10.8. Distribution, Abundance, and Habitat Use by Large Carnivores

10.8.1. General Description of the Proposed Study

The large carnivore study is a multi-year (2012–2014) effort that combines desktop analyses of existing data on bears and wolves from historical studies and ADF&G population-monitoring studies with field sampling focused on bears using specific riparian areas downstream from the proposed dam.

10.8.1.1. Study Goals and Objectives

The goal of the study is to obtain sufficient information on three dominant predators and game animals in the region—brown bear, black bear, and wolf—to use in evaluating Project-related effects and identifying any appropriate measures to avoid, minimize, or mitigate those effects.

Project development will inundate or modify habitats used seasonally by brown bears, black bears, and wolves. In addition, the associated development infrastructure and human activities in the area during construction and operation are likely to have indirect effects on bears and wolves through changes in prey populations, including moose, caribou, and salmon, and changes in disturbance and human hunting patterns. Data collected through this large-carnivore study will provide information on the value of lost, created, or altered habitats for bears and wolves in the study area.

Four primary objectives have been identified for this study:

1) Estimate the current populations of brown bears, black bears, and wolves in the study area, using existing data from ADF&G;
2) Evaluate bear use of streams supporting spawning by anadromous fishes in habitats downstream of the proposed dam that may potentially be altered by the Project;
3) Describe the seasonal distribution and habitat use of wolves in the study area using existing data from ADF&G; and
4) Synthesize historical and current data on bear movements and seasonal habitat use in the study area, including the substantial body of data gathered by radio-tracking during the 1980s, as a continuation of the 2012 wildlife studies (AEA 2012a).

10.8.2. Existing Information and Need for Additional Information

Existing information for bears and wolves is further detailed below. This study would supply baseline data essential to assess potential Project-induced impacts and facilitate the development of any necessary PM&E measures.

10.8.2.1. Bears

For the original APA Susitna Hydroelectric Project in the 1980s, Miller et al. (1997) estimated brown bear and black bear densities in the region using a mark-resight technique. In the spring of 2000, 2001, and 2003, ADF&G used aerial line-transect sampling (Becker 2001, Becker and Quang 2009) to estimate brown and black bear population size in their 26,490-square-kilometer

Talkeetna Study Area. That large area extends from the East Fork of the Yentna River to the northeastern portion of the Susitna River drainage and includes most of the Project area. The portion of the reservoir inundation zone located upstream from the mouth of Kosina Creek was not covered in that survey, however. In spring 2003 and 2004, ADF&G conducted aerial line-transect sampling (Becker and Quang 2009) to estimate the population sizes of black and brown bears in a 21,528-square-kilometer area encompassing GMUs 13A and 13B (GMU 13AB Study Area). That area was bounded on the west and north by the Susitna River and extends from Kosina Creek to the Gakona River. That survey area includes the part of the reservoir inundation zone that was not included in ADF&G's Talkeetna Study Area. Brown bear and black bear densities vary substantially across these large areas, showing a pronounced gradient from higher densities in the west to much lower densities in the east. The density gradient is larger for black bears than for brown bears (ADF&G, unpublished data).

The original APA Susitna Hydroelectric Project included studies of the population size and density, demography, seasonal movements, dispersal, den locations, and predation rates on moose calves by both brown and black bears from 1980 to 1985 (ABR 2011). No studies of bears were conducted downstream from Devils Canyon. The density of brown bears in the upstream area was estimated to be 29.7 bears/1,000 square kilometers for an area of 12,127 square kilometers, which was defined as the area within the mean home-range diameter from the Susitna River for brown bears (Miller 1987). Approximately 12 percent of the relocations (n = 1,720) of radio-collared brown bears occurred in the area that would have been inundated by the APA Susitna Hydroelectric Project's Low Watana reservoir; bears used that area twice as frequently as expected both in the spring and for all months combined. This pattern of use was evident for males and most females, but not for females accompanied by cubs of the year. Bears spent the highest proportion of time in the Watana inundation zone during June, when they foraged on south-facing slopes for roots, new vegetation, and overwintered berries, and preyed on moose calves. Females with young cubs tended to stay at higher elevations, possibly to reduce the risk of predation on cubs by male brown bears (Miller et al. 1997).

Brown bears preyed on moose calves from late May to early June, with predation rates declining substantially by mid-July (Ballard et al. 1990). In addition to moose calves, the Susitna bear population had access to salmon, which is unusual for brown bears in interior Alaska. Bears, especially males, moved to the Prairie Creek drainage, a tributary to the Talkeetna River located southwest of Stephan Lake (between the Devils Canyon and Watana dam sites), during July and early August to feed on spawning Chinook salmon (LGL 1985). Despite the availability of protein-rich animal foods, berry production appeared to be a major factor limiting brown bear productivity in the Susitna study area (LGL 1985). Miller (1987) estimated berry abundance and canopy coverage within and above both impoundment zones proposed for the original APA Susitna Hydroelectric Project. Horsetails (*Equisetum* spp.), an important spring food, were more abundant outside the impoundment zones, but some sites with abundant horsetails would have been inundated by the proposed reservoir (Helm and Mayer 1985). An ADF&G study of brown bear movements and demography in GMU 13A is nearing conclusion; that study area is located south of the proposed reservoir inundation zone for this Project.

The density of black bears in black bear habitat comprised of spruce forest and shrub-lands along the Susitna river was estimated to be 90 bears/1000 square kilometers in the 1980s (Miller 1987); that density estimate has not been updated since (Tobey 2008). Although black bears in the upper basin occasionally ate moose calves, berries appeared to be their most important food source

(LGL 1985). Black bears spent most of their time in forested areas along creek bottoms, but moved out into adjacent shrublands during late summer as they foraged for berries, particularly in the area between Tsusena and Deadman creeks (Miller 1987). In May and June, 52 percent and 46 percent, respectively, of all locations of radio-collared bears occurred in areas that would be flooded by the proposed impoundment (Miller 1987).

The ADF&G management objective for brown bears in GMU 13 is to maintain a minimum population of 350 animals (Tobey and Schwanke 2009). The management objective for black bears in GMU 13 is to maintain the existing population of black bears with a sex structure that will sustain a harvest of at least 60 percent males (Tobey 2008). Bears in GMU 13 are of interest both as predators of caribou and moose and as important game species.

The Project is likely to result in wildlife habitat loss and alteration, blockage of movements of mammals, disturbance, and changes in human activity and access due to construction and operation of the Project. Bears often pose management challenges for large development projects in Alaska because of their attraction to areas of human activity and associated waste-handling facilities; proper disposal of anthropogenic wastes is important for minimizing such problems.

10.8.2.2. Wolf

Most of GMU 13 (except Subunit 13D, south of the Glenn Highway), including the upper Susitna River basin, currently is managed by ADF&G under a predator control program instituted in response to the State's intensive management law, passed in 1994. Since 2006, the number of wolves in GMU 13 has been within the current management goal range of 135–165 wolves (3.3–4.1 wolves/1,000 square kilometers) after the end of the hunting and trapping seasons (Schwanke 2009). In neighboring GMU 14, the wolf population was estimated at 100–130 animals in fall 2004 and 145–180 in fall 2007, well above the management objective of a minimum population of 55 wolves (Peltier 2006, 2009). GMU 14 currently is not included in the State's predator control program.

The wolf study for the original APA Susitna Hydroelectric Project was conducted during 1981–1983 in the Nelchina and upper Susitna River basins, building on regional studies that began in the 1970s (see ABR 2011 for details). That study provided data on pack size, territory boundaries, den and rendezvous sites, and feeding habits, based on radio-tracking of collared animals. During the study period, 13 different packs and a lone individual used areas in or adjacent to the Devils Canyon and Watana impoundment zones proposed for the APA Susitna Hydroelectric Project. Wolf packs used almost the entire upper Susitna basin, except areas above 4,000 feet. elevation; elevational use varied seasonally, probably in response to availability of prey species. In each year, 5–6 wolf packs used the areas that would have been inundated by the APA Susitna Hydroelectric Project. Den and rendezvous sites usually were located on well-drained knolls and hillsides with sandy, frost-free soils and mixed, semi-open stands of spruce, aspen and willow. The most important potential impact on wolves from the APA Susitna Hydroelectric Project was predicted to be reduced winter availability of primary prey species (moose and caribou) in the impoundment zones. In addition, habitat loss due to inundation and facilities development would have caused wolves to adjust territory boundaries, potentially resulting in intraspecific strife.

Wolves have been studied extensively in GMU 13 since the mid-1970s and are the subject of ongoing surveys for ADF&G's intensive management program. The number of wolves and

packs using the Project area currently is unknown, although it appears to be substantially lower than during the original APA Susitna Hydroelectric Project studies because of current predator control efforts in GMU 13 and 16. Research in recent years has focused on ADF&G's Nelchina study area in GMU Subunit 13A, located south of the proposed reservoir.

10.8.3. Study Area

GMU 13 is an intensive management area where predator control measures have been implemented by the State of Alaska to increase caribou and moose populations. In GMU 13, predator control measures have included land-and-shoot harvest of wolves and liberalized regulations for the harvest of wolves and bears.

The study area for spatial modeling of bear density will encompass the proposed Project area, including the impoundment zone, the access and transmission corridors, and other Project features (Figure 10.8-1). Field work will be limited to surveys of bear use of anadromous fish spawning streams in the middle reach of the Susitna River and its tributaries downstream from the proposed Watana dam site that contain spawning runs of anadromous fishes, as far downstream as the confluence of the Susitna River and the Chulitna River, all of which are located within GMU Subunit 13E.

No field studies are proposed for wolves. The wolf study will involve analysis of existing ADF&G data from GMU subunits 13A and 13E, and possibly from adjacent subunits 14B, 16A, and 20A, pending further consultation with ADF&G.

10.8.4. Study Methods

10.8.4.1. Bears

Population Estimation

A multi-faceted approach will be used to address the need for current information on bears in the Project area. Reanalysis of 1980s data and synthesis with current data from other previous or ongoing ADF&G telemetry studies and other regional management studies will provide data on bear populations, movements, and habitat use in the study area (AEA 2012a).

Population estimates can be obtained from existing data collected recently in ADF&G's two line-transect study areas (described above in Section 10.8.2.1) by using complex distance models with a new gamma-like detection function (Becker, in prep.) that is consistent with point independence models (Borchers et al. 2006). By themselves, however, these estimates will not allow more detailed inference about the number of bears in areas potentially affected by the Project. The addition of spatial line-transect modeling (Hedley and Buckland 2004) will allow computation of estimates that are both more accurate and more precise. The analytical objective is to obtain density estimates from specialized multiple-covariate, mark-resight distance models (Becker, in prep.) along small transect sections. These estimates then will be fitted with a detailed spatial model (Miller et al., in prep) that incorporates potential explanatory variables such as elevation, aspect, habitat, and east-west and north-south gradients to derive a spatially explicit density model, from which sub-estimates can be obtained (e.g., parts of both bear survey areas that may be affected by the Project). The spatial models of Hedley and Buckland (2004) must be modified (Miller et al., in prep.) to work correctly with the more complex distance models (Becker, in prep.) used to model the initial bear densities. The spatial model must be

robust because of the potential for nonlinearity between the spatial covariates and bear density (Miller et al., in prep).

The analytical work will require writing a GIS program to subdivide the 1,238 35-km-long transects from the Talkeetna Study Area and the 1,221 30-km-long transects from the GMU 13AB Study Area into small (1-km) segments that retain all relevant geospatial information. This work will be performed by the ADF&G Division of Wildlife Conservation. The next step is to develop an R-based program to fit a spatial model to the two datasets and then to run this code on the datasets to obtain the population estimates. This work will be done by Dr. David L. Miller, University of Rhode Island, Department of Natural Resources Science, who will work on the analysis and report preparation with Earl Becker, ADF&G Division of Wildlife Conservation.

Downstream Surveys

ADF&G has concluded that adequate data generally are available for brown bears and black bears in the Project area to evaluate potential impacts of the Project, but "information on downstream use of habitat and the importance of salmon in bear diets in conjunction with impacts to salmon would aid in identifying potential impacts to bears downstream of the dam" (letter from M. Burch, ADF&G, to AEA dated November 22, 2011). ADF&G does not consider bear dens to be "sensitive" locations because they are seldom reused (letter from M. Burch, ADF&G, to AEA, dated December 20, 2011).

A survey of bear use of fish-spawning streams in the middle reach of the Susitna River and associated tributaries downstream from the proposed Watana dam site will be conducted to assess the use of those resources by bears in the Project area. The surveys would be conducted by monitoring streams using DNA sampling from hair samples to quantify the bear population using the downstream area and stable-isotope analysis of hair sample to characterize the diet of bears in the sampled area. Hair-snag stations (possibly hair traps that sample hair from only one individual and then close, pending further consultation with Laverne Beier of ADF&G's Division of Wildlife Conservation) would be deployed along game trails and scent stations in a grid pattern centered on the Susitna River (downstream from the dam site and upstream from Talkeetna) and extending up tributary drainages that support spawning runs of anadromous fishes. The size and design of the hair-snag grid will be based on the expected densities of bears, logistical considerations for access to the area, and comparison with similar studies in central Alaska.

DNA analysis of bear hair samples would provide information on the sex and species of bear, a minimum estimate of the number of different individuals using the sampling area, and stable isotope signatures. The isotopic signature would be used to classify the proportion of the diet made up of salmon, terrestrial meat, or vegetation (Fortin et al. 2007). ADF&G experts will be consulted by AEA during the sampling design and analysis phases of the downstream bear study.

Evaluation of berry resources in the reservoir inundation zone can be accomplished during the concurrent mapping efforts for vegetation, wetlands, and wildlife habitats (Sections 11.5 and 11.6) to assess the distribution and abundance of berry plants as forage for bears.

10.8.4.2. Wolf

ADF&G's Division of Wildlife Conservation has expressed the opinion that ongoing monitoring work would be sufficient (ADF&G memorandum to AEA, 22 November 2011), so no additional field surveys are deemed necessary for the Project. Hence, desktop analyses of existing ADF&G data would be used to meet the study objectives for wolves.

Historical reports from the original APA Susitna Hydroelectric Project study will be reviewed and synthesized, where possible, with data from other recent and current monitoring by ADF&G of wolves in GMU subunits 13A, 13B, 13E, 14B, 16A and 20A, as a continuation of AEA's wildlife studies (AEA 2012a), initiated in 2012. Mapping of wolf pack territories and movements from existing ADF&G telemetry datasets will provide useful background information, although delineation of current pack territories will not be possible without tracking collared individuals, and the applicability of the available data to the study area need to be evaluated. Although the findings of the wolf study conducted for the original APA Susitna Hydroelectric Project program remain relevant and could be used for the current Project analyses, the original telemetry data for wolves are no longer available and therefore cannot be reanalyzed using newer geospatial techniques.

10.8.4.3. Impact Assessment

The primary potential impacts on bears could be direct loss of habitat, changes in prey density and distribution, changes in berry production, changes in human use and hunting effort, and increased potential of mortality due to defense of life or property (DLP), or availability of anthropogenic food sources. Impacts on bears will depend, in part, on the proposed plan to control anthropogenic food sources. The primary potential impacts on wolves could be direct loss of habitat, changes in prey distribution and density, disturbance, and changes in hunting effort.

Telemetry data from the ADF&G will be used, in conjunction with bear survey data described above, to identify important habitats and high-use sites for bears and wolves in the Project area. Data on the distribution, abundance, movements, and habitat use by bears and wolves will be used to assess Project impacts. Direct habitat loss can be estimated through geospatial analysis by overlaying the impoundment, access and transmission corridors, and other Project infrastructure on the Project habitat map (Sections 11.5, 11.6 and 11.7) to identify important habitats that would be lost. Additional indirect habitat loss and avoidance effects can be similarly estimated by applying various buffer distances, as determined from available information on anticipated effects. Data from the bear DNA study can be used to estimate the number of animals that might be affected at various high-use areas and to assess the dietary importance of those streams to the bear population downstream of the Watana dam. Harvest data from ADF&G will provide baseline data for evaluation of changes in harvest and other mortality that may result from improved access. Data on the seasonal distribution, abundance, and movements of bears and wolves among habitats in relation to the geographic extent and seasonal timing of various Project activities can be used to identify necessary avoidance and minimization measures.

10.8.5. Consistency with Generally Accepted Scientific Practice

Distance sampling using aerial line transects (Becker and Quang 2009) is the primary method currently employed by ADF&G to obtain regional estimates of bear population density in

southern Alaska. Mark-recapture analysis of genetic markers and stable isotope analysis from hair samples have been widely used in recent years. Analysis of hair samples to examine bear diets and population size has been used previously in Alaska (Fortin et al. 2007, Gardner et al. 2010).

10.8.6. Schedule

This is a multi-year study, part of which began in 2012. Reanalysis and synthesis of existing bear and wolf data through 2011 is currently being conducted (AEA 2012a). Incorporation of new data and additional analyses will be conducted incrementally as recent and current data are obtained from ADF&G databases. Field surveys of bear use of salmon streams downstream from the proposed dam site will be conducted during mid- to late summer in 2013 and 2014 to coincide with the timing of spawning runs of salmon. Evaluation of berry resources in the reservoir inundation zone would be accomplished during concurrent mapping efforts for vegetation, wetlands, and wildlife habitats. Data analysis, QA/QC, and reporting will be conducted in the fall and winter months after recent and current data are transferred from ADF&G and field work is completed in late summer. The Initial Study Report and Updated Study Report will be completed within 1 and 2 years, respectively, of FERC's Study Plan Determination (i.e., February 1, 2013).

10.8.7. Level of Effort and Cost

Sightability of bears from aerial surveys over forests is low and the large Project area makes direct observations from the ground problematic. Stable-isotope analysis of bear hair provides an indirect estimate of the major components of bear diets without requiring capture and handling of bears. Approximately 1 to 2 weeks of field time by a crew of two biologists would be required in mid-summer to establish the hair-snag grid between the proposed dam site and Talkeetna. The hair-snag stations then will be checked at weekly intervals during late summer, when use of the streams by bears is expected to be highest. The seasonal timing of sampling visits may be adjusted on the basis of results from fish surveys for the Project.

Collection of data on berry distribution and abundance in the reservoir impoundment zone will be conducted during the vegetation and wetland field surveys (see Sections 11.5 and 11.6), eliminating the need for separate field surveys.

The spatial modeling of bear density, which would be conducted in 2013 only, is estimated to cost approximately $65,000.

The study cost in 2013 is estimated at approximately $200,000, including the bear density modeling, and the cost in 2014 is estimated to be less because the bear density modeling will not be included. The total two-year cost is estimated at approximately $325,000.

10.8.8. Literature Cited

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10.8.9. Figures

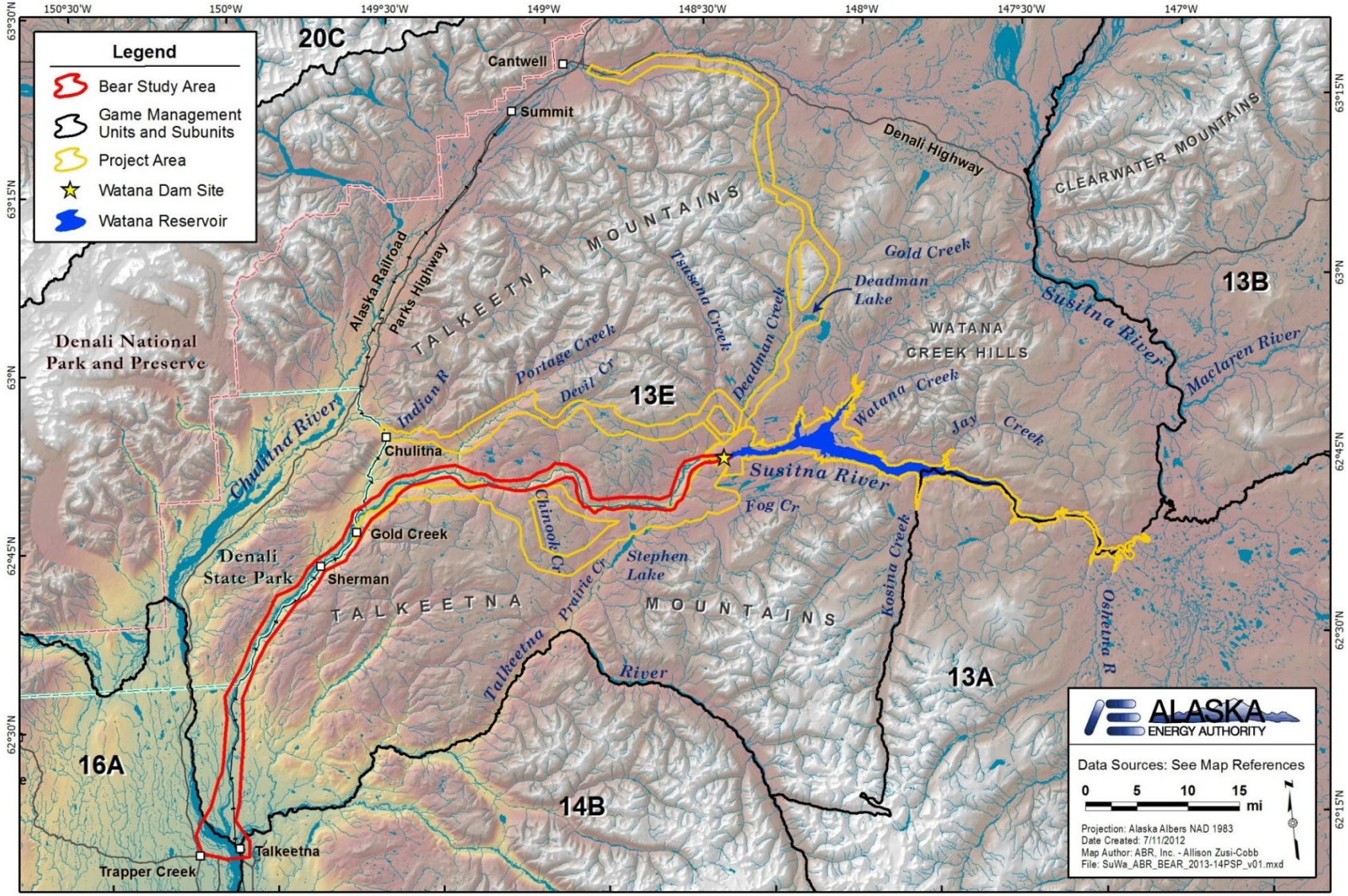

Figure 10.8-1. Study area for bears. [NOTE - TO BE REVISED FOR RSP; WILL ADD OUTLINE OF AREA WITHIN WHICH BEAR SPATIAL-DENSITY MODELING WILL BE DONE, AS WELL AS MODIFYING DOWNSTREAM STUDY AREA TO SHOW CATALOGED ANADROMOUS STREAMS]