



NORTHERN DYNASTY MINES INC.

**DRAFT ENVIRONMENTAL BASELINE STUDIES
PROPOSED 2007 STUDY PLANS**

**CHAPTER 12.
MARINE**

DRAFT

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12. MARINE

12.1 Marine Wildlife—Cook Inlet Study Area

12.1.1 Introduction

The 2007 studies for marine wildlife are smaller in scope than were those for the field programs in 2004 through 2006. The emphasis of the 2007 research will be on wintering endangered species, such as Steller's Eiders and sea otters, and on seasonal and geographic patterns of populations of harbor seals that haul out within the study area. ABR, Inc., will conduct the marine wildlife studies for Pebble Project in 2007.

12.1.2 Methods

12.1.2.1 Helicopter Surveys

One year of winter helicopter surveys, during which data on wintering Steller's Eiders and sea otters were collected, has been conducted in the Iliamna/Iniskin Bay area; data were collected in February through April and October through December 2006. The winter helicopter surveys will be continuing in 2007 to determine the following:

- When Steller's Eiders and sea otters move into and out of the proposed port area.
- Where these species occur when present.
- The distribution and abundance of other wildlife species in the nearshore zone.
- When possible, the location and numbers of concentrations of birds in the offshore zones of these bays.

The surveys will be conducted using the same methods used in 2006 (described below), with two primary changes. First, a third day of sampling will be added to obtain data from the Chinitna Bay area, where no information on the distribution and abundance of wildlife in the winter has been collected previously. (This area currently is one of the possible locations where the undersea electrical cable may come ashore.) Second, the survey effort will increase to a total of 14 surveys in 2007: January (1), February (1), March (2), April (2), May (1), August (1), September (2), October (2), November (1), and December (1). The protraction of the survey period and the increased sampling intensity will enable researchers to better quantify when some of the endangered species (Steller's Eider, sea otter) move into or out of the survey area in numbers and may allow the determination of timing of short-term movements of endangered species through the area (Steller's sea lion). Aside from this, surveys will be conducted as they were in 2006, as described below.

Helicopter surveys for Steller's Eiders, sea otters, and, when possible, concentrations (25 or more individuals) of other marine birds and mammals will be conducted in Iniskin, Iliamna, and Chinitna bays (Figure 12.1-1) in winter, spring, and fall 2007. During each trip, two surveys of Iliamna and Iniskin bays will be conducted on consecutive dates, and one survey will be conducted in Chinitna Bay, unless a

second one can be done on the same day one of the surveys of Iliamna and Iniskin bays is done. During these surveys, researchers will fly over nearshore waters and search for Steller's Eiders and sea otters there and in the centers of bays, as described in the *Draft Environmental Baseline Studies, 2006 Study Plan* (NDM, 2006). All surveys will be flown in a Robinson R44 helicopter that follows the shoreline approximately 50 to 100 meters from shore; when necessary, the helicopter occasionally will deviate from the nearshore trackline to verify the identification of a large group of birds or mammals in the center of a bay. During each survey, researchers on each side of the helicopter will identify, count, and map Steller's Eiders, sea otters, and when possible, large concentrations of other birds and mammals seen in the nearshore zone. Single or small groups of birds or mammals may not be counted or mapped. In addition, researchers will identify, count, and map Steller's Eiders, sea otters, and large concentrations of other birds and mammals seen in the centers of bays; single or small groups of birds or mammals in the centers of bays generally will not be counted or mapped.

These helicopter surveys will be flown at a speed of 80 to 130 kilometers per hour and an altitude of 60 meters above ground level, with both Steller's Eiders and harbor seals being surveyed at the same time. If Steller's sea lions or harbor seals are seen during these surveys, the helicopter will rise to approximately 150 meters above ground level and/or skirt around the animals to minimize disturbance. Also, no surveys will be flown within two hours of low tide to minimize the disturbance of harbor seals, which commonly haul out around the time of that tidal stage.

Locations of Steller's Eiders, sea otters, and concentrations of other species of interest will be digitized from field maps. Counts will be summed to show total numbers. Maps of locations of taxa of interest then will be generated from the digitized files.

12.1.2.2 Harbor Seal Aerial Surveys

Harbor seals are abundant in the Cook Inlet marine study area; the maximal estimate of seals in the marine survey area in 2005 was approximately 1,450 animals, or up to 27 percent of all seals estimated to inhabit western Cook Inlet. Only one year of baseline data has been collected on harbor seals, in 2005.

The standard fixed-wing survey methods for seals used in 2005 will be used again in 2007. Surveys will be flown within two hours on either side of low tide. The survey aircraft (Cessna 206) will fly a prescribed route in the area of Iliamna and Iniskin bays (from Turtle Reef to Oil Bay) and Chinitna Bay (Figure 12.1-1) at 305 meters above ground level. Two observers will map and count or estimate the numbers of all harbor seals at haulouts and will photograph groups larger than approximately 20 seals for later comparison and correction of field counts. Surveys will be conducted during 10 sampling events (with two replicate surveys on successive days per survey event, plus a third replicate in late July and early August for population-estimation surveys) between spring and fall 2007: April (1), May (1), June (2), July (2), August (2), September (1), and October (1). The specific timing of surveys will depend on the timing of low tides each month in relation to the amount of available daylight.

Analyses of the number of seals hauled out will examine the effects of covariates to estimate the total number of seals using the survey area and will generate a maximal population estimate with the following statistical procedures. Tide height during the surveys will be estimated from the predicted tide height at stations in the National Water Level Observation Network with the computer program WXTIDE32. The two closest tide stations are Iliamna Bay (153°35'W, 59°37'N) and Oil Bay (153°16'W, 59°38'N). Most of the seals recorded on past surveys were located on the Iniskin Islands, roughly halfway between these two

tide stations. Therefore, the mean tide height between these two tide stations will be calculated for the survey times to derive variables for tide height, height above the nearest low tide (relative tide height), time to low tide, and height of low tide. The time until solar midday also will be calculated. Because the surveys begin in Iliamna Bay and end in Chinitna Bay, and because tidal changes proceed in the same geographic direction (low tides are approximately one hour later in Oil Bay than in Iliamna Bay), the tide height is assumed to remain roughly the same at all points of the survey.

Survey totals will be analyzed with a generalized linear model. Statistical analysis will be conducted with the MASS library for the software package R. A candidate set of models will be developed to examine the effects of five covariates on harbor seal numbers: Julian date of survey (Date and Date2, to account for a non-linear relationship between date and number hauled out), time to solar midday (Time to Midday), tide height at time of survey (Tide Height), height above low tide at time of survey (Relative Tide Height), and length of time to closest low tide (Time to Low Tide). All combinations of variables will be used, except for the variables Relative Tide and Time to Low Tide, which are highly correlated.

Competing models will be compared with an information-theoretic approach. For each model, the Akaike Information Criterion (AIC), corrected for small sample sizes (AICc), will be calculated. The probability that each model is the “best model” in the candidate set will be estimated with the Akaike Weight (wi). Parameter estimates from all models will be weighted by the Akaike Weight for each model to get unconditional parameter estimates.

The observed haul-out counts will be adjusted with the coefficients of the covariates to estimate the number that would have been hauled out at low tide on that date. After calculating the adjusted counts of hauled-out seals, each estimate will be corrected for the proportion of seals that were not hauled out at the time of the surveys by using a correction factor.

Because the focus of the analyses will be on calculating the maximal number of harbor seals in the survey area, the results of two surveys on which the maximal observed number are expected to be hauled out (late July and early August) will be analyzed separately. The covariate-adjusted count will be calculated, and the variance in the adjustment will be estimated with a parametric bootstrap method; the variance in the bootstrap samples will be used to estimate the variance in the adjusted count. Then, the correction factor and its associated standard error will be used to calculate the variance of the population level with the formula for addition of two independent variance estimates.

12.1.3 References

Northern Dynasty Mines Inc. (NDM). 2006. Draft Environmental Baseline Studies, 2006 Study Plan.

12.2 Marine Nearshore Resources—Cook Inlet Study Area

No data on marine nearshore resources are being collected in 2007.

TABLE

TABLE 12.1-1
Pebble Project Environmental Studies
Study Summary for Marine Wildlife, 2004-2007
Consultant: ABR, Inc.

Discipline	2004 Data Collected or Tasks	2005 Data Collected or Tasks	2006 Data Collected or Tasks	2007 Tasks to be Completed
Marine Wildlife	Port/Cook Inlet			
	Information Gathering / Literature Search	Information Gathering / Literature Search & Review	Information Gathering / Literature Search & Review	Information Gathering / Literature Search & Review
	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan	Scope, Schedule, Field Sampling Plan
	2004 Study Plan	2005 Study Plan	2006 Study Plan Summary	2007 Study Plan Summary
	Marine Wildlife Surveys by Ship (June, November)	Marine Wildlife Surveys by Ship (March, May, June, November)	Marine Wildlife Surveys by Ship (March, May)	
		Aerial Photography Surveys for Harbor Seals (May to December)		Search for appropriate Control Study Sites for BACI study design
			Marine Surveys by Helicopter for Steller's Eiders and Sea Otters (February, March, April)	Marine Surveys by Helicopter for Steller's Eiders and Sea Otters (February, March, April, May, August, September, October, November, December)
	Data Entry and Analysis	Data Entry and Analysis	Data Entry and Analysis	Data Entry and Analysis
	Communication and Data Management	Communication and Data Management	Communication and Data Management	Communication and Data Management
	Coordination with NDM, Agency Meetings	Coordination with NDM, Agency Meetings, and Monthly Reporting	Coordination with NDM, Agency Meetings, and Monthly Reporting	Coordination with NDM, Agency Meetings, and Monthly Reporting
	2004 Progress Report	Draft Environmental Baseline Document	Finalize Draft Environmental Baseline Document	

FIGURE

Figure 12.1-1.
 Survey Areas for
 Marine Wildlife Studies,
 Cook Inlet Marine Survey Area,
 2007
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Marine Wildlife Survey Areas

 Marine Wildlife Survey Area

Harbor Seal Survey Areas:

-  Chinitna Area
-  Iliamna Bay Area
-  Iniskin Bay Area
-  Iniskin Islands Area
-  Harbor Seal Haul-out, 2005

-  Possible Road Alignment
-  Possible Powerline
-  Possible Submarine Powerline
-  Possible Port Site

