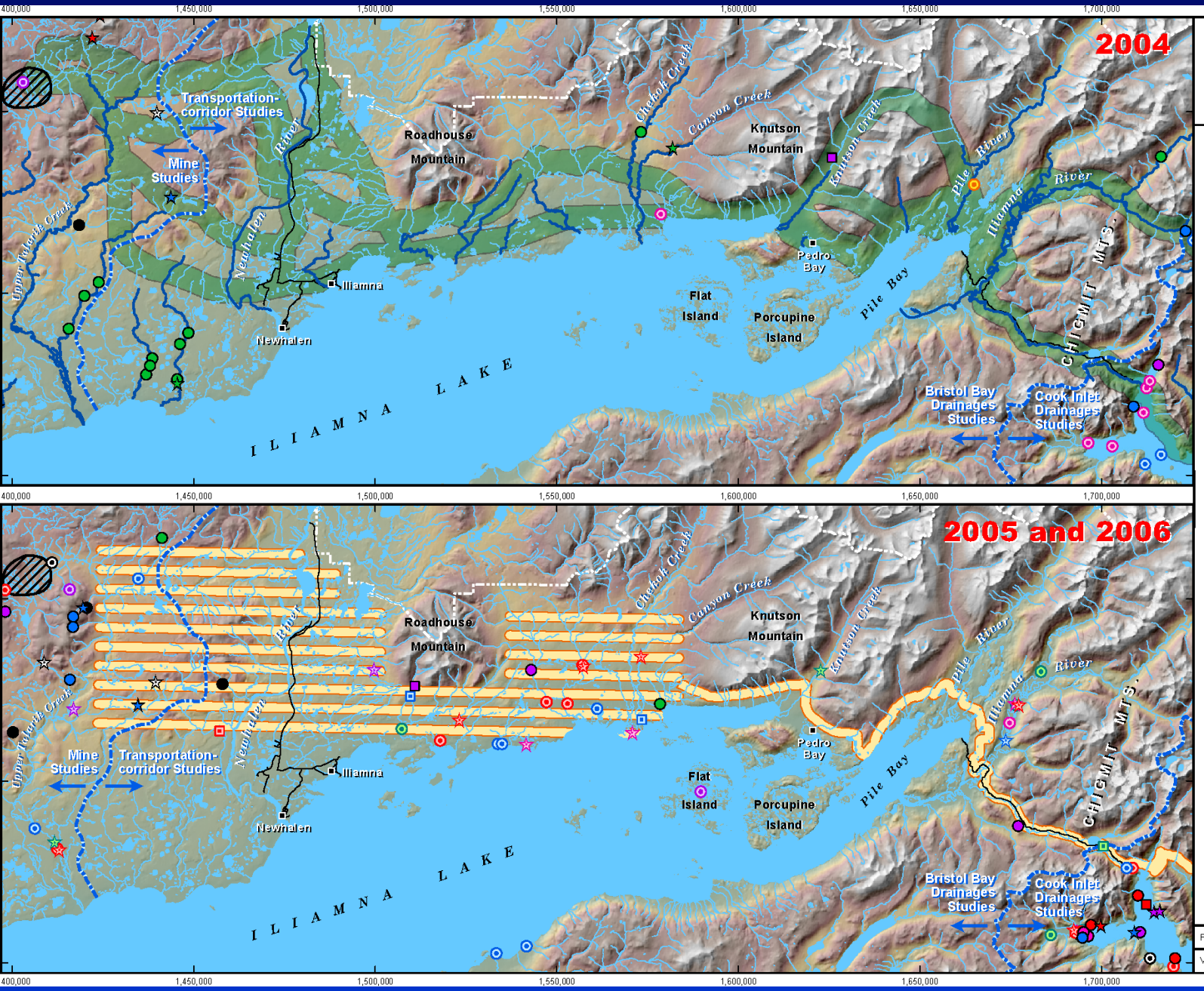
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 16-2-16_Bears06-07_Mine_PLP_EBD_v02.mxd | Date: March 8, 2011

Brown Bear & Wolf Dens — Mine Area, 2004 – 2006, 2010



Brown Bear Observations — Trans. Corridor, 2004 – 2006



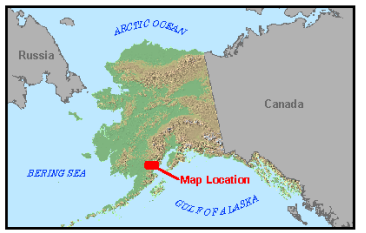
THE pebble PARTNERSHIP

Figure 16.7-2
Bear Observations, Transportation-corridor, Bristol Bay Drainages Study Area, 2004–2006

Legend

	Large Mammal Surveys		Other Surveys	
	Brown Bear w/ cubs	Brown Bear w/o cubs	Brown Bear w/o cubs	Black Bear w/o cubs
April				
May				
June				
July				
August				
September				
October				

- 2004 Survey Area
- August 2004 Stream Survey
- 2005–2006 Survey Area
- General Deposit Location
- Existing Road

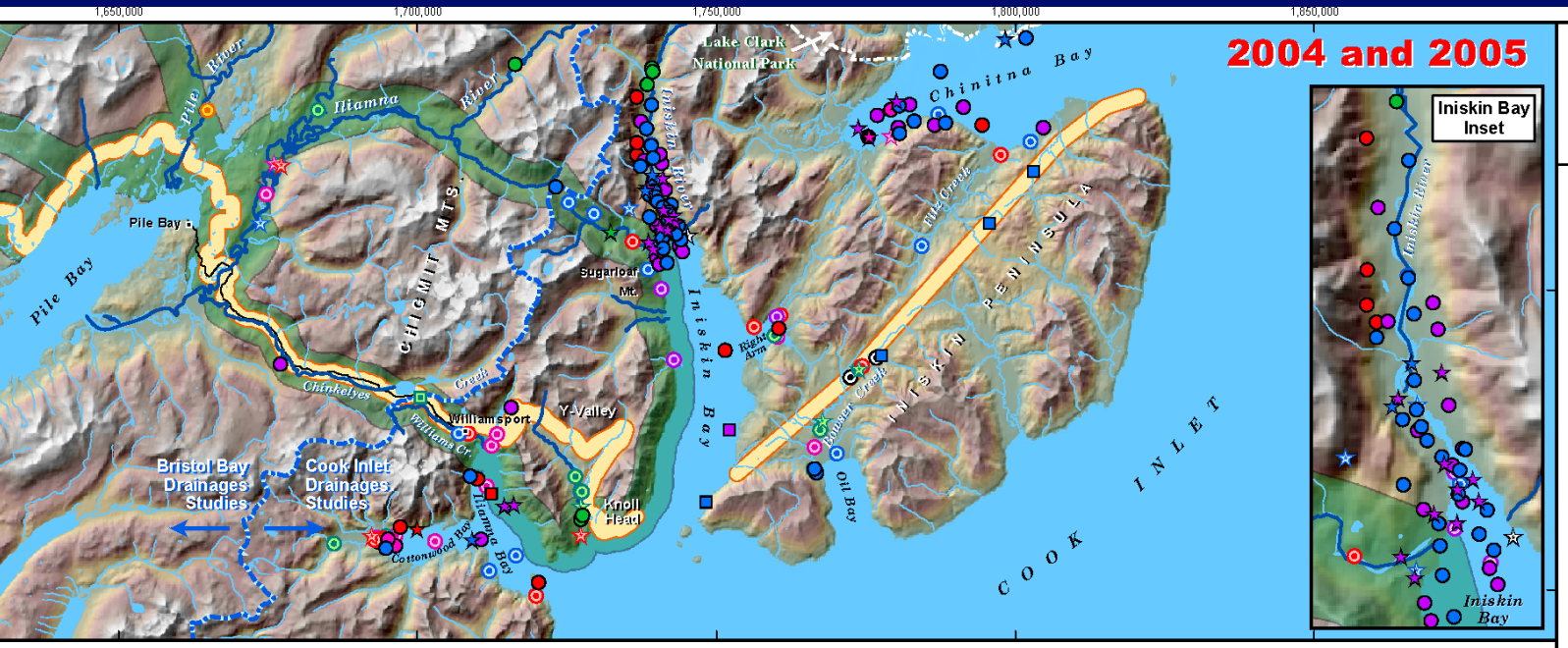


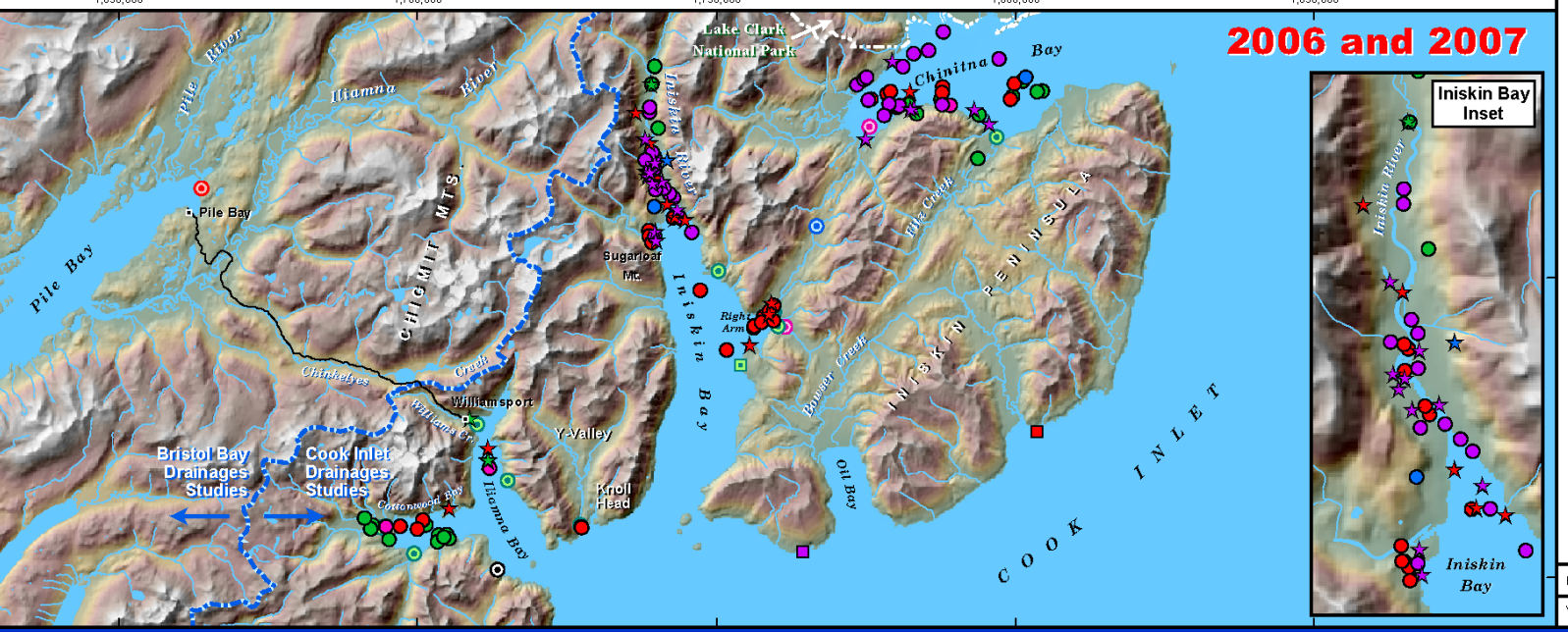
Miles 0 2 4 6 8 10
Kilometers 0 5 10 15
Scale 1:325,000

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

File: 16-7-2_BearObs_Rd_PLP_EBD_v02.mxd	Date: March 9, 2011
Version: 2	Author: ABR-AZC

Brown Bear Observations — Cook Inlet Drainages, 2004 – 2007





THE pebble PARTNERSHIP

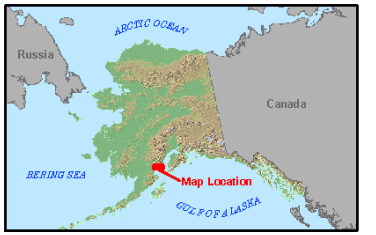
Figure 41.2-2
Bear Observations,
Cook Inlet Drainages, 2004–2007

Legend

	Large Mammal Surveys[a]		Other Surveys	
	Brown Bear w/ cubs	Brown Bear w/o cubs	Black Bear w/o cubs	
April				
May	☆	☆	○	□
June	☆	☆	○	□
July	☆	☆	○	□
August	☆	☆	○	□
September	☆	☆	○	□
October		☆	●	

[a]Includes sightings made during harbor seal surveys.

- 2004 Survey Area
- August 2004 Stream Survey
- 2005 Survey Area
- Existing Road



Miles 0 1 2 3 4 5 6 7 8
Kilometers 0 2 4 6 8 10 12
Scale 1:260,000
N

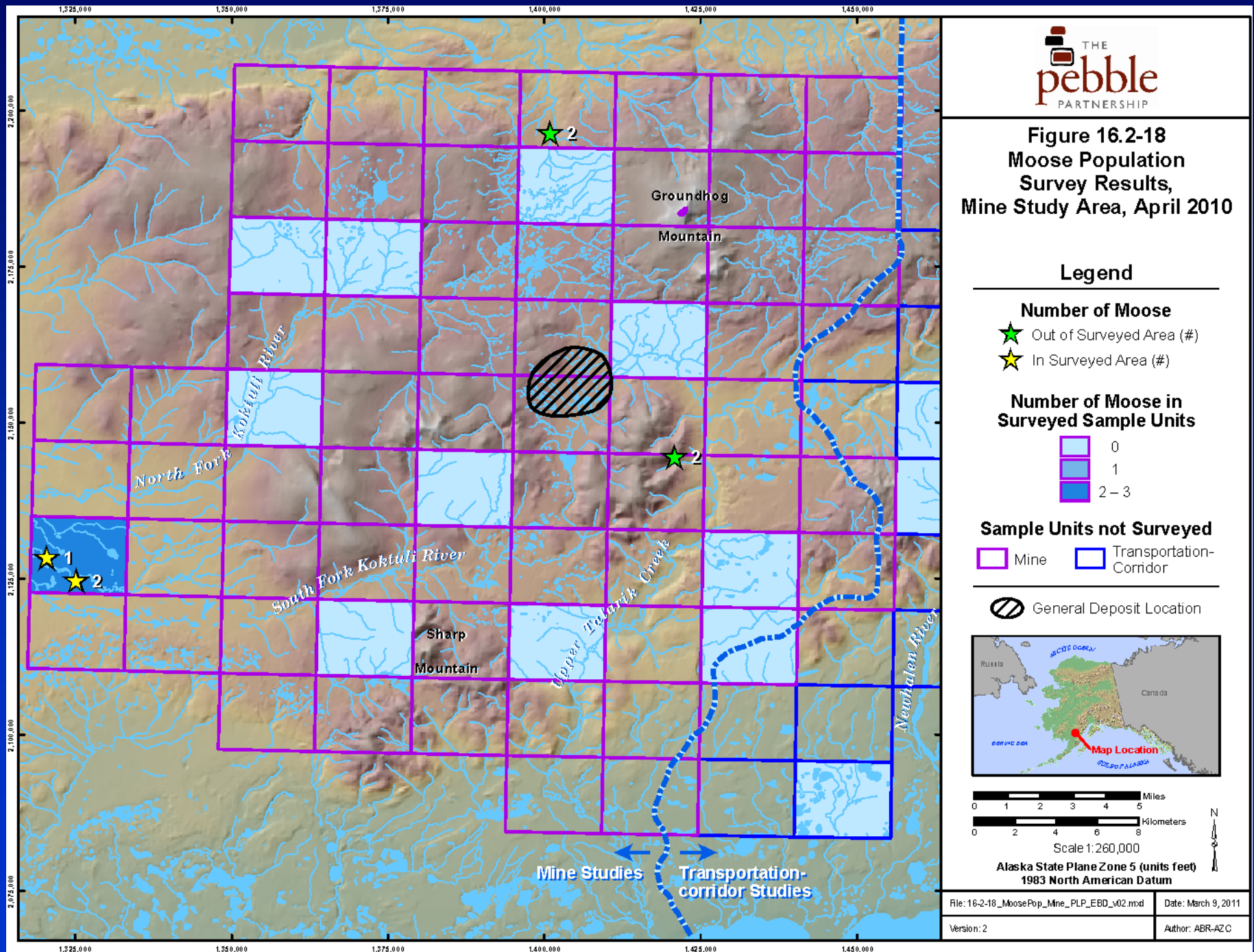
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: 41-2-2_BearObs_2004-07_CI_PLP_EBD_v02.mxd	Date: March 24, 201
Version: 2	Author: ABR-AZC

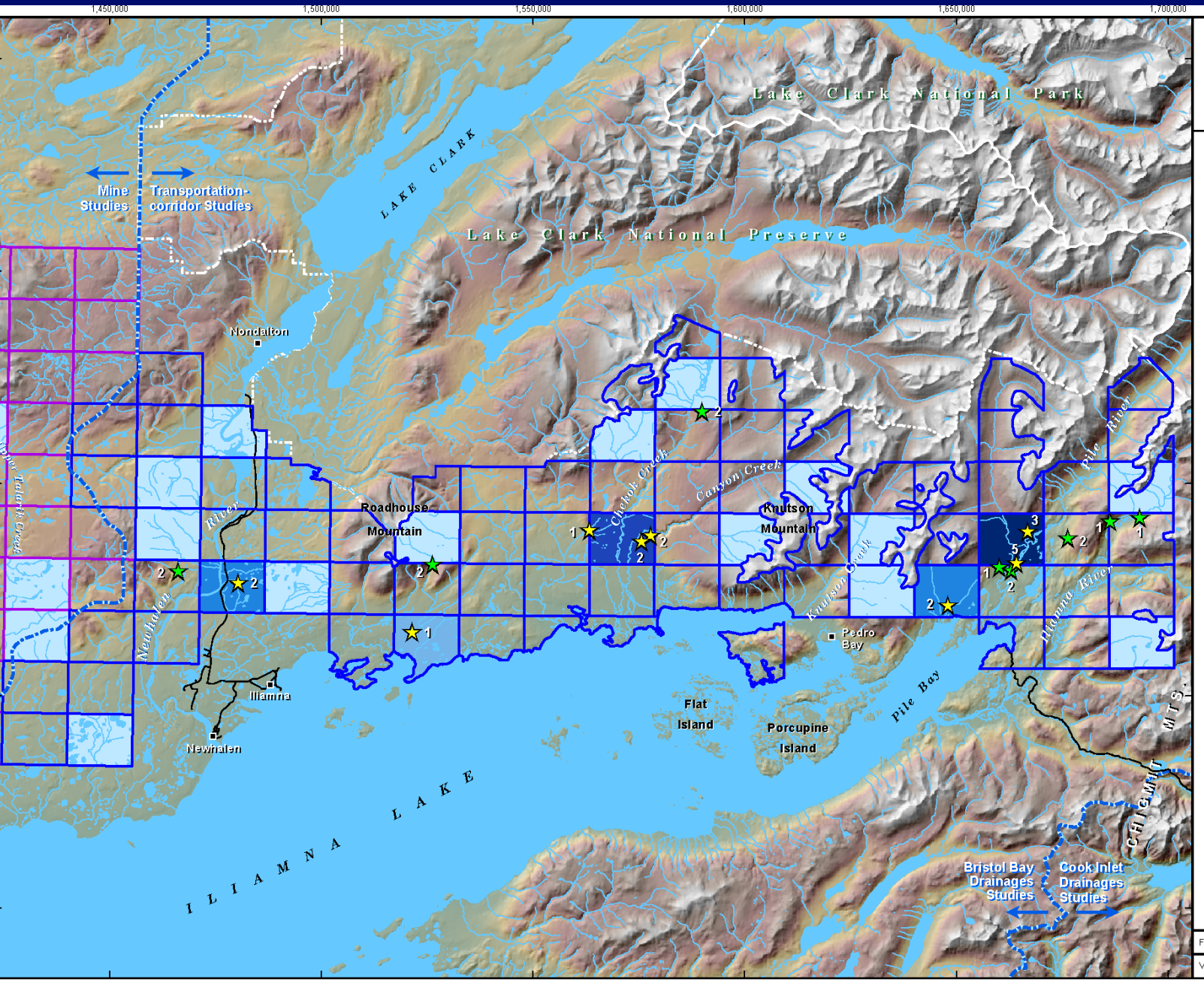
Moose

- Important species for local harvest & some sport hunting
- Moderate-/low-density population, probably relatively stable, probably limited by predation
- Winter concentrations noted east of mine area in 1980s, notably Upper Talarik Creek & large rivers in trans. corridor
- ADFG historical data in Chekok trend-count area (central transportation corridor) + NPS data for Lake Clark N.P.
- Used ADFG's Geospatial Population Estimator method in Apr. 2010 (late-winter density)
- Poor weather and lack of snow prevented early-winter survey in Nov.–Dec. 2009

Moose Population Survey — Mine Area, April 2010



Moose Population Survey — Trans. Corridor, April 2010



THE pebble PARTNERSHIP

Figure 16.7-3
Moose Population Survey Results, Transportation-corridor, Bristol Bay Drainages Study Area, April 2010

Legend

Number of Moose

- Out of Surveyed Area (#)
- In Surveyed Area (#)

Number of Moose in Surveyed Sample Units

- 0
- 1
- 2 – 3
- 4 – 5
- 6 – 8

Sample Units not Surveyed

- Mine
- Transportation-Corridor

Existing Road

Miles 0 2 4 6 8 10
Kilometers 0 2 4 6 8 10 12 14
Scale 1:280,000
N

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

File: 16-7-3_MoosePop_Rd_PLP_EBD_v02.mxd	Date: March 9, 2011
Version: 2	Author: ABR-AZC

Moose Population Survey — April 6 – 10, 2010

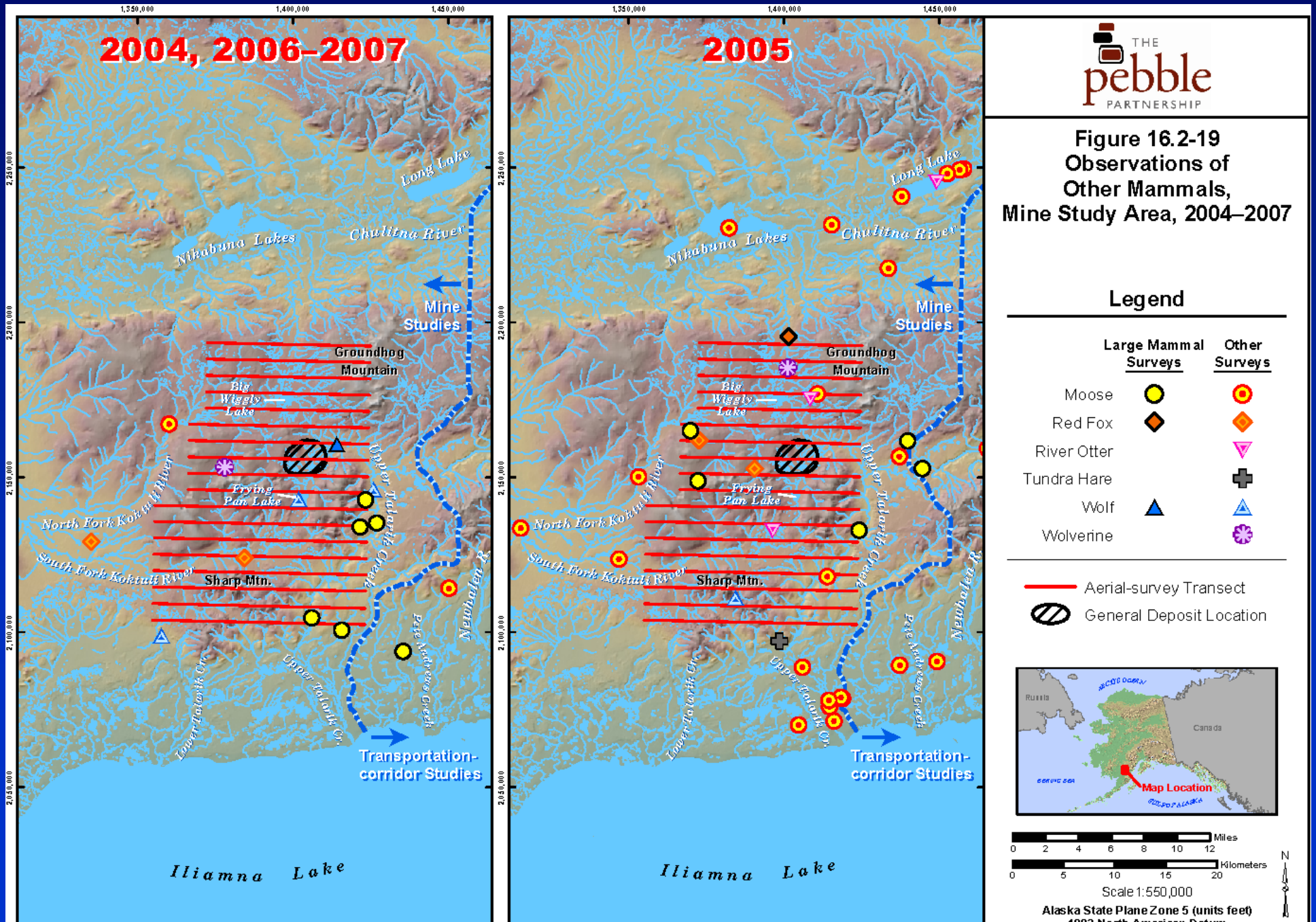
Number Observed Inside and Out of Surveyed Sampled Units, by Sex and Age Category

On/Off Survey	Study Area	Sex / Age Category				
		Adult Male	Cow with 1 Calf	Cow with 2 Calves	Unknown Sex	Total
Inside sample units	Mine Area	0	0	0	3	3
	Transportation Corridor	3	3	1	6	18
	TOTAL	**3**	**3**	**1**	**9**	**21**
Outside sample units	Mine Area	4	0	0	0	4
	Transportation Corridor	2	2	0	7	13
	TOTAL	**6**	**2**	**0**	**7**	**17**

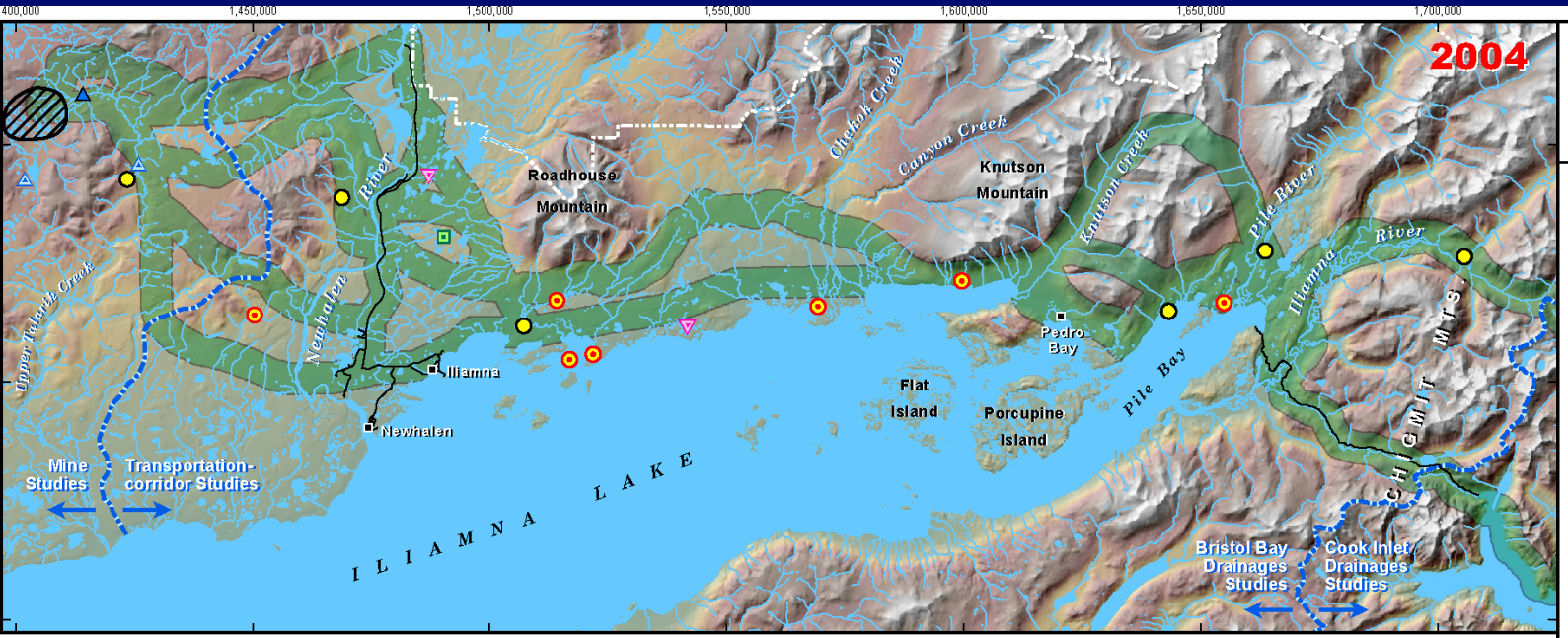
Estimated Number and Density, by Study Area

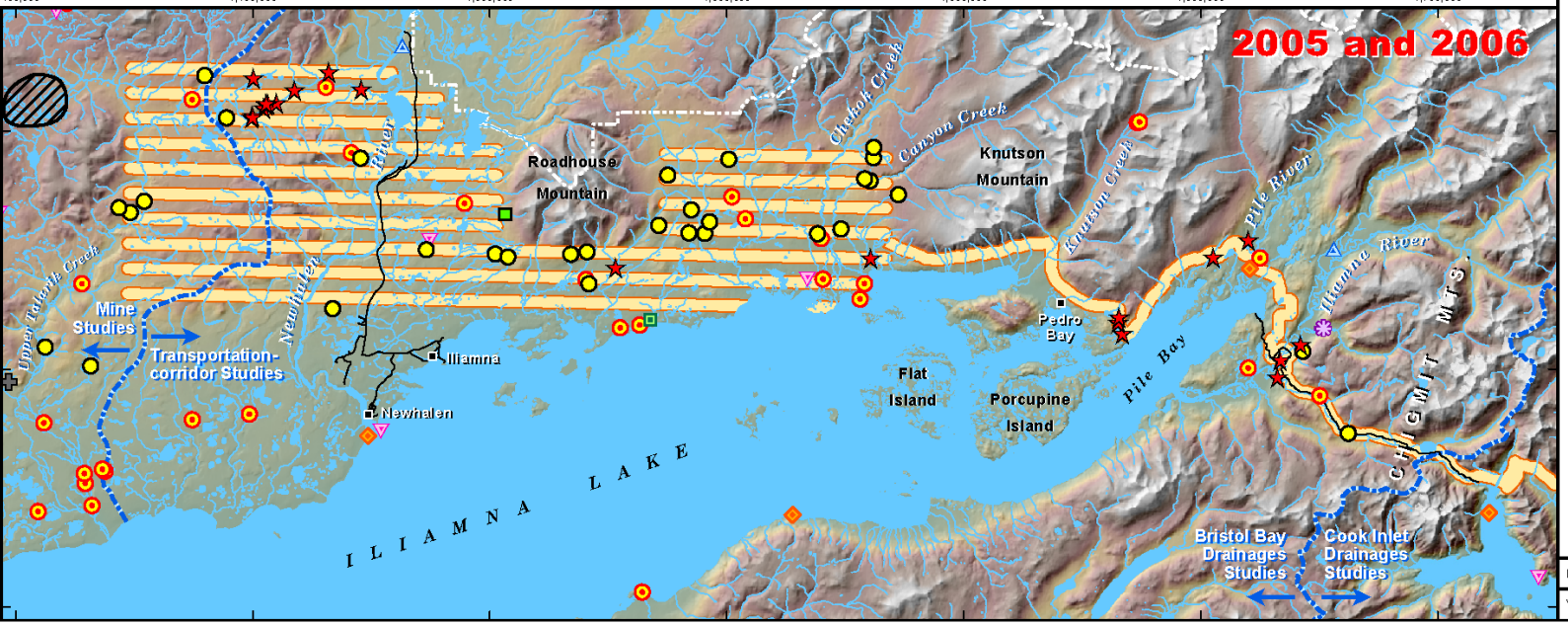
Study Area	Area (km²)	Estimated Population Size		Population Density (moose/km²)	
		Number	95% C.I.	Density	95% C.I.
Mine Area	1,178.4	33	7 – 81	0.03	0.01 – 0.07
Transportation Corridor	1,219.3	63	31 – 109	0.05	0.03 – 0.09
TOTAL	**2,397.7**	**96**	**38 – 176**	**0.04**	**0.02 – 0.07**

Other Mammal Observations — Mine Area, 2004 – 2007



Other Mammals — Transportation Corridor, 2004 – 2006





THE pebble PARTNERSHIP

Figure 16.7-4
Observations of Moose and Other Mammals, Transportation-corridor, Bristol Bay Drainages Study Area, 2004–2006

Legend

	Large Mammal Surveys	Other Surveys
Moose	○	○
Coyote	■	■
Red Fox		◆
Beaver Colony	★	
River Otter		▽
Wolf	▲	▲
Wolverine		✱

- 2004 Survey Area
- 2005–2006 Survey Area
- General Deposit Location
- Existing Road

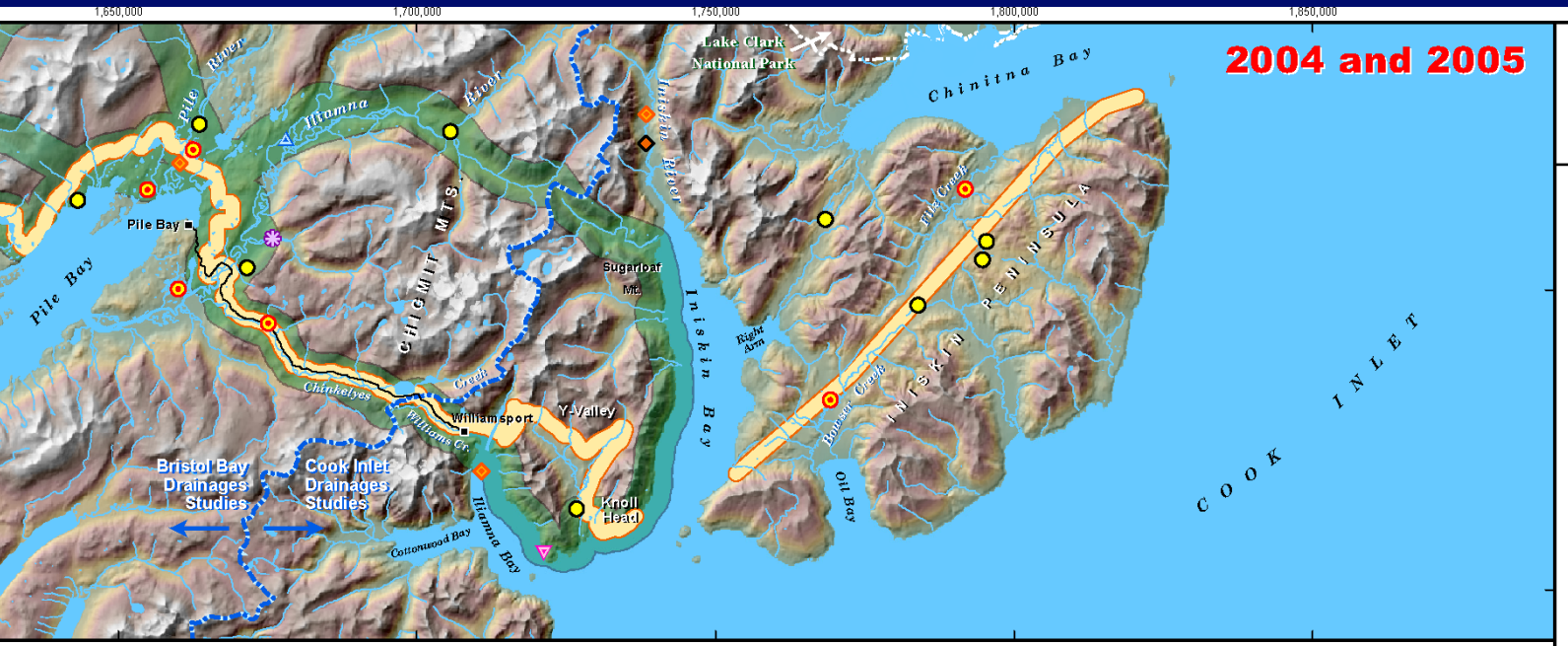
Miles 0 2 4 6 8 10
Kilometers 0 5 10 15
Scale 1:325,000

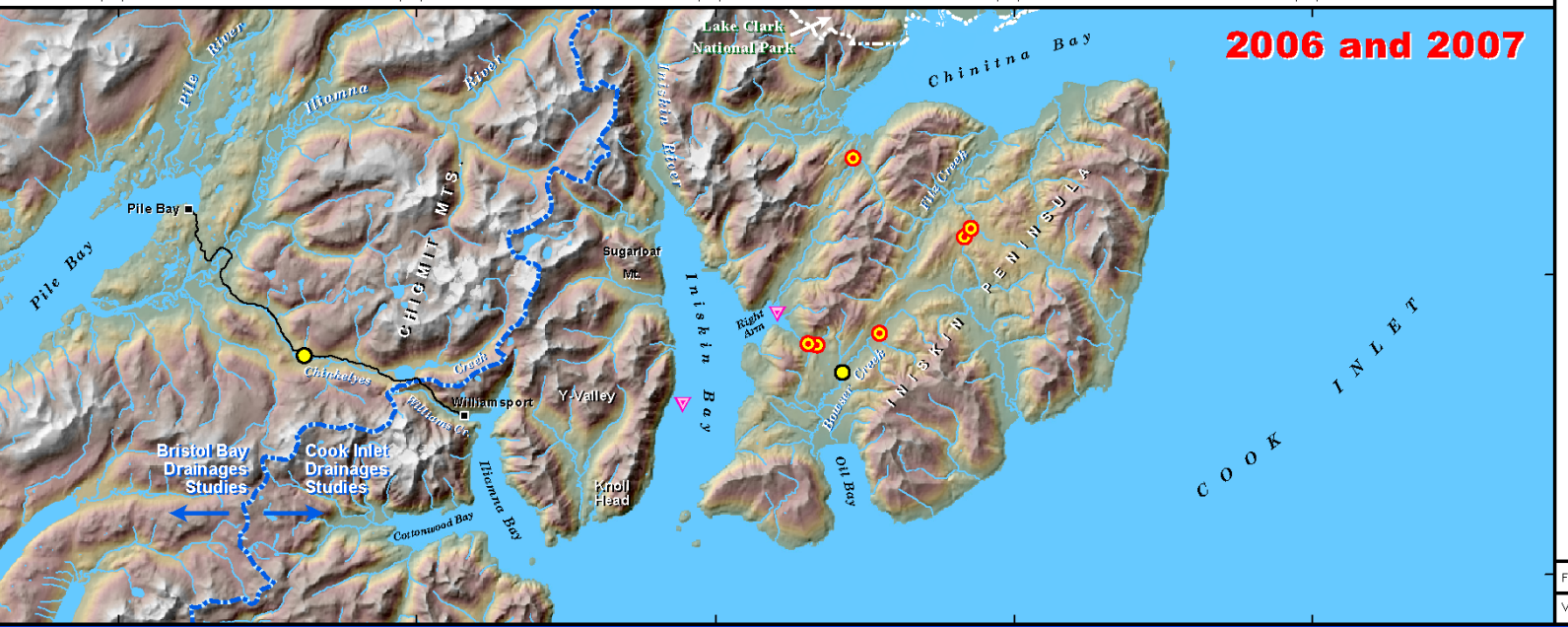
N

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

File: 16-7-4_OtherMam_Rd_PLP_EBD_v02.mxd	Date: March 9, 2011
Version: 2	Author: ABR-AZC

Other Mammals — Cook Inlet Drainages, 2004 – 2007





THE pebble PARTNERSHIP

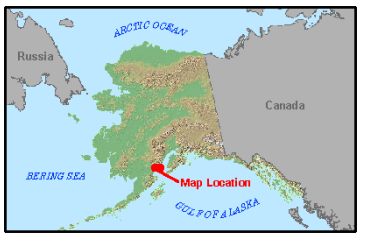
Figure 41.2-3
Observations of Other Mammals, Cook Inlet Drainages, 2004–2007

Legend

	Large Mammal Surveys[a]	Other Surveys
Moose	○	○
Red Fox	◆	◆
River Otter		▽
Wolf		△
Wolverine		✱

[a]Includes sightings made during harbor seal surveys.

- 2004 Survey Area
- 2005 Survey Area
- Existing Road



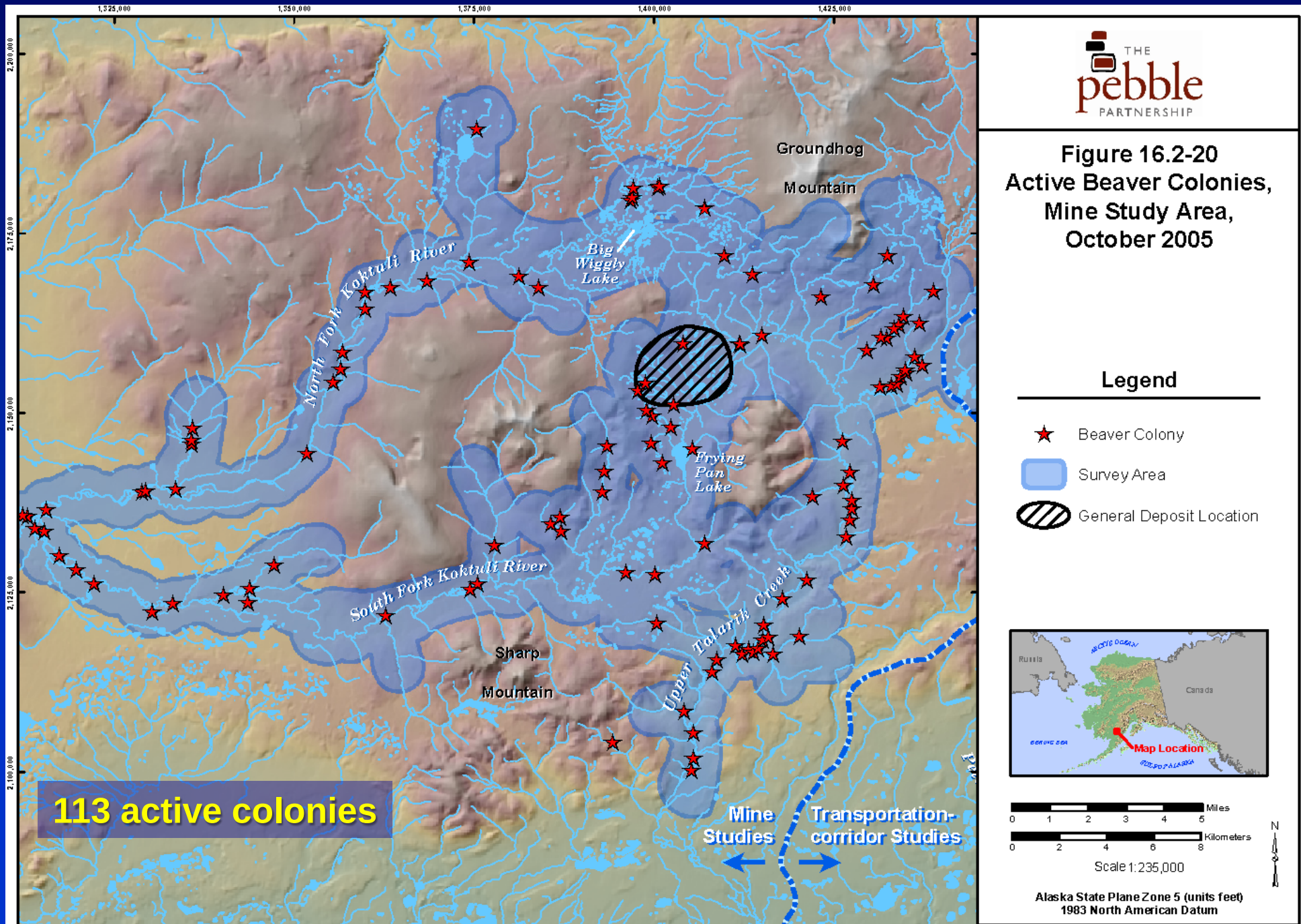
0 1 2 3 4 5 6 7 8 Miles
0 2 4 6 8 10 12 Kilometers
Scale 1:260,000
N

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

File: 41-2-3_OtherMam_2004-07_CI_PLP_EBD_v02.mxd	Date: March 24, 2011
Version: 2	Author: ABR-AZC

Active Beaver Colonies

Beaver Colony Survey — Mine Area, Oct. 9, 2005



Furbearer Harvests

ADFG harvest records in and near mine & transportation corridor study areas*

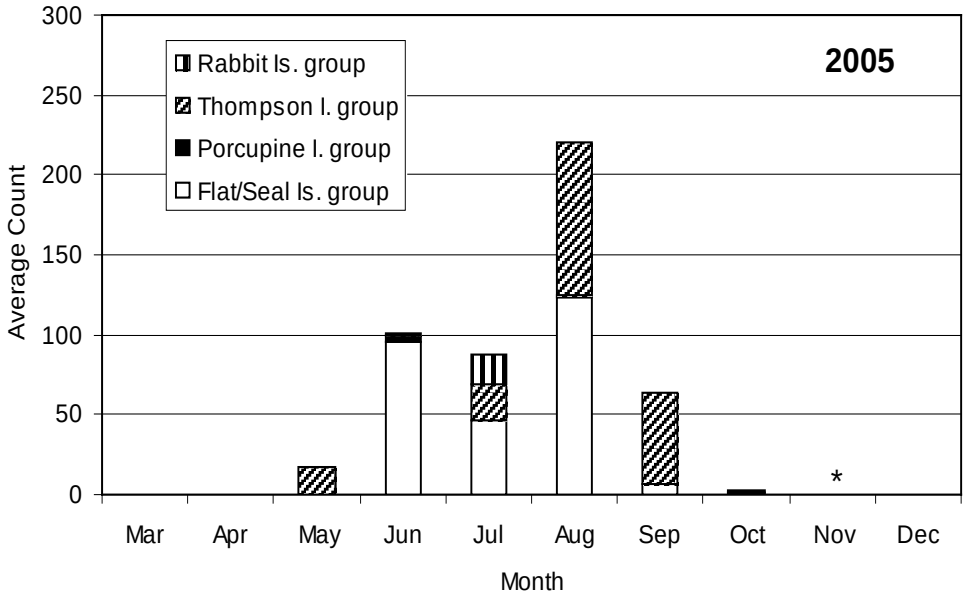
Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Lynx	5	13	18	9	2	8	7	10	18	1	1	3	1	0
River otter	29	17	18	15	18	30	15	6	3	1	6	0	28	3
Wolverine	22	19	22	23	10	15	17	10	4	4	5	1	21	8
Wolf	42	15	45	84	18	3	17	41	68	13	28	5	23	4
Beaver	305	111	70	174	65	163	19	8	8	15	24	10	23	0

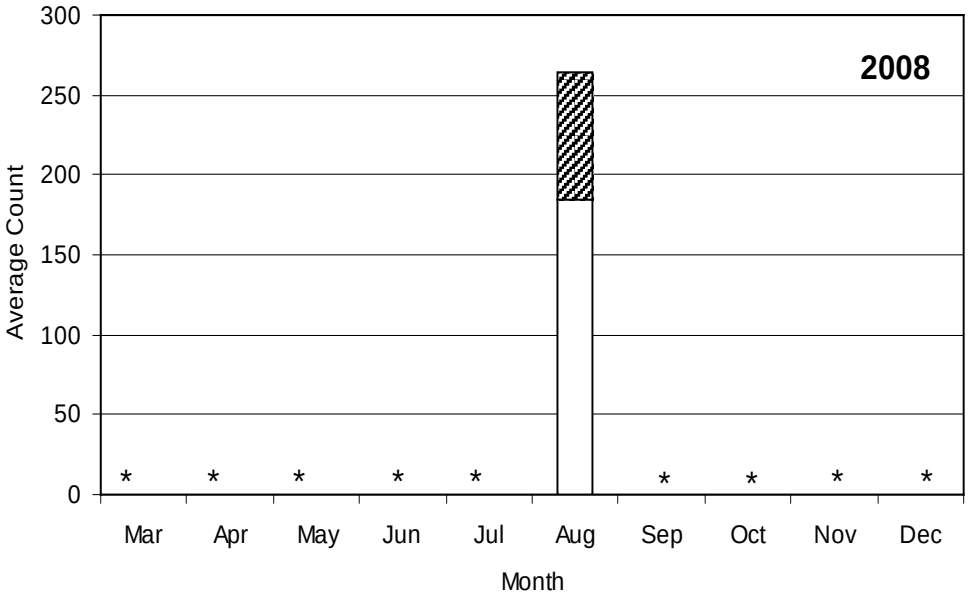
* Uniform Coding Units: 201 in GMU 17B + 203, 301, 302, 303, 304, 401, 601, 701 in GMU 9B

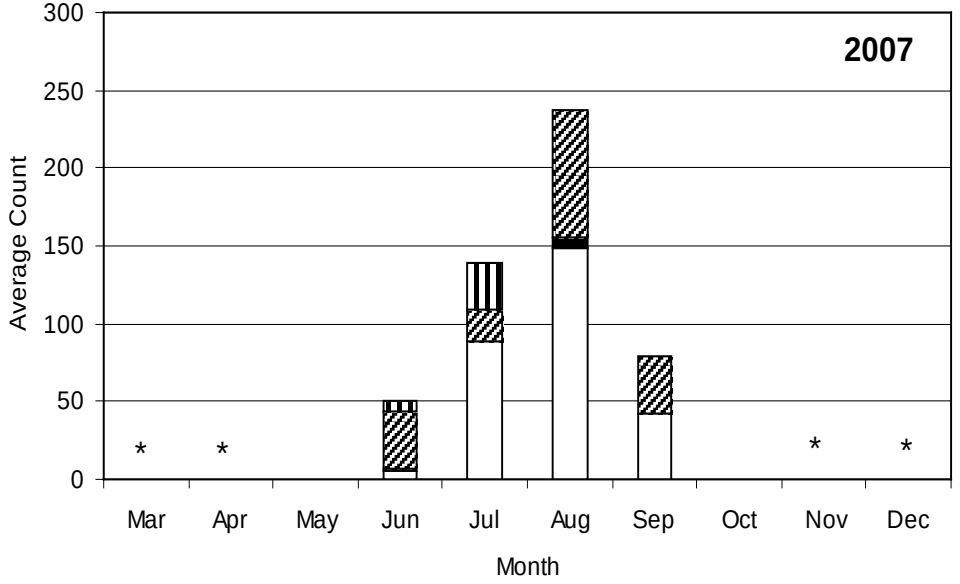
Harbor Seal — Iliamna Lake

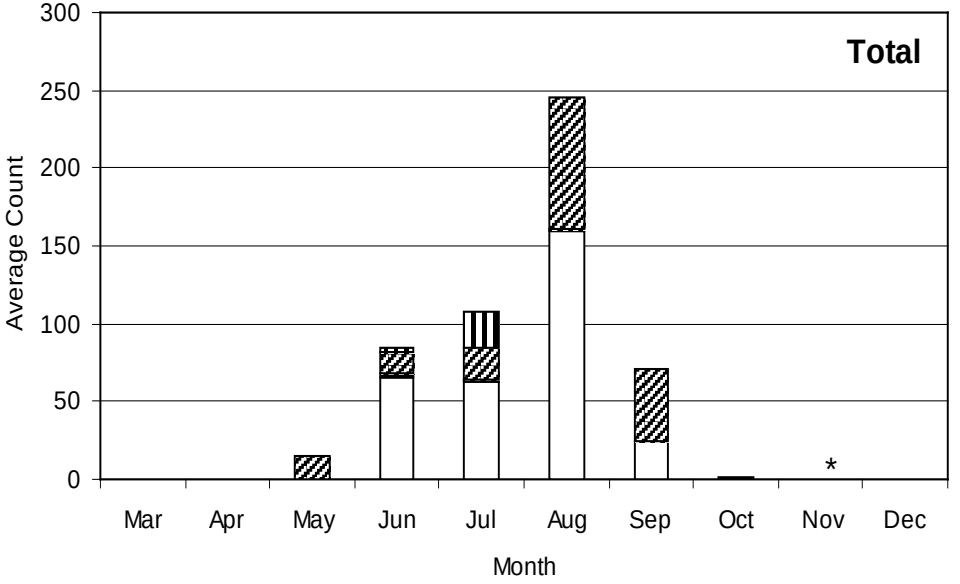
- Subject to MMPA permitting concerns
- Susceptible to disturbance when hauled out, especially during pupping in early summer & molt in late summer
- Iliamna Lake hosts only freshwater seal population in Alaska
- Coastal bays near potential port site known to support large numbers of seals (discussed under Marine Wildlife)

Timing of Seal Haulout Use, Iliamna Lake: 2005, 2007, 2008

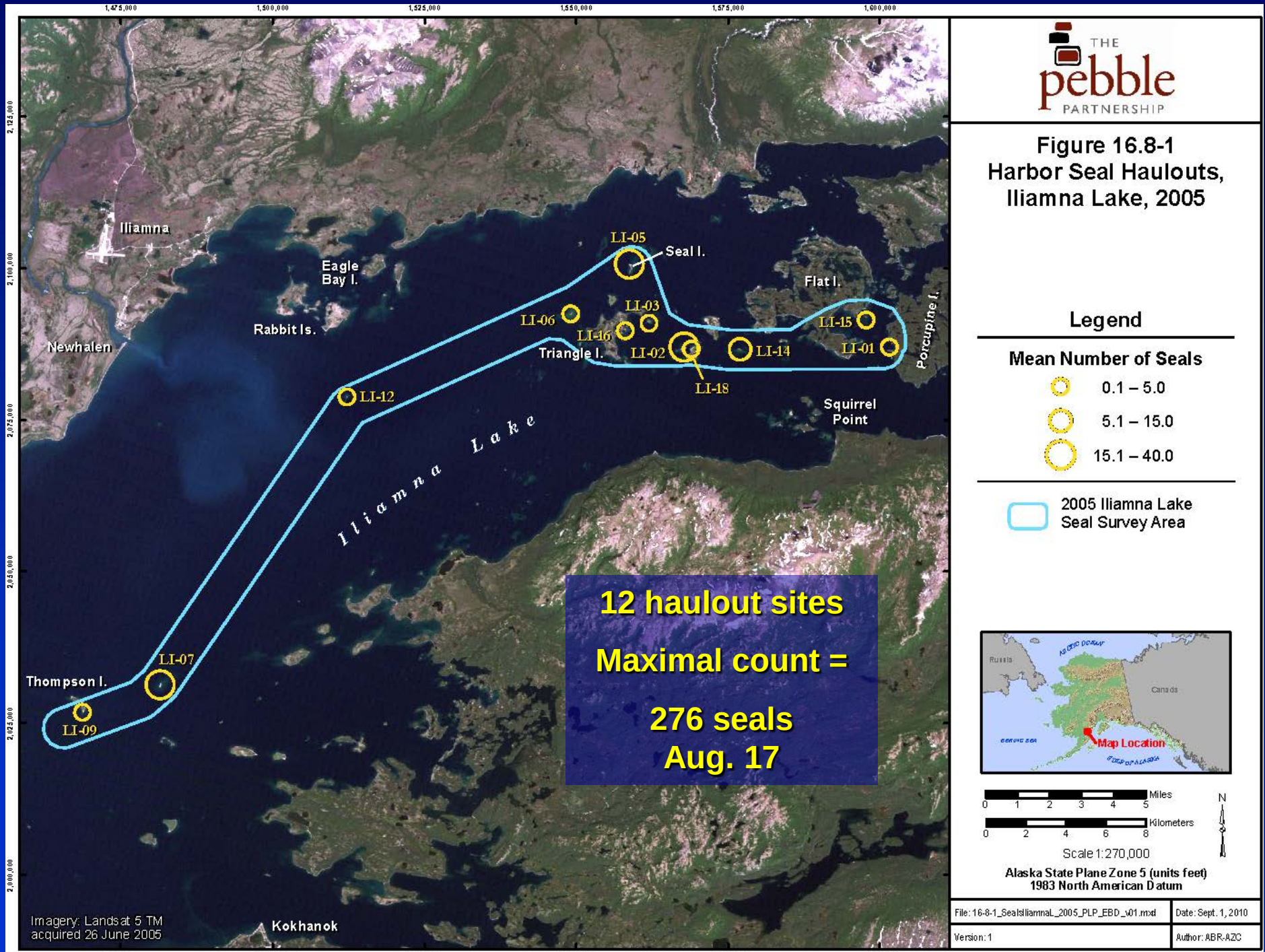




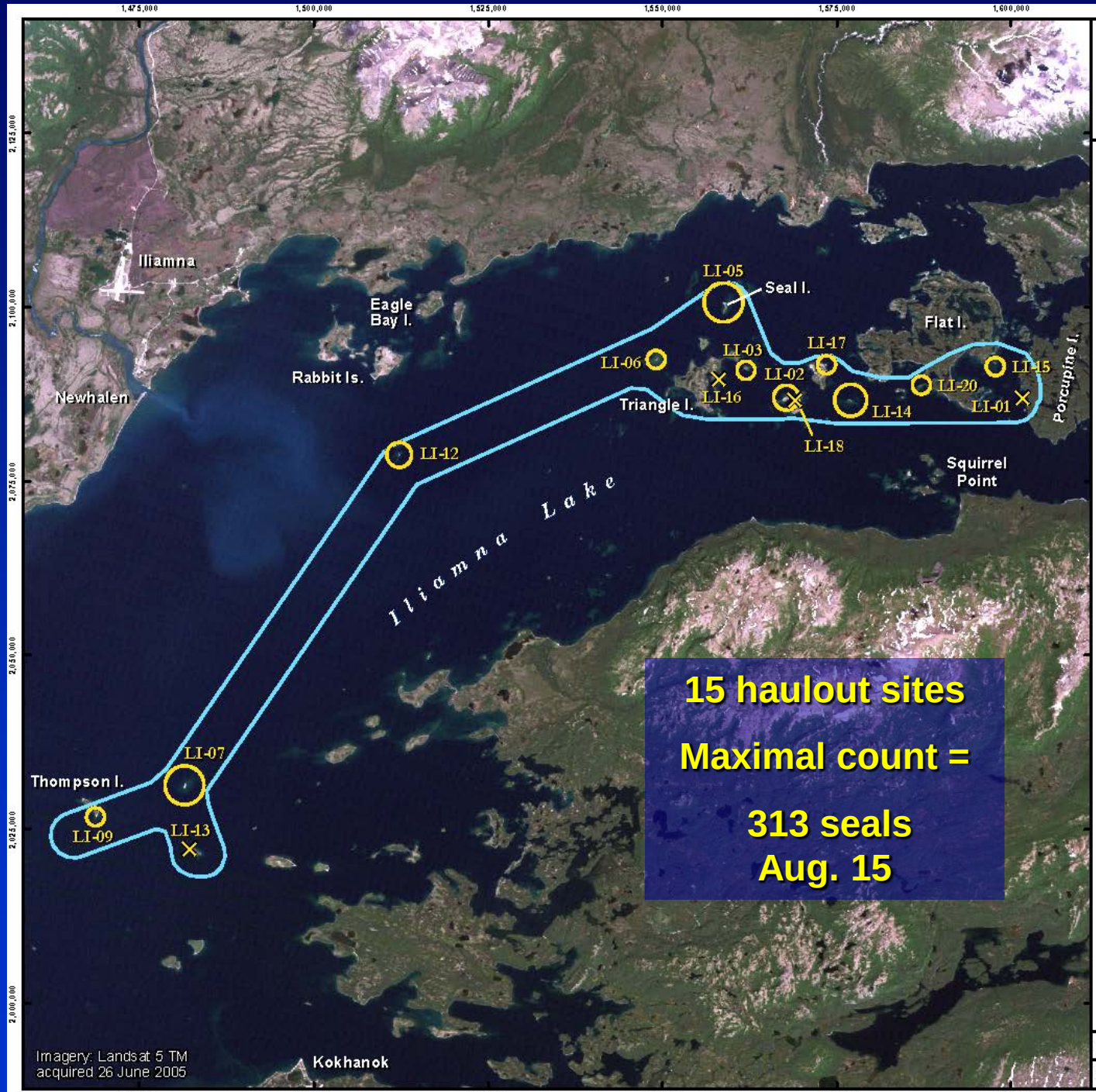




Harbor Seal Haulouts, Iliamna Lake, Mar. – Dec. 2005



Harbor Seal Haulouts, Iliamna Lake, May – Oct. 2007



THE pebble PARTNERSHIP

Figure 16.8-2
Harbor Seal Haulouts, Iliamna Lake, 2007

Legend

Mean Number of Seals

- 0
- 0.1 – 5.0
- 5.1 – 15.0
- 15.1 – 40.0
- 40.1 – 60.0

2007 Iliamna Lake Seal Survey Area

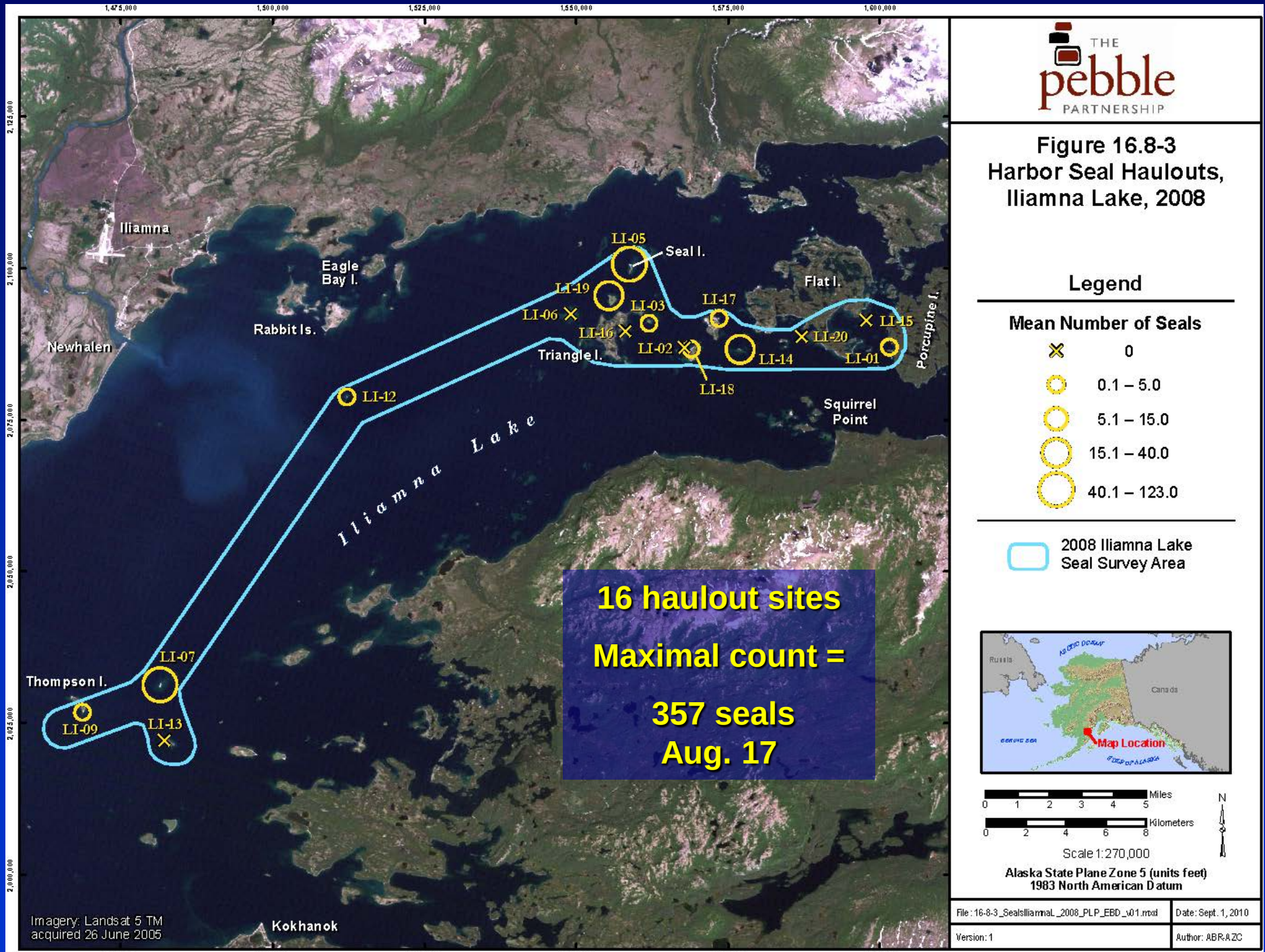
Miles 0 1 2 3 4 5
Kilometers 0 2 4 6 8
N

Scale 1:270,000

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

File: 16-8-2_SealsIliamnaL_2007_PLP_EBD_v01.mxd	Date: Sept. 1, 2010
Version: 1	Author: ABR-AZC

Harbor Seal Haulouts, Iliamna Lake, Aug. 2008



THE pebble PARTNERSHIP

Figure 16.8-3
Harbor Seal Haulouts, Iliamna Lake, 2008

Legend

Mean Number of Seals

- 0
- 0.1 – 5.0
- 5.1 – 15.0
- 15.1 – 40.0
- 40.1 – 123.0

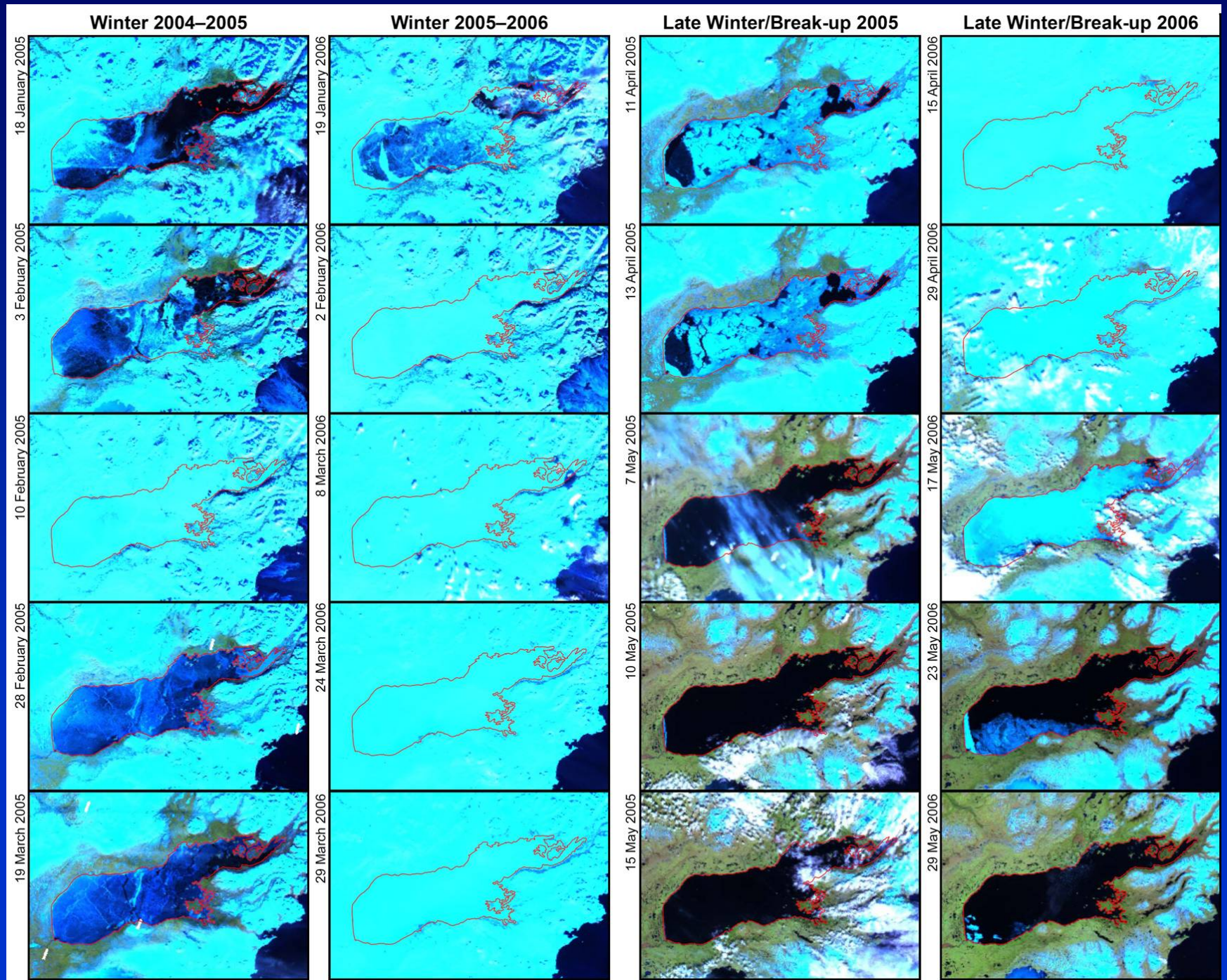
2008 Iliamna Lake Seal Survey Area

Miles 0 1 2 3 4 5
Kilometers 0 2 4 6 8
N
Scale 1:270,000

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

File: 16-8-3_SealsIliamnaL_2008_PLP_EBD_v01.mxd	Date: Sept. 1, 2010
Version: 1	Author: ABR-AZC

Ice Cover on Iliamna Lake (MODIS Satellite Imagery)



Questions?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