

Susitna-Watana Hydroelectric Project Document

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**Susitna-Watana Hydroelectric Project
(FERC No. 14241)**

**Analysis of Fish Harvest in and Downstream of the
Susitna-Watana Hydroelectric Project Area
Study Plan Section 9.15**

Final Study Plan

Alaska Energy Authority



July 2013

9.15. Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Section 9.15 of the RSP described the Analysis of Fish Harvest In and Downstream of the Susitna-Watana Hydroelectric Project Area. This section focuses on compiling and analyzing baseline information on the harvests of resident and anadromous fishes in and downstream of the proposed Project area to understand the potential for Project construction and operation to alter harvest levels and opportunity. RSP 9.15 provided goals, objectives, and proposed methods for data collection regarding the analysis of these fish harvests.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 9.15 was one of the 31 studies approved with no modifications. As such, in developing the Final Study Plan Section 9.15, AEA has made no modifications to this study from its Revised Study Plan.

9.15.1. General Description of the Proposed Study

Information from this fish harvest study will be used in combination with other studies to inform the licensing process by analyzing baseline harvest data from the Project area downstream to where the Susitna River joins Upper Cook Inlet and into the marine waters of the Upper Cook Inlet commercial fisheries management area (Figure 9.15-1). This study will provide a basis for assessing impacts on fisheries resources and developing protection, mitigation, and enhancement measures, if necessary.

Study Goals and Objectives

The goal of this study is to compile and analyze baseline information on the harvests of resident and anadromous fishes in and downstream of the proposed Project area to understand the potential for Project construction and operation to alter harvest levels and opportunity. This study has two primary objectives:

1. Describe baseline harvest levels and harvest locations for commercial, sport, personal use, and subsistence fisheries for Susitna-River-origin resident and anadromous fish.
2. Describe the potential for the Project to alter harvest levels and opportunities on Susitna-River-origin resident and anadromous fish based on potential Project-induced changes in fish abundance and distribution from flow- and habitat-related changes as estimated from other Project studies.

9.15.2. Existing Information and Need for Additional Information

The Alaska Department of Fish and Game (ADF&G) documents legal catches from commercial, sport, personal use, and subsistence fisheries. Fishing effort and harvest success data are collected annually by fishery, management area, district, subdistrict, and in some cases by smaller statistical harvest reporting areas. Historic harvest statistics are stored by ADF&G in statewide databases.

9.15.2.1. Commercial Fisheries

The Susitna River watershed is within the Upper Cook Inlet Management Area (UCIMA) for commercial fisheries. Commercial salmon fisheries in the UCIMA target salmon stocks bound for the major river systems of Cook Inlet, including the Susitna River. Salmon are harvested during seasons and according to regulations established by the Alaska Board of Fisheries. The ADF&G Division of Commercial Fisheries, based in Soldotna, monitors salmon returns in Cook Inlet and sets fishing periods based on the perceived strength of the returns to achieve escapement goals for the major rivers of the area. The UCIMA includes central and northern districts (Figure 9.15-1), each being further divided into subdistricts (Shields and Dupuis 2012). Two commercial gear types are permitted in the limited entry commercial fishery: drift gillnets (Central District only) and set gillnets (allowed in portions of both districts). Commercial harvests are recorded at the time of sale on a fish ticket, which includes the date, location code (statistical area), and the number and pounds of each species of salmon delivered. These data are stored in a statewide fish ticket database.

Five species of Susitna River salmon are commercially harvested in Upper Cook Inlet: Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*), chum (*O. keta*), pink (*O. gorbuscha*), and coho salmon (*O. kisutch*). Sockeye salmon make up the largest component of the harvest and commercial value. Harvest data are summarized and reported annually by the ADF&G Division of Commercial Fisheries (Shields and Dupuis 2012). The ADF&G Gene Conservation Laboratory has successfully used genetic mixed stock analysis techniques to identify stock-of-origin in commercial fishery catches such that the contribution of Susitna River-origin sockeye salmon can be estimated (Barclay et al. 2010). Efforts are underway to develop the baseline and resolution for other salmon species.

Eulachon (*Thaleichthys pacificus*), also known as smelt or hooligan, are harvested commercially in the UCIMA (Shields and Dupuis 2012; Shields 2005, 2010). Managed under the *Cook Inlet Smelt Fishery Management Plan* (5 AAC 21.505), the fishery has a harvest cap of 100 tons. Harvesters use dip nets, and a majority of the harvest is taken in the vicinity of the Susitna River delta. Harvest statistics have been reported since 1978; the 2011 season was the first year in which the harvest cap was reached (Shields and Dupuis 2012).

9.15.2.2. Sport Fisheries

The Susitna watershed lies within the Northern Cook Inlet Management Area (NCIMA) (Figure 9.15-2) established for the management of recreational fisheries. For the purposes of harvest reporting the NCIMA is divided into four subunits:

- Knik Arm Management Unit lying south of Willow Creek and east of the Susitna River.
- Eastside Susitna Management Unit including all waters of the Upper Susitna River above the Chulitna River to and including the Oshetna River.
- Westside Susitna Management Unit including the Chulitna and Yentna rivers.
- West Cook Inlet Unit including freshwater drainages entering Cook Inlet to the west of the Susitna River mouth (Figure 9.15-2).

Sport fisheries in the NCIMA are managed by the ADF&G Division of Sport Fisheries office in Palmer. The Statewide Harvest Survey (SWHS) annual postal survey of sport fish license holders is the primary method used by ADF&G to compile harvest estimates for NCIMA sport fisheries

(Jennings et al. 2007). Sport fishing harvest and effort by species have been estimated and reported annually for the four NCIMA management units since 1977.

Sport fisheries in the NCIMA target the five species of Susitna River salmon, with coho salmon and Chinook salmon making up the largest contributions to the harvest (Jennings et al. 2007). Other species taken in the sport fishery, ordered by amount harvested, include northern pike (*Esox lucius*), rainbow trout (*O. mykiss*), Arctic grayling (*thymallus arcticus*), lake trout (*Salvelinus namaycush*), Dolly Varden (*S. malma*), burbot (*Lota lota*), round whitefish (*Prosopium cylindraceum*), and humpback whitefish (*Coregonus clupeaformis*) (Jennings et al. 2007).

9.15.2.3. *Personal Use Fisheries*

Three personal use fisheries currently occur within the NCIMA:

- A sockeye salmon dip net fishery at Fish Creek located in Knik Arm.
- A dip net fishery for Alaska residents 60 years or older at the Beluga River (to the west of the Susitna River mouth).
- A eulachon fishery in the Lower Susitna River (Oslund and Ivey 2010).

Participants in these fisheries obtain a permit from ADF&G and are required to record daily harvest information on the permit. Permits are returned to ADF&G at the end of the season. Personal use harvest data are reported annually in ADF&G annual management reports (for example, Ivey et al. [2009]).

9.15.2.4. *Subsistence Fisheries*

Subsistence fishing regulations in the Susitna River watershed are complex and restrictive. A portion of the watershed falls within a “nonsubsistence area” defined under the Alaska Administrative Code (AAC) 5 AAC 99.015 (3). Trout, char, grayling, and burbot may not be taken for subsistence in fresh water (5 AAC 01.575. (c)). The only subsistence salmon fishery authorized within the Susitna watershed is a fishwheel fishery on the upper Yentna River near the community of Skwentna (5 AAC 01.593). A subsistence gillnet fishery is authorized in the Tyonek drainage for whitefish (5 AAC 01.580), and smelt may be taken in fresh and salt water (5 AC 01.599). A coastal set gillnet subsistence fishery operates near the community of Tyonek in Northern Cook Inlet, which targets salmon returning to the Susitna and other river systems of northern Cook Inlet. Educational subsistence fisheries are permitted on the east side of the Central District between Kenai and Anchor Point.

Subsistence salmon harvest data are reported annually in ADF&G annual fishery management reports (for example Oslund and Ivey 2010, and Shields and Dupuis 2012) and in the Alaska subsistence salmon fisheries annual reports (for example, Fall et al. 2011). Additional data have been gathered in targeted studies (for example, Fall and Foster 1987). Historic subsistence harvest data are stored in the Alaska Subsistence Fisheries Database (ASFDB) managed by the ADF&G Division of Subsistence in Anchorage (Caylor and Brown 2006). Harvest data for non-salmon species may not be regularly reported.

9.15.2.5. *Additional Information Needs*

To assess potential Project effects on harvest rates, it is necessary to draw upon other studies that are designed to estimate abundance and distribution of the various fish stocks in the Susitna River system. Existing information includes fish spatial and temporal distribution and relative abundance information from recent and early 1980s studies. The *Aquatic Resources Data Gap Analysis* (HDR 2011) and the *Susitna-Watana Hydroelectric Project Pre-Application Document* (AEA 2011) summarized existing information and identified data gaps for adult salmon, resident and rearing fish, and for subsistence resources (Northern Land Research, Inc. 2011). In recent years, ADF&G has conducted adult salmon (sockeye, coho, and chum salmon) spawning distribution and abundance studies in the Susitna River (e.g., Yanusz et al. 2011, Merizon et al. 2010). In 2012, ADF&G expanded its scope to include Chinook and pink salmon. Concurrent studies to be conducted as part of the licensing process for the Project include salmon escapement and run apportionment, fish distribution and abundance in the Susitna River, characterization of aquatic habitats in the Susitna River, and subsistence use.

9.15.3. **Study Area**

The study area includes the Susitna River from its mouth upstream to and including the Oshetna River (river mile [RM] 233.4). The study area includes tributaries that are connected to the mainstem of the Susitna River and marine waters of Upper Cook Inlet where anadromous fish species originating from the Susitna River are intercepted in commercial fisheries north of the latitude of Anchor Point (59° 46.15' N. lat.).

9.15.4. **Study Methods**

Baseline data on commercial, sport, personal use, and subsistence harvests of resident and anadromous fish in the Project area and other potentially affected areas downstream of the Project will be gathered and synthesized. Specific tasks include compilation and apportionment of ADF&G commercial harvest records, compilation of harvest and effort from sport fisheries, compilation of harvest and effort from personal use fisheries, compilation of subsistence harvest data, and evaluation of potential project effects. ADF&G opens and closes fishing areas each year by issuing emergency orders. These orders are necessary to achieve escapement goals for the various salmon returns to the Cook Inlet area as well as adhering to regulatory directives for allocation of harvest between user groups. To minimize the effect that emergency order closures may have on a given year, harvest data will be averaged over a 20-year time period.

These data will be used in combination with the results of fish abundance studies conducted as part of Project licensing to assess potential Project impacts; further, these data will feed into analyses to be completed by recreation, socioeconomic and subsistence study teams. Specific methods are detailed below.

9.15.4.1. *Compilation and Apportionment of ADF&G Commercial Harvest Records*

Evaluating potential Project effects on commercially harvested fish species is a two-step process to identify the following: (1) how many Susitna River fish are harvested in the area's commercial fisheries, and (2) how many of those fish use mainstem Susitna River habitats that have the potential to be affected by the Project.

Investigators will contact ADF&G Commercial Fisheries staff in area and regional offices to better understand the spatial and temporal resolution of commercial harvest records in the UCIMA. Harvest statistics for each of the salmon species commercially harvested in the UCIMA are stratified spatially and temporally and are reported annually (Shields and Dupuis 2012). Investigators will compile a minimum of 20 years of harvest and effort statistics from the ADF&G statewide fish ticket database. Data will be requested at the smallest geographic reporting units (statistical areas) and time strata. The number of fish and pounds harvested by species, by day, and by harvest area will be compiled, and trends will be noted. Minimum, maximum, and mean harvest statistics will be calculated over the 20-year period. These data represent a mixture of stocks returning to a combination of river systems draining into Upper Cook Inlet. A review of available genetic stock identification studies will be used to estimate the proportion of Susitna River stocks in the harvest mixtures. Genetic stock composition data are of higher resolution for sockeye salmon (Barclay et al. 2010) than for other species, though some progress has been made apportioning chum and coho salmon stocks (Merizon et al. 2010). Species that lack sufficient genetic data for run apportionment will be assessed based on the best available geographic distribution and timing information from telemetry studies, escapement counts, and harvest reports.

Commercial harvest data from the eulachon fishery will be requested from the state database at the smallest temporal strata that will produce meaningful interpretation. Because of low participation, broad time strata may be required to prevent the identification of individual fishermen. Because the eulachon fishery takes place at the Susitna River mouth, all reported harvest will be assumed to represent stocks potentially affected by the Project.

9.15.4.2. Compilation of Harvest and Effort from Sport Fisheries

Sport fishery harvest and effort data for the 13 species identified in Section 9.15.2 will be compiled at the finest geographic resolution available for freshwater fisheries in the Susitna watershed. Catch, harvest, and angler-day information will be compiled for a minimum of 20 years, and minimum, maximum, and mean values calculated by geographic area. Sources of information will include annual management reports from the ADF&G Sport Fish Division (e.g., Ivey et al. 2009) and from statewide harvest reports (e.g., Jennings et al. 2007). ADF&G Division of Sport Fish Division staff will be interviewed to better interpret the data available from the SWHS, and to uncover whether focused creel surveys have been conducted in select Susitna tributaries. Geographic harvest reporting areas best conforming to the area of potential Project effects will be selected from the SWHS data. In general, SWHS estimates from smaller fisheries with low participation are less accurate than those of larger fisheries (Mills and Howe 1992). If the fishery size or level of participation is too small to be adequately assessed by the SWHS, qualitative information on angler success and participation will be obtained by interviewing guides, outfitters, fishery participants, and lodge owners operating in the Upper Susitna.

9.15.4.3. Compilation of Harvest and Effort from Personal Use Fisheries

Harvest and effort data will be compiled for the Fish Creek and Beluga River personal use salmon fisheries. Sources of information will include annual management reports from the ADF&G Sport Fish Division, for example Ivey et al. (2009). These fisheries target stocks returning to a number of river systems including the Susitna River; hence, the likelihood of

detecting significant Project effects is low. Regardless, harvest and effort data will be compiled for the eulachon fishery at the mouth of the Susitna River from permit return data and annual reports produced by ADF&G.

9.15.4.4. *Compilation of Subsistence Harvest Data*

All Cook Inlet subsistence fisheries will be reviewed. However, due to their proximity to the Susitna River watershed it is likely that the only fisheries that would have any potential linkage to the Susitna Project are the Tyonek gillnet fishery and the Yentna fishwheel fishery. A minimum of 20 years of harvest and effort data will be compiled for the Tyonek Subdistrict subsistence gillnet fishery from the ASFDB and/or available reported harvest data. Because this is a marine fishery, an estimate will need to be made about the proportion of Susitna River stocks in the harvests. The estimate will use available genetic stock identification information (e.g., Barclay et al. 2010) and other sources such as run timing and proximity to other salmon systems. Harvest statistics will be compiled for the fishwheel fishery on the upper Yentna River near the community of Skwentna.

9.15.4.5. *Evaluation of Potential Project Effects*

Evaluating the potential for flow- and habitat-related changes to alter harvest rates for Susitna River fishery resources will require an integration of the results from multiple studies (Figure 9.15-3). Potential effects will differ based on species, fishery type, fishery location, life history and periodicity of affected species, and the magnitude of flow and habitat effects and other Project-related changes. The following studies initiated in 2012 and/or conducted during 2013–2014 will provide information useful for evaluating effects on fish harvest and opportunity.

- The *River Flow Routing and Instream Flow Models Data Collection* initiated in 2012 will predict stage versus discharge relationships for approximately 100 transects in the mainstem of the Susitna River below the proposed reservoir.
- The *Aquatic Habitat and Geomorphic Mapping of the Middle River Study* will provide a comparison of the habitat mapping conducted in the 1980s with habitat mapping developed at similar discharges in 2012. One of the intents of the *Geomorphic Mapping Study* is to help address the potential effect of Project operations on the stability of tributary mouths and access to tributaries within the Middle Susitna River. It is also intended to provide baseline information to evaluate the influence of Project-induced changes to mainstem water surface elevations in July through September on adult salmon access to upland sloughs, side sloughs, and side channels used for spawning.
- The *Fish Passage Barriers Study* (Section 9.12) will help inform how Project-induced changes to mainstem water surface elevations in July through September influence adult salmon access to upland sloughs, side sloughs, and side channels.
- The *Upper Susitna River Fish Distribution and Habitat Study* will quantify the amount of riverine habitat likely to be lost due to inundation and interruption of fish passage.
- The *Fish Distribution and Abundance Studies* in the Upper, Middle, and Lower Susitna River will provide necessary information on fish abundance by habitat type.

- The *Eulachon Distribution and Abundance Study* (Section 9.16) will estimate the abundance of eulachon in the Lower Susitna River.
- The *Susitna-Watana Instream Flow Study* (ISF) is focused on development of macrohabitat-specific models that can reliably estimate flow-habitat response patterns for different species and life stages of fish and other aquatic biota.
- The *Salmon Escapement and Run Apportionment Study* will provide a watershed perspective on the salmon returns to the Susitna River and apportion runs to the major tributaries (Yentna River, Chulitna River, Talkeetna River, etc.) as well as the mainstem areas potentially affected by the Project.

A synthesis of the results from these studies will be required to estimate Project effects on fisheries as a proportion of the returns to the entire Susitna watershed. It is important to note that there will be high inter-annual variability in fish abundance estimates used to quantify potential impacts; in some cases the error associated with these estimates may exceed harvest levels for a particular fishery. For this reason, potential changes to harvest level and opportunity will be expressed as a range.

Potential effects to marine fisheries

For commercial salmon fisheries in the Northern and Central Districts and the Tyonek subsistence salmon fishery, estimates of harvest rates for Susitna River stocks based on genetic stock allocation will be analyzed to quantify potential effects on harvests. Northern District set gillnet fisheries likely harvest a higher proportion of Susitna River salmon than Central District drift and set gillnet fisheries. Thus, effects will need to be assessed by district and on a gear type basis, taking the timing of fishery openings and closures into account. Outputs from the flow routing model and riverine process models developed as part of the instream flow studies will provide simulations of Project effects under various proposed operational scenarios. These localized effects from the models will need to be put into the context of population level of harvested species within the Susitna River system and the mixtures of Susitna River and non-Susitna River stocks in the marine fisheries in the Northern and Central districts of the UCIMA. Potential impacts will be analyzed over the 20-year record of harvest.

Potential effects to eulachon fisheries

Eulachon harvested in the commercial and personal use fisheries operating in the mouth of the Susitna River will be treated as a single stock in the effects analysis. Abundance estimates generated from the Eulachon Distribution and Abundance Study of the RSP, coupled with the reported harvest information, will be used to estimate exploitation rates for the years that abundance data are available. Quantitative estimates of Project effects resulting from proposed operational scenarios will be obtained from the flow routing model and riverine process models developed as part of the instream flow studies.

Potential effects to sport fisheries

Effects on sport fisheries will be analyzed spatially based on the four broad reporting areas and on a species-by-species basis within the Susitna River system. Potential Project effects within the reservoir and tributaries upstream of the proposed dam site will be assessed by studies conducted in 2013–2014 as part of the Project licensing process, i.e., the Fish Distribution and Abundance Study, the Aquatic Habitat Study, the Fish Passage Study, and the Instream Flow

Study and related operational models. Analysis will be conducted on a species-by-species basis taking into account migratory versus non-migratory and other life history characteristics. The future Watana Reservoir Fish Community Study will provide information on potential sport fishing opportunities anticipated in the proposed Project reservoir.

Middle and Lower River sport fisheries will be analyzed spatially and on a species-by-species basis. Outputs from the flow routing model and riverine process models developed as part of the instream flow studies will provide quantitative results of Project effects under various proposed operational scenarios. These localized effects will need to be put into the context of the species populations within the major tributaries of the Susitna River system to estimate potential effects on harvest opportunity and catch rates.

9.15.5. Consistency with Generally Accepted Scientific Practices

This study plan was developed by fisheries scientists in consultation with ADF&G and the U.S. Fish and Wildlife Service (USFWS). The data used in this study have been and will be collected by ADF&G as part of its annual harvest assessments and rely upon regionally accepted methods for estimation of harvest.

9.15.6. Schedule

Harvest and effort statistics will be compiled in 2013 along with a synthesis of the best available genetic apportionment of salmon stocks harvested in commercial and subsistence fisheries (Table 9.15-1). Analyses of potential Project-related effects on harvest levels and opportunity will be conducted in 2014 as results from other Project studies become available. Initial and Updated Study Reports discussing actions taken to date will be issued within 1 and 2 years, , respectively, of FERC's Study Plan Determination (i.e., February 1, 2013).

9.15.7. Relationship with Other Studies

The Fish Harvest Study will interrelate with eight other AEA Project studies (Figure 9.15-3). Evaluating the potential for flow- and habitat-related changes to alter harvest rates for Susitna River fishery resources will require an integration of the results from multiple studies. The River Flow Routing and Instream Flow Study (Section 8.0) will predict stage versus discharge relationships for approximately 100 transects in the mainstem of the Susitna River below the proposed reservoir. The Aquatic Habitat (Section 9.9) and Geomorphic Mapping (Section 6.0) studies will provide a comparison of the habitat mapping conducted in the 1980s with habitat mapping developed at similar discharges in 2012. One of the intents of the Geomorphic Mapping Study is to help address the potential effect of Project operations on the stability of tributary mouths and access to tributaries within the Middle Susitna River. It is also intended to provide baseline information to evaluate the influence of Project-induced changes to mainstem water surface elevations in July through September on adult salmon access to upland sloughs, side sloughs, and side channels used for spawning. The Fish Passage Barriers Study (Section 9.12) will help inform how Project-induced changes to mainstem water surface elevations may influence adult salmon access to upland sloughs, side sloughs, and side channels. The Aquatic Habitat Study (Section 9.9) will quantify the amount of riverine habitat likely to be lost due to inundation and interruption of fish passage. The Lower/Middle (Section 9.5) and Upper (Section 9.6) Susitna River Fish Distribution and Abundance will provide necessary information on fish

abundance by habitat type. The Eulachon Distribution and Abundance Study (Section 9.16) will estimate the abundance of eulachon in the Lower Susitna River. The Susitna-Watana Instream Flow Study (ISF, Section 8.0) is focused on development of macrohabitat-specific models that can reliably estimate flow-habitat response patterns for different species and life stages of fish and other aquatic biota. The Escapement Study (Section 9.7) will provide a watershed perspective on the salmon returns to the Susitna River and apportion runs to the major tributaries (Yentna River, Chulitna River, Talkeetna River, etc.) as well as the mainstem areas potentially affected by the Project. A synthesis of the results from these studies will be required to estimate Project effects on fisheries as a proportion of the returns to the entire Susitna watershed. Results of the Fish Harvest Study will be used as output to inform the Recreational Resources Study (Section 12.5).

The flow of information into the Fish Harvest Study is anticipated to occur over the two-year study period through an iterative process. Relevant analyses of potential Project effects, from studies described above, will be disseminated from the Aquatic Resources and Instream Flow Programs to the Fish Harvest Technical team. To maximize communication among the Fish Study Programs, study leads will participate in internal meetings where preliminary data will be presented and implications to fish production will be discussed. These discussions will occur to a limited degree in Q1 2014 and more significantly in Q4 of 2014, feeding directly into study results.

9.15.8. Level of Effort and Cost

This study will focus on compiling and analyzing existing harvest data and new data collected from other fish, habitat, subsistence, and recreational studies. This study will be primarily a desktop exercise. It is estimated that this study will cost approximately \$200,000.

9.15.9. Literature Cited

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9.15.10. Tables

Table 9.15-1. Schedule for implementation of the Analysis of Fish Harvest Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Compile harvest & effort statistics					—	—				-----			
Apportion commercial harvests using genetics					—	—							
Estimate potential changes to abundance											—	—	
Estimate potential changes to distribution											—	—	
Analyze changes to harvest and opportunity											—	—	
Initial Study Report									—Δ				
Updated Study Report												—	▲

Legend:

- Planned Activity
- Follow-up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

9.15.11. Figures

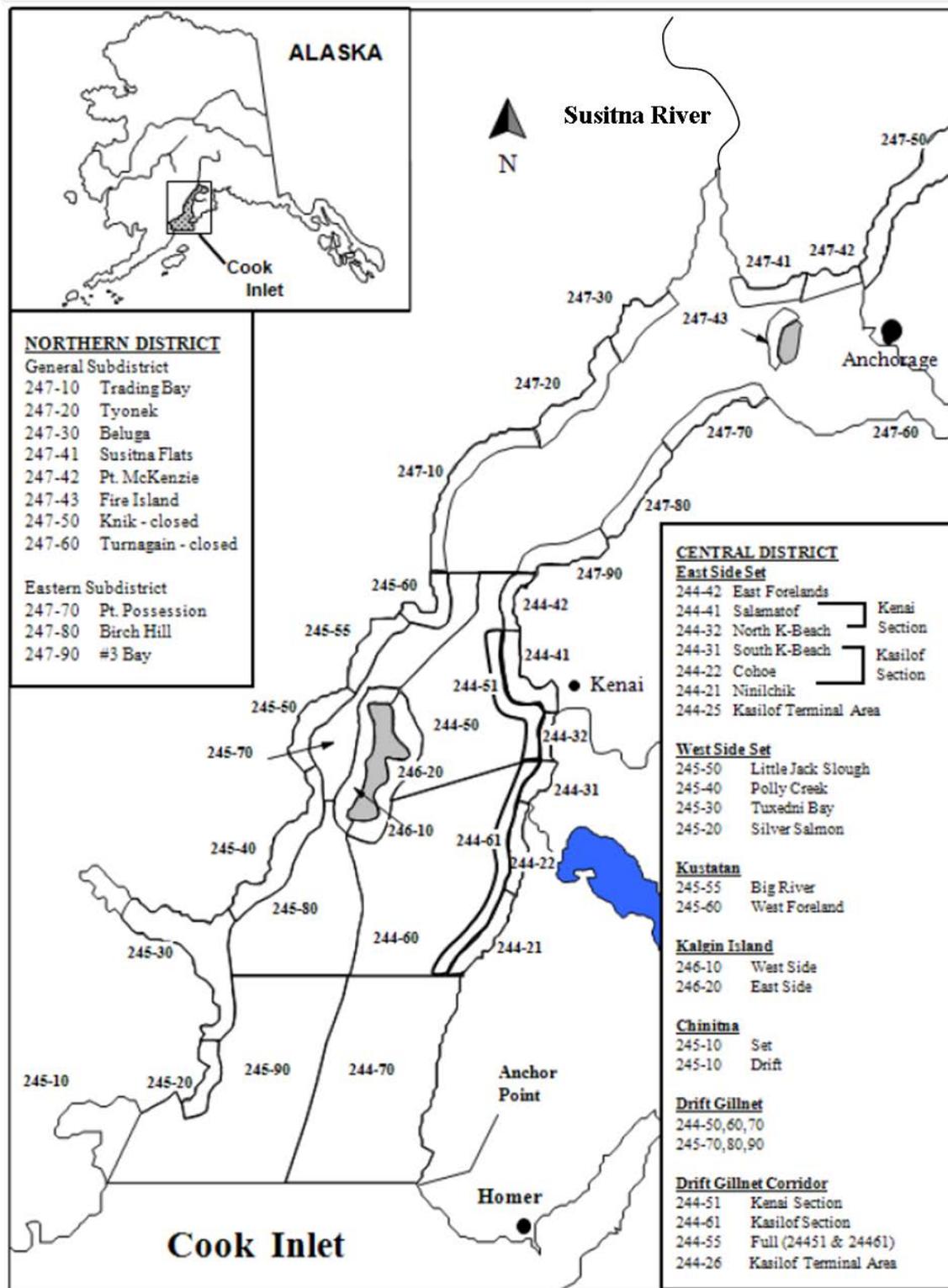


Figure 9.15-1. Upper Cook Inlet Management Commercial Fishing Districts and Statistical Reporting Areas (Shields and Dupuis 2012).

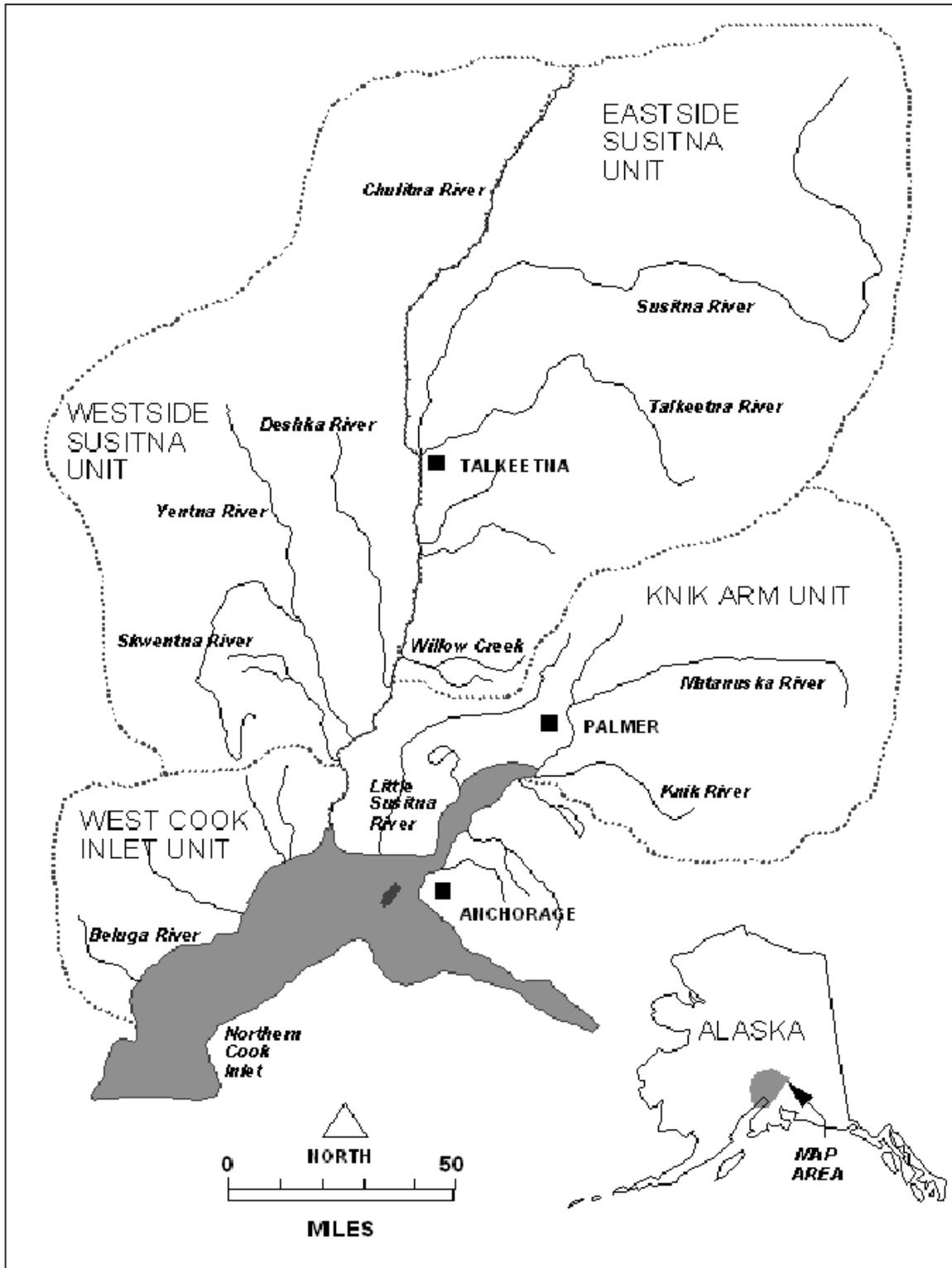


Figure 9.15-2. Northern Cook Inlet Management Area Sport Fishing Management Units (Oslund and Ivey 2010).

STUDY INTERDEPENDENCIES FOR THE FISH HARVEST STUDY

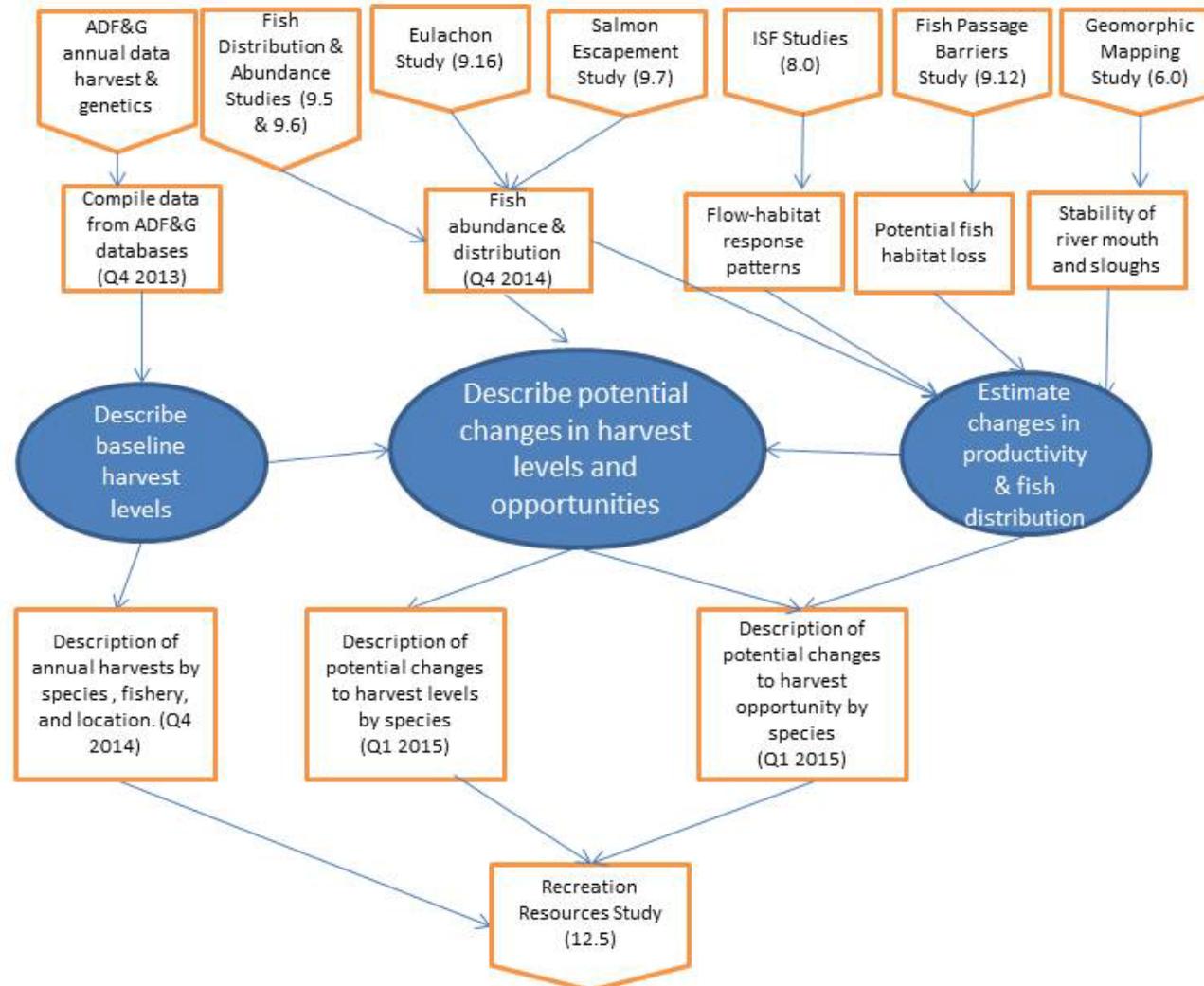


Figure 9.15-3. Study Interdependencies for Analysis of Fish Harvest Study.