

**A Program for Improving Fisheries Management and
Research in the Arctic-Yukon-Kuskokwim (AYK)
Region**

by

Jan M. Conitz

December 2012

Alaska Department of Fish and Game

Divisions of Commercial Fisheries



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H_A
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, χ^2 , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient	
milliliter	mL	west	W	(multiple)	R
millimeter	mm	copyright	©	correlation coefficient (simple)	r
		corporate suffixes:		covariance	cov
Weights and measures (English)		Company	Co.	degree (angular)	$^\circ$
cubic feet per second	ft ³ /s	Corporation	Corp.	degrees of freedom	df
foot	ft	Incorporated	Inc.	expected value	E
gallon	gal	Limited	Ltd.	greater than	>
inch	in	District of Columbia	D.C.	greater than or equal to	≥
mile	mi	et alii (and others)	et al.	harvest per unit effort	HPUE
nautical mile	nmi	et cetera (and so forth)	etc.	less than	<
ounce	oz	exempli gratia	e.g.	less than or equal to	≤
pound	lb	(for example)		logarithm (natural)	ln
quart	qt	Federal Information Code	FIC	logarithm (base 10)	log
yard	yd	id est (that is)	i.e.	logarithm (specify base)	log ₂ , etc.
		latitude or longitude	lat. or long.	minute (angular)	'
Time and temperature		monetary symbols (U.S.)	\$, ¢	not significant	NS
day	d	months (tables and figures): first three letters	Jan, ..., Dec	null hypothesis	H_0
degrees Celsius	°C	registered trademark	®	percent	%
degrees Fahrenheit	°F	trademark	™	probability	P
degrees kelvin	K	United States (adjective)	U.S.	probability of a type I error (rejection of the null hypothesis when true)	α
hour	h	United States of America (noun)	USA	probability of a type II error (acceptance of the null hypothesis when false)	β
minute	min	U.S.C.	United States Code	second (angular)	"
second	s	U.S. state	use two-letter abbreviations (e.g., AK, WA)	standard deviation	SD
Physics and chemistry				standard error	SE
all atomic symbols				variance	
alternating current	AC			population sample	Var
ampere	A			sample	var
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

REGIONAL INFORMATION REPORT 3A12-06

**A PROGRAM FOR IMPROVING FISHERIES MANAGEMENT AND
RESEARCH IN THE ARCTIC-YUKON-KUSKOKWIM (AYK) REGION**

by

Jan M. Conitz

Alaska Department of Fish and Game, Division of Commercial Fisheries,
Arctic-Yukon-Kuskokwim Region, Anchorage

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road, Anchorage, AK 99518

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*Jan M. Conitz,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
333 Raspberry Rd, Anchorage, AK, 99518, USA*

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	ii
ABSTRACT	1
INTRODUCTION	1
Arctic Area	2
Yukon Area	3
Kuskokwim Area.....	5
PROPOSED PROJECTS.....	6
Arctic Area	6
I. Arctic Area Salmon Projects	6
II. Arctic Area Marine Projects.....	11
III. Miscellaneous Arctic Area Projects.....	13
Yukon Area	15
I. Yukon River Salmon Assessments.....	15
II. Yukon River Non-Salmon Species Assessments	20
Kuskokwim Area.....	21
I. Kuskokwim River Salmon and Whitefish Assessments	21
II. Kuskokwim Bay Salmon.....	26
III. Other Kuskokwim Area Salmon Studies	29
IV. Kuskokwim Area Staffing and Infrastructure.....	31
Regional Projects.....	32
I. AYK Region Salmon Age-Sex-Length Data Collection Program	32
ACKNOWLEDGEMENTS.....	35
REFERENCES CITED	36
TABLES	37

LIST OF TABLES

Table		Page
1	Summary of AYK Region projects and estimated costs in thousands of dollars	38
2	Summary of Arctic area projects and estimated costs.	39
3	Summary of Yukon area projects and estimated costs.	40
4	Summary of Kuskokwim area projects and estimated costs.....	41
5	Summary of AYK Region projects and estimated costs.....	42

ABSTRACT

The Arctic-Yukon-Kuskokwim region is vast, encompassing the entire drainage areas of the Yukon, Kuskokwim and northern rivers and coastal waters of the Bering, Chukchi, and Beaufort seas. The region is characterized by small villages within the traditional territories of Inupiaq, Yup'ik, and Athabascan people, whose residents depend today, as they have for countless generations, on subsistence fishing for a major portion of their livelihood. Throughout more recent history, commercial fisheries for salmon *Oncorhynchus* spp., crab *Paralithodes camtschaticus* and *P. platypus*, whitefish *Coregonus* spp. and *Prosopium cylindraceus*, and other species have also sustained local economies and are economically intertwined with subsistence fisheries for many families. Fisheries management in this region is extremely challenging due to the mixed stock origin of most fisheries, remoteness, complexity, and vast size of the major river drainages, U.S./Canada Treaty agreements for the Yukon River, and the interdependence of subsistence and commercial fisheries. The proposed projects would provide necessary research and support management activities within the region. For the Arctic area, 6 salmon projects, 2 marine research, and 3 management support projects are proposed. For the Yukon area, 8 research projects are proposed to improve stock assessment and understanding of salmon, whitefish, and lamprey *Lampetra camtschatica* populations important for commercial and subsistence fisheries. Two would extend ongoing sonar assessment projects in need of more stable funding sources. For the Kuskokwim area, 12 projects for salmon and whitefish assessments, 2 fishery specific projects, and 3 general support projects are proposed, many of which would extend ongoing research and management activities in need of more stable sources of funding. Regionally, 2 projects are proposed to enhance the salmon stock biology program through quality control improvements and training, and a marine research project is proposed focusing on juvenile salmon originating in the Yukon and other area rivers.

Key words: Yukon River, Kuskokwim River, Kuskokwim Bay, Norton Sound, Port Clarence, Kotzebue Sound, AYK region, subsistence fishery, commercial fishery, test fishery, fisheries management, Pacific salmon *Oncorhynchus* spp., whitefish *Coregonus* spp. and *Prosopium cylindraceus*, lamprey *Lampetra camtschatica*, weir, radiotelemetry, sonar, age-sex-length, ASL, federal funding, state funding.

INTRODUCTION

The Arctic-Yukon-Kuskokwim (AYK) region encompasses the coastal waters of, and rivers and streams draining into, the Bering, Chukchi, and Beaufort seas. This vast area extends from Cape Newenham, at the boundary of the Bristol Bay area, to the Canadian border on the Arctic Ocean and inland. The entire U.S. drainage area of the Yukon River and its tributaries, including the Koyukuk, Tanana, and Porcupine rivers; the entire Kuskokwim River drainage, which extends from the Alaska Range near Mt. McKinley to the Bering Sea; and the large rivers of northwestern Alaska flow through this region. Outside the population centers of Fairbanks, Nome, and Bethel, most of the region is remote. The majority of residents in the nonurban areas are Athabascan, Yup'ik, or Inupiaq people, living in small villages along the rivers and coastlines within areas of traditional land occupancy and use. Traditionally, villages were situated to provide access to the fish, wildlife, and marine mammal resources that have sustained the people for countless generations. Present day communities are characterized by subsistence-based socioeconomic systems, with communitywide involvement in a seasonal round of subsistence activities, extensive noncommercial distribution networks, and a mix of subsistence and commercial or wage earning activities (Wolfe 1984). Economic opportunity is limited, and the cost of importing goods and fuel from outside is extremely high. Subsistence fishing is essential to the livelihood of many households, and is typically combined with commercial fishing participation wherever that opportunity exists. Cash income from commercial fishing or other employment enables households to maintain equipment and purchase fuel for subsistence fishing and hunting (Wolfe 1984; Wolfe and Walker 1986).

Pacific salmon *Oncorhynchus* spp. are the predominant resource for both subsistence and commercial fisheries, followed by crab *Paralithodes camtschaticus* and *P. platypus*, whitefish *Coregonus* spp. and *Prosopium cylindraceus*, and herring *Clupea pallasii* (State of Alaska, Department of Fish and Game website, <http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByArea.interior>). All subsistence and commercial fisheries in the region are managed by the Division of Commercial Fisheries. As throughout the state, the primary management objective is to maintain reproductive fish populations at sustainable levels while providing subsistence and commercial fishing opportunities under the sustained yield principle. Subsistence is designated the highest priority, after ensuring sustainable spawning populations. For salmon and whitefish in particular, achieving these objectives is complicated because different species and stock groups arrive in the fishing areas during the same time periods, and conservation and sustained yield management must be achieved for each distinct stock. Even using the best available technology, most stock-specific assessments must be conducted in tributaries and spawning areas that may be hundreds of miles upstream from fishing areas and where migrating fish may not arrive until weeks after the start of a fishery. These areas are for the most part remote, difficult and expensive to access, and subject to severe ice break-up and flooding. Although remarkable progress has been made in the past 20 years, assessing fish populations in the AYK region will continue to be expensive, technically challenging, and critical to proper management of the resource.

ARCTIC AREA

The Arctic area includes Norton Sound, Port Clarence, and Kotzebue Sound and encompasses all waters from Point Romanof, in southern Norton Sound, to Point Hope, as well as St. Lawrence Island. This area of over 65,000 square miles has a coastline longer than that of California, Oregon, and Washington combined (Menard et al. 2012). Approximately 16,000 people live in the area, in the hub communities of Nome and Kotzebue, or in 1 of over 26 small villages scattered along the coast and major river systems (State of Alaska, <http://labor.alaska.gov/research/census>). The majority of these residents are Alaskan Natives of Inupiaq and St. Lawrence Island Yupik origin (Alaska Native Heritage Center, Anchorage, <http://www.alaskanative.net>).

Commercial and subsistence fisheries in the area target 5 species of Pacific salmon, Pacific herring, red and blue king crab, inconnu or sheefish (*Stenodus leucichthys*), other whitefish, and Dolly Varden (*Salvelinus malma*). Other species harvested for subsistence and occasional commercial sale include northern pike (*Esox lucius*), Arctic grayling (*Thymallus arcticus*), burbot (*Lota lota*), saffron cod (*Eleginus gracilis*), rainbow smelt (*Osmerus mordax*), capelin (*Mallotus villosus*), Pacific halibut (*Hippoglossus stenolepis*), yellowfin sole (*Pleuronectes vetulus*), and flounders (*Platichthys* spp.). Of the salmon species, chum *O. keta* and pink *O. gorbuscha* are the most abundant, followed by coho *O. kisutch*, sockeye *O. nerka*, and Chinook *O. tshawytscha* salmon. Although Chinook, chum, and pink salmon are found as far north as Barrow, they are uncommon north of Kotzebue Sound (Menard et al. 2012).

The importance of fishing to life in this area is illustrated in the archeological record, which dates to at least 2,000 years ago. Larger settlements were located near the migratory routes of marine mammals, but small seasonal settlements were also dispersed along the coastline, strategically placed at the mouths of streams in summer to take advantage of migrating salmon and other fish. Commercial salmon fishing began on an informal basis through domestic

production and barter, during the time of the Seward Peninsula gold rush in the late 1890s, primarily to provide food for dog teams which were used to transport goods and mail.

Commercial salmon fishing for outside markets began in the early 1960s, supported by Alaska Department of Fish and Game (ADF&G) management beginning at Alaska statehood (Menard et al. 2012). Currently, chum and coho salmon are the primary target species; pink salmon may be harvested depending on market availability, and sockeye salmon from the Pilgrim River and Salmon Lake system have been targeted in Port Clarence in years of sufficient abundance. Low abundance of Chinook salmon returning to rivers in the area has resulted in closure of directed commercial fishing of this species since 2000. Markets for commercially caught salmon have not been consistently available during this period in all districts, due in large part to low salmon market values and high transportation costs. All salmon fishing in the area, both commercial and subsistence, is conducted from open skiffs with hand-pulled set gillnets. As in the rest of the Arctic-Yukon-Kuskokwim region, subsistence and commercial fishing have historically been and continue to be economically interdependent. Average annual subsistence harvest of all salmon in the Norton Sound area from 2001 to 2010 exceeded 73,000 fish, mostly pink salmon, and average annual subsistence harvest from the Kotzebue Sound area from 1995 to 2004 was nearly 58,000 fish. Harvest surveys were discontinued in the Kotzebue Sound area since 2004 due to lack of funding (Menard et al. 2012).

The Norton Sound commercial crab fishery operates in waters to the south and southeast of Nome, in both a summer and a winter fishery. In the 2011–2012 winter season, 35 permits were fished and 9,157 red king crab were harvested. In the 2011 summer season, 25 permits were fished and the total harvest was about 141,600 crab (J. Bell, Commercial Fisheries Biologist, ADF&G, Nome; personal communication). Nonsalmon fish species are harvested for subsistence by jigging, longlining, or rod and reel fishing, throughout the year and through the ice in winter. Subsistence king crab fishing is conducted mainly in winter, fishermen traveling by snow machine to set and retrieve crab pots or handlines on near shore ice. A small amount of subsistence crab fishing is conducted by boat in open water in summer. In the 2011–2012 winter season, 138 subsistence permits were fished, and the total winter subsistence harvest was 7,366 red king crab (J. Bell, Commercial Fisheries Biologist, ADF&G, Nome; personal communication).

YUKON AREA

The Yukon Management Area encompasses the entire U.S. portion of the Yukon River drainage and coastal waters from Point Romanof, northeast of Kotlik, to the Naskonat Peninsula. The Yukon River is the largest river in Alaska and has the fifth largest drainage area in North America. Originating in British Columbia, Canada within 30 miles of the Gulf of Alaska, it flows over 2,300 miles to the Yukon Delta, where it splits into 3 mouths emptying into the Bering Sea. It drains an area of approximately 330,000 square miles, approximately 35% of the state. Human populations within the U.S. portion of Yukon River drainage include approximately 98,000 people living in and around Fairbanks, Alaska's second largest city, and approximately 22,000 people living in some 43 small, remote villages scattered along the river, its major tributaries, and the coastal area (State of Alaska, <http://labor.alaska.gov/research/census>). The rural populations are predominately Alaska Native, the Yup'ik cultural group occupying the coast, Yukon Delta, and lower river areas, and several different Athabaskan cultural groups occupying the interior regions. The Yukon River drainage supports Chinook, chum, coho, pink, and sockeye salmon, although sockeye salmon are

uncommon in this system. The chum salmon return consists of early (summer) and late (fall) runs, comprising 2 genetically distinct populations. Other species of freshwater fish occurring within the Yukon River drainage include whitefish and cisco, sheefish or inconnu, Arctic grayling, Arctic char *Salvelinus alpinus*, Alaska blackfish (*Dallia pectoralis*), burbot, and Arctic lamprey *Lampetra camtschatica*.

Subsistence fisheries target mainly Chinook and chum and smaller amounts of coho salmon, but whitefish and other species are harvested, mainly in winter or in times of salmon shortage. Permits are not required for subsistence fishing in more isolated areas away from the state's road system, but they are required for subsistence or personal use fishing in the Tanana River and those parts of the Yukon River accessible by road. The area around Fairbanks is defined as a nonsubsistence area, where only personal use and sport fisheries are allowed. Participation and harvest in all subsistence and personal use fisheries are estimated by an intensive postseason survey program and returned permits. In contrast to other areas of Alaska that are dominated by marine commercial fisheries, subsistence salmon harvests in the Yukon area often exceed commercial, sport, and personal use harvests combined (Fall et al. 2012). In 2011, approximately 1,540 households in the Yukon area harvested about 41,000 Chinook, 96,000 summer chum, 80,000 fall chum, and 12,000 coho salmon (D. Jallen, Commercial Fisheries Biologist, ADF&G, Fairbanks; personal communication).

Commercial salmon fishing is allowed along the entire 1,200 mile length of the mainstem Yukon River in Alaska and throughout the lower 225 miles of the Tanana River. Management of salmon stocks that spawn in the Canadian portion of the Yukon River drainage, primarily Chinook and fall chum salmon, is coordinated between the U.S. and Canada according to the *Yukon River Salmon Agreement*, an annex to the *Pacific Salmon Treaty*. The Yukon River Panel makes recommendations to management agencies in Alaska and Canada. Most salmon fisheries within the Yukon River drainage harvest from mixed species and stocks, comprising runs originating in different tributaries or mainstem areas, some being up to several weeks and over a thousand miles from their spawning grounds. Like other mixed stock fisheries, Yukon River commercial fisheries must be managed to minimize the risk, to the extent possible, that tributary populations would be under or over harvested in relation to their actual abundance. Given the current state of knowledge and technology, management for individual stocks in mixed stock fisheries is only possible for a few specific stocks, and only stocks within the Tanana and Anvik rivers can be managed within terminal harvest areas (Estensen et al. 2012).

Summer and fall chum comprise most of the Yukon area commercial salmon harvest; coho salmon are also harvested concurrently with fall chum salmon. Directed Chinook salmon fishing in the Yukon River has been strictly curtailed in recent years due to low abundance, and in 2011 and 2012, even sale of incidentally caught Chinook salmon was prohibited through most of the season. Preliminary salmon harvest totals for the Yukon area in 2012 included approximately 317,000 summer chum; 282,000 fall chum; and 36,000 coho salmon (State of Alaska, Department of Fish and Game website, <http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.bluesheet>, 21 September 2012).

KUSKOKWIM AREA

The Kuskokwim Area includes the Kuskokwim River drainage basin and all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, plus Nunivak and St. Matthew Islands. Approximately 17,000 people live in the Kuskokwim area, including 6,080 in the hub community of Bethel, and the remainder in some 37 small villages scattered along the length of the river and its tributaries and the adjacent coastline. Alaska Natives represent over 80% of the total population in the area, predominantly of Yup'ik origin, along with some Athabascan origin communities in the upper river. About 65% of Bethel residents are Alaska Native (State of Alaska, <http://labor.alaska.gov/research/census>).

The Kuskokwim River supports large runs of Chinook, sockeye, chum, coho, and pink salmon, with important fisheries on all except pink salmon. Other fish resources utilized in the area include herring in marine waters and whitefish, inconnu or sheefish, and miscellaneous species including Dolly Varden and burbot in freshwater.

Subsistence is the dominant fishery in the Kuskokwim area, and the Kuskokwim subsistence salmon fishery is one of the largest and most important in the state and in North America (Brazil et al. 2011). Subsistence fishing traditions have been perpetuated through the generations by both Yup'ik and Athabascan people. Despite many social, economic, and cultural changes over the past 100–150 years, subsistence fishing remains an important feature of life throughout the area (Brown et al. 2012). According to recent surveys, about 3,700 households out of an estimated total of 4,200 households in the Kuskowkim area indicated that they usually harvest salmon, and in 2010 about 2,700 households actually fished (Carroll and Hamazaki 2012). Even those households not directly involved in catching salmon frequently assist family and friends with processing fish, and catches are shared and widely distributed among households. Nearly all local residents depend to some degree on fish and game resources for their sustenance and livelihood.

Chinook salmon are by far the preferred species in the subsistence fishery. Over 69,000 Chinook salmon were harvested for subsistence use in 2010, yet this harvest was smaller than in any of the preceding 20 years due mainly to poor returns in 2010 (Carroll and Hamazaki 2012). Continuing low returns and unprecedented restrictions to the subsistence fishery in 2011 and 2012 have likely had a further effect on reducing the total subsistence Chinook salmon harvest. Chum and sockeye salmon are also harvested for subsistence, but usually in smaller numbers: in 2010 the harvest totals were about 47,000 chum and 40,000 sockeye salmon (Carroll and Hamazaki 2012).

Chum, sockeye, and coho salmon are harvested in the commercial fisheries in Kuskokwim River and Kuskokwim Bay. Directed fishing for Chinook salmon in Kuskokwim River was discontinued by regulation in 1987, but in Kuskokwim Bay, Chinook salmon may still be targeted subject to a gillnet mesh size restriction of 6 inches or less (Brazil et al. 2011). In 2012, preliminary harvest estimates for Kuskokwim River are about 86,000 coho, 65,000 chum, and 2,800 sockeye salmon. For Kuskokwim Bay, the 2012 preliminary totals are about 56,000 coho, 86,000 chum, 87,000 sockeye, and 8,250 Chinook salmon (State of Alaska, Department of Fish and Game website, <http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.bluesheet>, 21 September 2012). The preliminary total salmon harvest for the entire Kuskokwim area was about 392,000 fish, a sharp decline from recent years' totals and less, by about 14%, than the 10 year average from 1999 to 2008 (Brazil et al. 2011). Whereas commercial harvests were limited in the recent

past because of poor salmon returns, low salmon market values, and limited processing capacity, in 2012 the commercial fishery was primarily constrained by closures for Chinook salmon conservation.

As in other areas of the state, general fisheries management goals in the Kuskokwim area are to sustain production of the resource, maintain a subsistence priority, and allow harvest of remaining surpluses. Most Kuskokwim area fisheries, in both the bay and river, occur in areas where migrating salmon species and stocks are mixed and upriver stocks are still far from their spawning grounds. Furthermore, most salmon stocks in this area are not distinguishable from one another using currently available genetic markers (W. Templin, ADF&G Gene Conservation Laboratory, Anchorage; personal communication). Therefore, fishery schedules are conservatively designed to distribute harvest as much as possible over the entire time period of each run and reduce the potential for over harvesting or under harvesting specific stocks or populations. Most Kuskokwim area research is focused on obtaining biological samples to adequately represent all components of each harvested salmon run, and estimates or counts of escapements into tributaries. These data are being incorporated into run reconstruction models, enabling better assessments of the salmon fisheries in relation to salmon returns.

PROPOSED PROJECTS

The suite of proposed projects presented in this section would provide necessary research and support management activities in each management area. For the Arctic area, 6 salmon projects, 2 marine research projects, and 3 general management support projects are proposed. For the Yukon area, 8 research projects are proposed to improve understanding of Chinook, chum, and coho salmon; whitefish; and lamprey populations important for commercial and subsistence fisheries. For the Kuskokwim area, 14 projects for salmon and whitefish assessments are proposed, many of which would extend ongoing research and management activities in need of more stable sources of funding. Additionally, 3 general support projects are proposed for the Kuskokwim area. Regionally, 2 projects are proposed to enhance the stock biology program through quality control improvements and training, and a third project, a marine survey program, is proposed to assess status of juvenile salmon from the Yukon and other rivers in the region (Table 1).

ARCTIC AREA

Proposed salmon projects for the Arctic Area are designed to support salmon fishery management by providing more information on run timing and inseason abundance, improve salmon monitoring at poorly monitored sites, and gain understanding of sockeye salmon dynamics in the Glacial Lake/Pilgrim River system. Other projects include benthic habitat mapping to better understand crab habitat needs, and budget supplements to support annual subsistence permit collection, surveys, and program support in the Kotzebue office (Table 2).

I. Arctic Area Salmon Projects

Project I-A: Unalakleet Subdistrict Chinook salmon test fishery

Project location

Marine areas near the village of Unalakleet.

Primary objective

Conduct a test fishery for Chinook salmon in the marine waters north and south of Unalakleet to develop an early season index of Chinook salmon abundance and assist in management of fisheries Unalakleet area fisheries.

Project description

Chinook salmon in Subdistricts 5 and 6 were designated a yield stock of concern by the Alaska Board of Fisheries in 2004 and sport and subsistence fisheries within these districts are intensively managed. Currently, management decisions for Chinook salmon harvest in the marine waters and lower Unalakleet River are based on Chinook salmon counts at the North River counting tower and the Unalakleet River weir in the mainstem. However it can take 10 days to 2 weeks for Chinook salmon to migrate past the counting tower or weir; thus management decisions for subsistence harvest in the marine waters and lower Unalakleet River must be conservative to ensure Chinook salmon escapement objectives are met. Additionally, opening the commercial chum salmon fishery may be delayed to minimize incidental catch of Chinook salmon.

A nearshore test fishery would provide a daily index of abundance and movement of Chinook salmon into the Unalakleet Subdistrict. These standardized catch statistics would be used as an early indicator of Chinook salmon run strength and timing, thus allowing more timely management decisions to ensure escapement goals are achieved and harvest is maximized.

This project will be conducted in June in the marine waters immediately north and south of the village of Unalakleet using a variable mesh set gill net. Nets will be 50 fathoms in length and made up of four 75 ft variable mesh panels (8.0", 7.5", 7.0", and 6.5"), to capture Chinook salmon greater than 660 mm in length. Salmon caught will be given to local subsistence users; any chum salmon refused by subsistence users for human consumption or dog food will be sold to Norton Sound Seafood Products for use as crab hanging bait.

Project duration

Long term

Estimated costs

\$22,000 per year

Project I-B: Tracking Chinook salmon movement in Norton Sound

Project location

Nearshore waters of Norton Sound and major salmon spawning rivers within the Norton Sound region.

Primary objective

Tag adult Chinook salmon in the marine waters of Norton Sound and track their movements and migration patterns into local rivers.

Project description

Management of Shaktoolik and Unalakleet subdistricts are primarily based on data collected from Unalakleet River stock assessment projects. To expand the suite of assessment projects, a sonar feasibility study is currently being tested on the Shaktoolik River and a marine test fishery is being investigated in waters adjacent to the Unalakleet River. While these and established assessment projects provide insight into escapement to these river systems, all commercial harvest and much subsistence harvest occurs in the marine environment on mixed stocks. Current genetic assessment cannot distinguish stocks between these river systems or other rivers in southeastern Norton Sound. It is unknown how timing and location of fishery harvest may differentially harvest specific stocks within southeastern Norton Sound; salmon migration patterns and offshore distribution relative to fishery activity are poorly understood.

Acoustic tag technology would make it possible to track tagged salmon through nearshore marine waters and to their rivers of origin. Movement patterns and timing can enhance the efficacy and interpretation of data collected from projects like the Unalakleet marine test fishery. Tag recoveries could lead to harvest apportionment estimates of marine subsistence and commercial salmon harvests, which has important implications for establishing new escapement goals, reevaluating existing escapement goals, and improving management precision by enhancing existing assessment tools.

Salmon will be captured in the marine waters with variable mesh gillnets. Salmon will be tagged with acoustic tags and immediately released. Receiver arrays will be placed in streams and nearshore marine waters to monitor migration patterns. While this project concept is focused on southeastern Norton Sound Chinook salmon, it can be altered to include other salmon species and subdistricts, depending on funding availability and management needs.

Project duration

Three years

Estimated costs

\$300,000 per year

Project I-C: Coho salmon escapement at Unalakleet River weir**Project location**

Unalakleet River

Primary objective

Provide funding to modify and operate the Unalakleet River weir through the coho salmon run.

Project description

The Unalakleet River is the largest producer of coho salmon within Norton Sound yet the majority of the run is uncounted because it returns later than the operating period of the Unalakleet River weir. Currently the weir operates from mid-June to July 31 and to effectively capture the coho salmon run weir operations should be extended to mid-September.

At the inception of the Unalakleet River weir project, concern was expressed about hindering movement of boaters on the river, specifically during moose hunting season. To accommodate this ADF&G pulls the weir before hunting season begins. The weir has been equipped with a boat gate making travel over the weir simpler than expected. The addition of this boat gate makes it possible to keep the weir in place though the coho salmon run. However, a light source will need to be added to the boat gate so it is useable at night.

Project duration

Long term

Estimated costs

\$35,000 for first year, and \$30,000 per year for subsequent years.

Project I-D: Noatak River sonar

Project location

Noatak River, approximately 15 miles north of Kotzebue.

Primary objective

Estimate daily and seasonal chum passage and run timing.

Project description

Salmon runs in the Kotzebue area are poorly monitored; there is one test fishery project on the Kobuk River and elsewhere, aerial surveys are the primary assessment tool. However, aerial surveys are not possible in all years due to funding limitations, helicopter or fixed-wing aircraft availability, or poor environmental conditions. Historically there have been attempts to monitor salmon movement in the Noatak River using sonar. Begun in 1980, it operated intermittently until 1994 when it was shut down for lack of qualified personnel.

This site can be reestablished with a high likelihood for success because the original site on the Noatak River was confined to a V-shaped bedrock channel so there is little possibility of a channel profile change; counts would be primarily on a single species.

Project duration

Long term

Estimated costs

\$280,000 start-up, and \$80,000 per year for subsequent years.

Project I-E: Glacial Lake sockeye salmon adult enumeration

Project location

Glacial Lake, approximately 45 miles northwest of Nome.

Primary objective

Provide funding to enumerate adult sockeye salmon entering Glacial Lake.

Project description

Currently there is no dedicated funding to enumerate adult sockeye entering Glacial Lake. Recently, video monitoring in combination with a weir has become a low cost viable option for counting sockeye salmon at Glacial Lake. Annual funds are required to deploy and remove the video system and weir, and maintain the system through the season. Funding would cover charter transportation costs for set up and removal, and equipment maintenance.

Project duration

Long term

Estimated costs

\$12,000 per year

Project I-F: Bonanza River coho salmon adult enumeration

Project location

Bonanza River, mouth located about 33 miles east of Nome.

Primary objective

Provide funding to enumerate adult coho salmon entering Bonanza River.

Project description

Currently there is no assessment project on Bonanza River yet its coho salmon return is the largest among eastern Nome subdistrict rivers. Enumerating coho salmon on Bonanza River will provide managers with baseline information about return size and timing, which can then be used to inform decisions about potential coho salmon commercial fisheries within the subdistrict.

The development of video monitoring has provided the option to conduct small, low cost assessment projects on salmon runs that may not merit full scale enumeration projects. Bonanza River coho salmon is a candidate for video monitoring. First year funding would cover initial purchase of monitoring equipment and power generation; subsequent years' costs would cover operating and maintenance expenses.

Project duration

Long term

Estimated costs

\$20,000 for the first year, and \$7,000 per year in subsequent years.

II. Arctic Area Marine Projects***Project II-A: Benthic mapping for crab habitat*****Project location**

Nearshore waters of eastern Norton Sound.

Primary objective

Use side-scan sonar to map local bottom habitat within eastern Norton Sound.

Project description

Adult red king crab migrate depending on life history stage; they move to nearshore waters for breeding in late winter and spring, and to offshore waters for feeding and molting in summer and fall. In addition to this migration, adult red king crab may be driven to follow sea ice patterns as adults are typically less tolerant of fresh water than juvenile crab. Based on movement patterns of adult red king crab, nearshore areas may be refuges for juvenile red king crab seeking to escape predation by conspecifics. Further, nearshore areas may contain complex habitat structure capable of providing consistent food resources and increased protection from predators.

Historically, trawl surveys have been conducted every 3 years to assess red king crab abundance within Norton Sound. However there are areas within Norton Sound that are not suitable for trawling. Typically these areas are located near shore and make up a large portion of eastern Norton Sound, (i.e. east of Cape Nome). In addition to trawl surveys, a number of pot surveys have been conducted in both winter and summer but have generally been limited to waters around Nome.

Nearshore areas are closed to commercial red king crab fishing to protect subsistence harvest and also to potentially protect critical habitat and minimize handling rates of sublegal and female red king crab. A closure line was established in 1981, which prohibits commercial fishing within 15 miles of the north shore of Norton Sound.

A recently funded project is deploying small mesh crab pots in the nearshore waters between Topkok Head and Cape Darby to obtain indices of juvenile and female red king crab relative abundance. To supplement this research, side-scan sonar would be used to map the benthic habitat in these locations, and look for correlations between crab abundance and habitat type. This work can serve as a pilot study for research identifying essential habitat for juvenile red

king crab within Norton Sound. Establishing essential habitat type will enable fishery managers to make informed decisions about use of the closure line.

Project duration

Three years

Estimated costs

\$150,000 per year

Project II-B: Capelin spawning abundance and distribution in Norton Sound

Project location

Norton Sound

Primary objective

Assess spawning abundance and distribution of capelin, a primary prey species for juvenile Chinook salmon, in Norton Sound.

Project description

Capelin are prey for top level predators including sea birds, marine mammals, and predatory fish. Juvenile Chinook salmon from the Yukon and Norton Sound rivers rear in Norton Sound and the northern Bering Sea shelf during their first summer at sea. Studies have identified larval capelin as a primary food source for juvenile Chinook salmon in this area.

Within Norton Sound, capelin are reported to spawn on the sandy beaches between Golovnin Bay and Cape Rodney and anecdotal information suggests spawning capelin distribution may be more extensive. Spawning areas within Norton Sound were documented in the early 1980s and have not been revisited.

Norton Sound is unique in Alaska where mining of placer deposits for gold occurs within a mile of shore. Recreational gold mining along the shoreline has been conducted for decades and there have been limited commercial ventures attempting to extract minerals as well. It is currently unknown how dredging activities may impact capelin spawning habitat, capelin abundance and distribution, but a decline in capelin abundance may cause a trophic cascade with consequences for important fisheries species including Chinook salmon. In light of the known importance of larval capelin in juvenile Chinook salmon diets and the continued decline of Chinook salmon runs in Norton Sound and the Yukon River, more research is needed to increase our understanding of the environment necessary to support forage fish populations.

Funds are required to conduct a 3 year study to identify the distribution, timing, and biological composition of capelin, and the physical environmental characteristics associated with spawning habitat.

Project duration

3 years

Estimated costs

\$80,000 per year

III. Miscellaneous Arctic Area Projects***Project III-A: Norton Sound subsistence surveys and management supplement*****Project location**

Norton Sound Area

Primary objective

Provide needed funds to determine subsistence salmon harvest and age composition by species, and to support other baseline research and management programs.

Project description

Since the implementation of Tier II permitting requirements, Norton Sound managers are responsible for issuing and retrieving subsistence salmon permits in 5 northern Norton Sound villages. Area biologists also conduct subsistence salmon surveys in 4 southern Norton Sound villages. Costs for subsistence surveys include personnel, travel, printing, phone, postage expenses, and staff time needed for data analysis and interpretation. Funds are needed to support this added and underfunded responsibility.

In addition to harvest surveys, proposed funding would be used to initiate a stakeholder sampling program to collect age, sex, and length for subsistence harvested salmon. This type of program has been successful in other areas of AYK and would provide valuable information about a segment of the salmon returns that are consistently underrepresented in current sampling efforts.

Project duration

Long term

Estimated costs

\$50,000 per year

Project III-B: Kotzebue Sound management supplement**Project location**

Kotzebue Area

Primary objective

Provide needed funds to program management.

Project description

Kotzebue Sound management funds are needed to cover the costs of program management in that district, which are currently underfunded. This has led to diversion of Norton Sound management funds for utilization in Kotzebue district to pay 2 months of Office Assistant time in Kotzebue. Norton Sound management funds are also used to fund office expenses split under CAP costs for the Kotzebue Fish & Game office. Lastly, Norton Sound management funds are used for costs associated with travel to Kotzebue and for truck and vessel expenses. Funds are needed to support underfunded program operations in the Kotzebue district.

Project duration

Long term

Estimated costs

\$25,000 per year

Project III-C: Management supplement for Norton and Kotzebue Sound aerial surveys**Project location**

Northern Norton Sound and Kotzebue.

Primary objective

Provide funds to program management to cover increased cost of aerial surveys.

Project description

In Norton Sound and Kotzebue, fishery management decisions are based on information collected from enumeration projects and aerial surveys. In northern Norton Sound, aerial surveys are conducted using helicopters and there are few other options for completing surveys using other methods. In 2012, the hourly rate for a helicopter increased approximately 20% and another price increase is anticipated in 2013. Increased costs of aerial surveys in Northern Norton Sound and Kotzebue have limited the number and scope of aerial surveys conducted. Funds are needed to support underfunded aerial survey program operations in Norton Sound and Kotzebue districts.

Project duration

Long term

Estimated costs

\$20,000 per year

YUKON AREA

Yukon Area proposals are directed towards improving information on Chinook, summer chum, and coho salmon, as well as whitefish and lamprey (Table 3). For all salmon the focus is on obtaining accurate run abundance, escapement, and age composition estimates (6 projects). For nonsalmon species, basic run timing and relative abundance estimates are sought, which would support management of small scale fisheries on these species (2 projects).

I. Yukon River Salmon Assessments

Project I-A: Yukon River summer chum salmon radiotelemetry studies

Location

Yukon River Drainage

Primary objective

To provide migratory characteristics and escapement distribution of summer chum salmon among major tributaries in the Yukon River drainage

Description

Implementation of this program would greatly assist in the conservation and management of Yukon River summer chum salmon by collecting more precise information on stock composition, run timing, movement patterns, and spawning distribution. Summer chum salmon are harvested in important subsistence, commercial, and personal use fisheries throughout the majority of the Yukon River drainage.

Radiotagged fish migrating upriver will be recorded by remote tracking stations located at approximately 37 sites along important migratory routes and spawning tributaries. Recorded information for each tagged fish will be used to estimate migration rates and describe movement patterns of the different stocks tagged during the run. This work would be complemented by the stock identification project conducted annually on chum salmon for inseason fishery management.

Aerial tracking surveys will be flown to determine the status of radio tagged fish in nonterminal reaches of the basin, and obtain detailed movement and distribution information in spawning tributaries. The information will then be used to estimate the population and proportional distribution of summer chum salmon within major tributaries, with particular emphasis on the Anvik, Koyukuk, and Tanana river stocks.

Summer chum salmon will be captured with drift gillnets and marked at Dogfish (old village) near Russian Mission. Marked fish will receive a primary spaghetti tag, secondary external mark, and internal radio tag transmitter; and other biological data will be collected (age, sex, length, and genetics sample). In addition to tracking, marked fish will be recovered opportunistically at various run assessment sites and from fishery harvests.

Project duration

Three years, with full scale tagging and recovery fieldwork during years 1 and 2; dismantling or powering down receiver system, analysis and reporting during year 3.

Estimated costs

Total \$1,869,000 for 3 years: \$1,025,000 in the first year (includes cost of purchasing tags for both years of field work); \$563,000 in the second year; and \$281,000 in the third year (includes shutdown and report writing).

Project I-B: Yukon River coho salmon radiotelemetry studies**Location**

Yukon River

Primary objective

To provide migratory characteristics and escapement distribution of coho salmon among major tributaries in the Yukon River drainage.

Description

Implementation of this program would greatly assist in the conservation and management of Yukon River coho salmon by collecting more precise information on run timing, movement patterns and spawning distribution, and stock composition. Currently coho salmon are harvested in subsistence, commercial, personal use, and sport fisheries yet little is known about the abundance and distribution of the Yukon River stocks.

Radiotagged fish migrating upriver will be recorded by remote tracking stations located at approximately 37 sites along important migratory routes and spawning tributaries. Recorded information for each tagged fish will be used to estimate migration rates and describe movement patterns of the different stocks tagged during the run.

Aerial tracking surveys will be flown to determine the status of radio tagged fish in nonterminal reaches of the basin, and obtain detailed movement and distribution information in spawning tributaries. The information will then be used to estimate the population and proportional distribution of coho salmon within major tributaries.

Coho salmon will be captured with drift gillnets and marked at Russian Mission. Marked fish will receive a primary spaghetti tag, secondary external mark, and internal radio tag transmitter, and other biological data will be collected (age, sex, length, and genetics sample). In addition to tracking, marked fish will be recovered opportunistically at various run assessment sites and from fishery harvests.

Project duration

Three years, with a feasibility study in year 1, full scale tagging and recovery in year 2, and system power down, data analysis, and reporting in year 3.

Estimated costs

Total \$1,922,000 for 3 years: \$903,000 in year 1 (includes cost of purchasing tags for year 2); \$738,000 for year 2 (includes cost for an additional tagging crew); and \$281,000 for year 3 (includes shutdown and report writing).

Project I-C: Anvik River chum sonar project**Location**

Yukon River

Primary objective

To enumerate daily and annual escapement of summer chum salmon in one of the most important summer chum spawning tributaries on the Yukon River.

Description

The Anvik River is one of the largest producers of summer chum salmon in the Yukon River drainage. The Anvik River sonar project was initiated in 1979 and is one of the longest running projects in the Yukon River. Because of the longevity of the project and overall contribution to information about the summer chum salmon run, it has been extremely important in setting escapement goals and managing the summer chum salmon stocks in the Yukon River. The Anvik River sonar project counts migrating chum salmon using DIDSON sonar on both banks. Passage estimates are provided daily to fishery managers to aid in management decisions and to determine whether escapement objectives are achieved. The project is currently funded by the United States Fish and Wildlife Service Office of Subsistence Management, and this agency has been experiencing budget reductions in recent years. Because of the uncertainty in the funding source, this project seeks to fund the Anvik River sonar project through State of Alaska general funds. Two seasonal FWT II positions (2 months) and one FWT III position (2 months) would be funded.

Project Duration

Long term

Estimated annual cost

\$100,000

Project I-D: Anvik River Chinook salmon carcass sampling**Location**

Yukon River

Primary Objective

Collect age, sex, and length data from Chinook salmon of Anvik River origin.

Description

This project would collect biological data from Anvik River Chinook salmon for the purpose of identifying population characteristics of this Chinook salmon stock. The project would gain efficiency by utilizing crew and facilities at the Anvik River sonar site. Funds would be needed for travel, additional seasonal staff time, equipment maintenance, and supplies.

Project Duration

Long term

Estimated Annual Costs

\$10,000

Additional costs for personnel and field site logistics will be avoided if the Anvik River sonar (Project I-C) continues operation and staff and facilities can be shared between these 2 projects.

Project I-E: Sheenjek River fall chum sonar project

Location

Upper Yukon River

Primary objective

To enumerate daily and annual fall chum salmon escapement in one of the most important fall chum spawning tributaries on the Yukon River.

Project description

The Sheenjek River is a tributary of the Porcupine River and is one of the major producers of fall chum salmon in the Yukon River drainage. Fall chum salmon typically spawn in the upper portion of the drainage in spring-fed streams that usually remain ice-free during the winter. Because of the importance of the Sheenjek River as Yukon fall chum spawning habitat, a sonar project on this tributary was initiated in 1981 and has operated annually since. The project currently operates DIDSON sonar on each bank to count migrating fall chum salmon. Passage estimates are provided daily to fishery managers to aid in management decisions and to determine whether escapement objectives are achieved. There is currently no dedicated funding for this project. This project would fund 2 seasonal FWT II positions (3 months) and partially fund a permanent full-time FB II (6 months).

Project Duration

Long term

Estimated annual cost

\$112,000

Project I-F: Upper Yukon River Chinook salmon aging consistency

Location

Upper Yukon River

Primary Objective

Investigate age determination consistency in Chinook salmon from the upper Yukon River drainage.

Description

The methods for estimating Canadian Chinook salmon brood tables, run reconstructions, and run size projections assumes that age determinations have been consistent and precise over the years. Any inconsistencies would add uncertainty to these important analyses. Furthermore, inconsistencies and age determination errors would also affect any analyses investigating changes in age and growth patterns of these fish over time. This project would greatly improve scientific credibility of and confidence in run size estimates and projections, as well as studies investigating temporal patterns in age and growth of Yukon Chinook salmon.

This project would first review and compile age data from Canadian-origin Chinook salmon determined independently by ADF&G and Department of Fisheries and Ocean Canada (DFO) staff. The AYK regional stock biology program will perform QA/QC on selected data; perform statistical tests to determine if age determination was consistent between the 2 agencies; and identify possible biases. If found, errors in the ADF&G AYK database will be corrected and the corrected information will be shared with DFO.

If these results suggest significant historical inconsistencies, a second part of this project will be implemented to standardize ages across time. Given age criteria identified in the age data review (particularly for freshwater age-2 growth), previously aged Canadian-origin scales will be reanalyzed with the newly established criteria to standardize ages across years and provide historical consistency. Funding would be required for staff time required to conduct this study. Other laboratories may also be contracted to provide independent review of age determinations.

Project Duration

One year for initial review; with 2 additional years depending upon results from first year.

Estimated Annual Costs

\$20,000 first year; \$15,000 per year for 2 additional years, as needed.

II. Yukon River Nonsalmon Species Assessments

Project II-A: Yukon River whitefish monitoring and assessment program

Location

Lower Yukon River

Primary objectives

To monitor commercial fishing and determine the run timing, relative abundance, biological characteristics (e.g. ages, sex ratios, lengths, maturity), and distribution of whitefish stocks in the Lower Yukon River.

Project description

Little is known about the life histories and adaptive strategies employed by the 5 species of whitefish common to the Yukon River delta. Currently, there is an effort to expand a commercial freshwater whitefish (Bering cisco) fishery in the lower river, which since 2005 has been prosecuted with a commercial harvest cap of around 10,000 lbs. This project would conduct test fishing with gillnets with 3.5 inch mesh size or less from late July until the end of the whitefish migration, which may last until after the river has frozen in mid-October or November. Additionally, the project would employ staff on site to monitor the Bering cisco commercial fishery and obtain harvest and effort data. This type information must be systematically collected and analyzed before any expansion from the current commercial harvest levels can be supported.

Project duration

Long term

Estimated annual costs

\$38,000

Project II-B: Yukon River lamprey assessment

Location

Lower Yukon River

Primary objectives

To determine the run timing and relative abundance of lamprey in the Lower Yukon River.

Project description

Little is known or documented about the distribution and abundance of lamprey populations in the Yukon River. While a small commercial lamprey fishery in the lower Yukon River has been prosecuted in recent years, more information on lamprey needs to be collected before any changes in the commercial harvest can be considered. This project will provide an estimate of

lamprey abundance that could be examined across years to understand the population cycle, derive escapement goals, and establish harvest guideline ranges.

This project will utilize a Dual Frequency Identification Sonar (DIDSON) to count lamprey migrating under the ice at 2 communities in the lower Yukon River (e.g. Marshall and Grayling). Currently, DIDSON sonar is successfully used at multiple sites across Alaska to count salmon, and preliminary work conducted in 2005 was successful in detecting swimming lamprey. Anecdotal evidence suggests the duration of the lamprey run is typically short, lasting from less than an hour to 10 days during approximately the middle of November. Based on communication with lower river villages, 2 biologists will travel to the lower Yukon River, deploy sonar on one bank, and count lamprey over the duration of the run at 2 separate villages. The duration of the field work is estimated to be about 14 days.

Project duration

Long term

Estimated costs

\$57,000 initial startup; \$47,000 per year for subsequent years.

KUSKOKWIM AREA

On the Kuskokwim River, 7 projects are proposed for salmon abundance estimation and escapement monitoring and biological and genetic sampling of salmon and whitefish. For rivers draining into Kuskokwim Bay, 5 projects are proposed for salmon abundance estimation and escapement monitoring. Three additional projects are proposed to support data collection and analyses necessary for abundance and escapement estimation throughout the area. Support is also proposed to meet ongoing staffing and facility maintenance needs (3 projects; Table 4).

I. Kuskokwim River Salmon and Whitefish Assessments

Project I-A: Kuskokwim River postseason salmon age-sex-length analysis

Location

Kuskokwim River

Primary objective

Provide processing and assessment of salmon age-sex-length (ASL) data for use in the management of Kuskokwim Area subsistence and commercial fisheries.

Description

The monitoring platform in place along the Kuskokwim River collects thousands of ASL samples that contribute in many ways to management and overall understanding of escapement and harvest patterns. This project would provide salary for a FWT IV/FBI program coordinator

and a FWT II/III (4 months) trained to analyze age-sex-and length information from the salmon stock assessment projects and fisheries in the Kuskokwim River. Currently this staffing need is being provided through grants with the United States Fish and Wildlife Service (USFWS) Office of Subsistence Management, which require periodic renewal.

Duration

Long term

Estimated annual cost

\$75,000

Project I-B: Telaquana Lake weir and Kuskokwim River sockeye salmon escapement enumeration

Location

Kuskokwim River

Primary objective

Use a weir to count sockeye salmon migrating into Telaquana Lake, in conjunction with genetic mark recapture methods to estimate total inriver abundance of Kuskokwim River sockeye salmon.

Description

Sockeye salmon have been an important subsistence resource along the Kuskokwim River for generations. More recently there has been increasing interest in harvesting Kuskokwim sockeye salmon commercially. Understanding the variability in total abundance and stock composition is critical to successful management of sockeye salmon. This project extends a current project which monitors sockeye salmon migrating into Telaquana Lake and is funded by a short-term grant only through the 2014 season. Telaquana Lake supports the majority of the lake type sockeye salmon that spawn and rear the Kuskokwim River drainage. Genetic characteristics of the Telaquana Lake population appear to be distinct from other sockeye populations within the Kuskokwim watershed. The feasibility of using genetic markers for the Telaquana Lake population in a drainagewide genetic mark–recapture study is currently being assessed. The initial sample for the mark–recapture study is being collected in the Bethel test fishery, to determine the number and proportion of Telaquana Lake sockeye salmon. The count of sockeye salmon at the Telaquana Lake weir constitutes the second sample for the mark–recapture study.

Duration

Long term

Estimated annual cost

\$115,000

Startup costs will be avoided if this project can be continued without a break when grant funding expires.

Project I-C: Salmon (Aniak) River salmon escapement enumeration

Location

Aniak River drainage within the Kuskokwim River system.

Primary objectives

Enumerate escapement of salmon by species into the Salmon River, a tributary to the Aniak River.

Description

Aniak River is one of the largest producers of salmon in the Kuskokwim watershed. However, estimating salmon escapement into the Aniak River has been difficult. Sonar methods have been used for a number of years, but counts are not apportioned to species and have been used primarily as an index of chum salmon escapement. The proposed weir site on Salmon River was used in the past as a recapture site for tagged Chinook and coho salmon. The weir performed well and data collected there indicated that a large number of Chinook salmon spawn in Aniak River drainage. A consistent proportion of Chinook and coho salmon appear to return to the Salmon River, compared with the whole Aniak River drainage. An escapement counting weir on the Salmon River will provide an annual index of escapement for all salmon species in the Aniak River. This project would likely be a cooperative venture between ADF&G Division of Commercial Fisheries and Kuskokwim Native Association.

Duration

Long term

Estimated annual cost

\$150,000

Project I-D: Bethel test fishery ASL and genetic sampling

Location

Kuskokwim River drainage.

Primary objectives

Provide additional staff salary for one FWTII (3 months) and to cover additional cost of ASL and genetic sampling for all species captured in the Bethel test fishery.

Description

Salmon age, sex, and length data have been collected from the Bethel test fishery intermittently over the past 20 years. Consistent collection of this information would allow for analysis of mesh size selectivity and long-term monitoring of salmon age and size composition. Additionally, genetic identification of sockeye salmon stocks has been proposed to develop a riverwide mark–recapture estimate (see Project I-B). The additional time required to collect these data would require an additional crew member, and additional overtime for the existing crew. This project would likely be a cooperative venture between ADF&G Division of Commercial Fisheries and the Association of Village Council Presidents or Orutsararmuit Native Council.

Duration

Long term

Estimated annual cost

\$40,000

Project I-E: Kuskokwim River chum salmon escapement estimation**Location**

Kuskokwim River

Primary objective

Estimate chum salmon escapement using mark–recapture and newly developed modeling techniques.

Description

Chum salmon are the dominant species of salmon in the Kuskokwim River and provide a consistent commercial opportunity that can enhance local economies. In order to maximize harvest opportunities, reliable escapement estimates are needed but there are currently no drainagewide escapement estimates for chum salmon. Improvements in tagging and modeling methods present an opportunity to obtain an estimate of total Kuskokwim River chum salmon escapement. In addition to providing ongoing annual escapement estimates, a reliable drainagewide escapement estimate can also be applied to a retrospective run reconstruction model to estimate abundance and escapement back to 1988. This model has already been developed and only the lack of accurate total run estimates is keeping it from being put into use.

Duration

Three years

Estimated annual cost

\$300,000

Project I-F: Kuskokwim River whitefish ASL collection

Location

Kuskokwim River

Primary objectives

Obtain ASL samples from subsistence caught whitefish in the Lower Kuskokwim River.

Description

Whitefish are an important subsistence species in the Kuskokwim area and small scale catcher–seller whitefish and nonsalmon commercial fisheries have occurred sporadically in the Kuskokwim River. Until recently, little information was available about Kuskokwim River whitefish populations. The U.S. Fish and Wildlife Service and ADGF&G Division of Subsistence have initiated programs in recent years to determine life history and subsistence harvest patterns of Kuskokwim River whitefish populations. This project seeks to extend an existing subsistence salmon harvest ASL collection program to whitefish. In the current program, subsistence fishers are recruited to collect and document scales and sex and length information from salmon in their subsistence catch. Subsistence samplers are compensated on a per sample basis. Proposed funding would be used to additionally compensate subsistence samplers for whitefish samples, and for staff time and logistics costs associated with these collections. This project would likely be a cooperative venture between ADF&G/CF and Association of Village Council Presidents or Orutsararmuit Native Council.

Duration

Long term

Estimated annual cost

\$50,000

Project I-G: Upper Kuskokwim River tributary salmon escapement enumeration

Location

Headwaters of the Kuskokwim River drainage.

Primary objectives

Enumerate escapement of salmon species into a headwaters tributary of the Kuskokwim River.

Description

Harvest timing of the subsistence fishery in the lower Kuskokwim River in early June is at the beginning of the run when other species are absent and fishermen can effectively catch large numbers of Chinook salmon. Considering this in light of the run timing of Chinook salmon overall, suggests a higher rate of harvest on the earliest arriving fish, which are likely bound for the upper tributaries of the Kuskokwim River, than on other substocks that we already monitor.

An enumeration weir on the Salmon River of the Pitka Fork or Little Tonsona River would help to indicate if the early Chinook harvest in the lower Kuskokwim River is disproportionately affecting escapement in the headwaters of the Kuskokwim River. This area also supports known populations of fall chum salmon, as well as other salmon species. This would likely be a cooperative project with the village of Nikolai.

Duration

Long term

Estimated annual cost

\$150,000

II. Kuskokwim Bay Salmon

Project II-A: Kanektok River Chinook and chum salmon radiotelemetry study

Location

Kanektok River, District W-4.

Primary objective

Estimate the proportion of Chinook and chum salmon that spawn below the Kanektok River weir using radiotelemetry methods.

Description

The Kanektok River is the main spawning stream in the District 4 commercial salmon fishery. The Kanektok River also supports important subsistence and sport fisheries. The Kanektok River weir is located approximately 42 miles upstream from Kuskokwim Bay where most District 4 commercial fishery occurs. Because the weir is so far upstream, a significant number of salmon likely spawn below it, preventing a complete assessment of escapement. The proposed initiative seeks to develop a 3-year radiotelemetry study that will provide information on how many salmon spawn below the weir. This study would likely be a cooperative venture between ADF&G Division of Commercial Fisheries, the Native Village of Quinhagak (NVK), and the U.S. Fish and Wildlife Service.

Duration

Three years

Estimated costs

\$250,000 first year, and \$150,000 per year for the following 2 years.

Project II-B: Middle Fork Goodnews River coho salmon escapement enumeration

Location

Middle Fork Goodnews River, District W-5.

Primary objectives

Monitor coho escapement by extending the operation of the Middle Fork Goodnews River weir through September.

Description

The Goodnews River drainage is the main spawning drainage for the District 5 commercial salmon fishery. The drainage also supports important subsistence and sport fisheries on returning salmon. Currently, these fisheries are managed by monitoring salmon escapement at the Middle Fork Goodnews River weir. However, the department does not fund operation of the weir during the coho season. Since 1997, the U.S. Fish and Wildlife Service has provided grant funding to extend the operation of the weir into September, which has made possible a complete assessment of coho salmon escapement and run timing, and collection of other biological data. The extension also allows for the complete assessment of pink salmon escapement and enumeration of migrating of Dolly Varden, which is an important subsistence and sport fishing species. This proposed initiative seeks long term and stable state operating funds for the extended operation of the Middle Fork Goodnews River weir.

Duration

Long term

Estimated annual cost

\$40,000

Project II-C: Arolik River weir

Location

Arolik River, District W-4.

Primary objectives

Use a weir to estimate annual escapement of Chinook, chum, sockeye, and coho salmon.

Description

The Arolik River is the second largest spawning stream contributing to the District 4 commercial fishery. Five species of Pacific salmon spawn in significant numbers in the Arolik River, and are targeted in important subsistence, commercial, and sport fisheries. A new weir is proposed, approximately 8 miles upstream from Kuskokwim Bay, which would provide escapement assessments for these salmon species. This project would likely be a cooperative venture

between ADF&G Division of Commercial Fisheries and the Native Village of Quinhagak (NVK).

Duration

Long term

Estimated costs

Start up \$300,000 for first year; approximately \$140,000 per year for subsequent years.

Project II-D: Goodnews River drainage sockeye and Chinook salmon radiotelemetry study

Location

Goodnews River, District W-5.

Primary objective

Develop a drainagewide escapement estimate and estimate the proportion and distribution of sockeye and Chinook salmon that spawn in the North and South Fork Goodnews River using radiotelemetry methods.

Description

The Goodnews River is the main spawning stream contributing to the District 5 commercial fishery, and its salmon runs support important subsistence, commercial, and sport fisheries. The Middle Fork Goodnews River weir is located approximately 10 miles upstream from Goodnews Bay and is the primary site of the District 5 commercial fishery. Numbers of salmon spawning in the North and South Fork Goodnews River are unknown but probably substantial; this lack of information prevents the complete assessment of escapement in the Goodnews River. The proposed initiative seeks to develop a 3-year radiotelemetry study that will provide information needed to estimate the proportions of salmon spawning in the North and South Fork Goodnews River. This would allow a more complete assessment of salmon escapement in the Goodnews River, as needed for the development of escapement goals in accordance with the Escapement Goal Policy. This study would likely be a cooperative venture between ADF&G Division of Commercial Fisheries and the U.S. Fish and Wildlife Service.

Duration

Three years

Estimated costs

\$250,000 first year, and \$150,000 per year for the following 2 years.

Project II-E: Kanektok River drainage sonar enumeration of salmon species

Location

Kanektok River, District W-4.

Primary objective

Enumerate escapement of all salmon species into the Kanektok River.

Description

The Kanektok River is currently monitored with a weir located 45 miles upstream from Kuskokwim Bay. Significant numbers of Chinook and chum salmon spawn below the weir site and can only be roughly estimated relative to weir passage. Because of the emphasis on Chinook and chum salmon in the commercial fishery, accurate and timely estimates of total escapement are needed. A sonar project, placed below the existing weir, is proposed for this purpose. A sonar operation at the proposed site would provide escapement information up to 2 weeks earlier than that of the weir, and permit the enumeration of most of the escapement of all salmon species. This project would likely be a cooperative venture between ADF&G Division of Commercial Fisheries and the Native Village of Quinhagak (NVK).

Duration

Long term

Estimated costs

\$300,000 first year, and \$150,000 per year.

III. Other Kuskokwim Area Salmon Studies

Project III-A: Commercial harvest ASL sampling at Platinum plant

Location

Platinum

Primary objectives

Establish a sampling program based in Platinum for collecting ASL data from Kuskokwim Area commercial harvests.

Description

One of the primary responsibilities of the Division of Commercial Fisheries is the documentation and assessment of commercial harvests, including information about the age, sex, and length composition of harvested stocks. In the face of incomplete or uncertain data, Kuskokwim Area salmon fisheries must be managed more conservatively, which increases the potential for foregone harvest and economic opportunity. Since 2009, the majority of annual Kuskokwim

Area commercial salmon harvest has been processed at a new and remote fish processing plant located at the village of Platinum in Kuskokwim Bay. Salmon delivered to Platinum are unavailable for sampling by staff based in Bethel. Existing budgets were not developed for, nor are they adequate, to cover the increased costs of commercial sampling in such a remote location. This program will provide salary for a 2 person crew based in Platinum for 3 months and partial funding for a Technician IV to oversee Kuskokwim Area ASL sampling program. Remaining funds will cover housing, logistical, and materials costs associated with annual ASL sample collection in Platinum.

Duration

Long term

Estimated annual cost

\$85,000

Project III-B: Kuskokwim gillnet mesh size study

Location

Bethel

Primary objectives

Investigate differences in the harvest composition of various gillnet mesh sizes.

Description

The commercial and subsistence fisheries of the Kuskokwim River utilize different gillnet mesh sizes which result in different harvest compositions. The size and sex selectivity of the large mesh subsistence fishery has caused concern about possible effects on the quality of escapement. The proposed project would investigate size selectivity of a range of mesh sizes; data will be used to evaluate harvest practices and allowable gear under current regulations. There is potential to cooperate on this project with Association of Village Council Presidents.

Duration

Two years

Estimated costs

\$80,000 startup; \$65,000 for second year.

IV. Kuskokwim Area Staffing and Infrastructure

Project IV-A: Permanent full-time staff funding

Location

Kuskokwim area.

Primary objectives

Completely fund permanent full time Kuskokwim Area staff with state general funds.

Description

Several permanent full time biologist positions have been partially funded using grants for several years. This project seeks to stabilize permanent full time salaries in light of recent funding cuts at granting agencies and the uncertain nature of the grant funding process.

Duration

Long term

Estimated annual cost

\$82,000

Project IV-B: Kuskokwim Area budget supplement

Location

Kuskokwim area.

Primary objectives

Provide needed funds to accommodate accumulated budget shortfalls associated funds used to support baseline research and management programs in the Kuskokwim Area.

Description

In the Kuskokwim Area, baseline program operational costs have increased dramatically over the past 5+ years. In particular, air and vessel travel in remote locations, food, and program materials and equipment costs have been increasing in the face of stagnant baseline funding for many years. Additionally, accumulated loss of test fishery revenue from reduced commercial activity, capacity, and changes in commercial processing infrastructure in the past decade has resulted in underfunding of overall management program and test fishery program operations. Over time, operation and support of various baseline programs have been impacted to offset these increasing costs. Funds are needed to support various underfunded baseline program operations in the Kuskokwim Area.

Duration

Long term

Estimated annual cost

\$50,000

Project IV-C: Bethel facility maintenance**Location**

Bethel

Primary Objectives

Maintenance and improvement of the state properties located in Bethel.

Description

Upgrade the ADF&G residential duplex waste lines. With the exception of existing floor penetrations, underground lines leading up to and including the existing septic tanks shall be removed and replaced with standard code compliant waste line material and new septic holding tanks with easily accessible pumping opening/connections. Stairs and landings to entry ways need replacing as the railings and steps are rotten. Appliances are failing and many need to be replaced.

Duration

One Year

Estimated costs

\$74,000

REGIONAL PROJECTS

Two regional projects are proposed to help with staff training and maintain quality assurance and control for the regional salmon ASL program. A third regional project would initiate a new marine research program, obtaining information about the early marine life history of Chinook salmon.

I. AYK Region Salmon ASL Data Collection Program

ADF&G has been collecting age, sex, and length (ASL) data from adult salmon in the AYK Region since 1961. Most samples are currently collected from escapement projects, followed by commercial harvests, test fisheries, and subsistence harvests. Over the last decade, the volume of ASL data has increased considerably. The 2006–2010 average total sample size for the region was 60,000 salmon, of which approximately 20% were from Kotzebue/Norton Sound, and 40% each were from the Yukon and Kuskokwim areas. Consistency in age determination is essential, as age data from multiple sources are used in analyses critical to fisheries management.

Salmon age determination is conducted by personnel in several offices across the region. Recently, the salmon age determination function has been coordinated under a regional stock biology program in an effort to provide regional consistency and oversight, mechanisms for staff development, and a more efficient and coordinated overall effort, among other benefits.

Project I-A: AYK salmon aging quality assurance and control (QA/QC)

Location

Entire AYK region

Primary Objective

Standardizing application of age determination criteria and implementation of quality control among technical staff.

Description

This project would support training and oversight and promote consistent age determination among staff working in Anchorage, Emmonak, Bethel, and Nome. The stock biology program would implement quality control procedures, such as having a second reader independently age a portion of another reader's scales. Age disagreements between the 2 readers would be reviewed, helping to reduce errors and bias. Overall, this project would improve interpretation of age determination by implementing criteria and techniques. Funding is needed for travel costs and seasonal staff time.

Project Duration

Long term

Estimated Annual Costs

\$30,000

Project I-B: Stock biology data collection training

Project location

AYK Region

Primary objective

Provide training and training materials for efficient collection of stock biology data.

Project description

This project would provide dedicated funding for the AYK Regional Stock Biology program to train ADF&G staff and partners on collaborative projects in proper data collection and recording procedures. Training materials would be created for use by area staff and to be distributed to field crews. Workshops would be presented within the region. A trial preseason workshop for Yukon River stock biology samplers has been tested in Fairbanks. Proposed funding would be

used to cover salaries, travel, and costs of training materials to further develop stock biology data collection training throughout the AYK region.

Project duration

Long term

Estimated costs

\$10,000 per year

Project II-A: Yukon River marine salmon surveys

Location

Nearshore marine waters of the northern Bering Shelf.

Primary objective

To study the early marine life of Chinook salmon from the Yukon and other rivers in the AYK region, during the juvenile rearing period in the nearshore marine waters of the northern Bering Shelf.

Description

In 2002–2007 and 2008–2013, NOAA fisheries conducted annual pelagic trawl surveys on the eastern Bering Shelf to study ecosystem processes, oceanography, and marine organisms including juvenile salmon. This research has provided an opportunity to study the marine life of AYK salmon, for which there is little other data available. ADF&G is currently collaborating with NOAA, using data obtained in this survey to monitor juvenile salmon abundance, distribution, diet, growth and condition. While this platform has served as a good starting point for studying AYK salmon stocks, funding is not secured past 2013. Furthermore, NOAA’s survey objectives are not limited to AYK salmon, so salmon specific information drawn from this platform is limited and ADF&G has little or no ability to direct the survey design to more specifically address salmon research needs.

Funds are needed to secure a long-term monitoring survey that specifically investigates juvenile salmon. Marine research would focus on 2 themes: 1) developing a forecasting tool for Yukon Chinook salmon using juvenile abundance indices, 2) evaluating changes in marine survival of Yukon River salmon stocks. Such changes may have contributed to recent declines in Yukon Chinook salmon returns. The effects of migratory behavior, freshwater life history strategies, diet, energetic condition, size selective mortality, and other factors would be examined.

This work use methodologies developed by NOAA, integrating existing NOAA data with ADF&G data, and building upon previous NOAA efforts to address specific objectives pertinent to AYK salmon fishery management. Funding is needed for vessel time, fuel, and fishing crew required for the surveys. Funding is also needed for genetic, energetic, age and growth, and diet analyses of salmon captured in these surveys. While the primary near-term focus of this research would be on Yukon Chinook salmon, this survey could also serve as a platform for studying Norton Sound Chinook salmon stocks and for studying other salmon species originating in the Arctic and Yukon areas.

Project duration

Long term.

Estimated costs

\$481,000 first year; \$421,000 per year for subsequent years.

ACKNOWLEDGEMENTS

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TABLES

Table 1.–Summary of AYK Region projects and estimated costs in thousands of dollars

	Annual or Total Cost	Duration
Arctic area projects		
Unalakleet Subdistrict Chinook salmon test fishery	\$22.0/yr	Long term
Tracking Chinook salmon movement in Norton Sound	\$300.0/yr	3 Years
Coho salmon escapement at Unalakleet River weir	\$35.0 yr1; \$30.0 /yr	Long term
Noatak River sonar	\$280.0 yr1; \$80.0 /yr	Long term
Glacial Lake sockeye salmon adult enumeration	\$12.0/yr	Long term
Bonanza River coho salmon adult enumeration	\$20.0 yr1; \$7.0/yr	Long term
Benthic mapping for crab habitat	\$150.0/yr	3 Years
Capelin spawning abundance and distribution	\$80.0	3 Years
Norton Sound subsistence surveys and management supplement	\$50.0 /yr	Long term
Kotzebue Sound management supplement	\$25.0 /yr	Long term
Management supplement for Norton and Kotzebue Sound aerial surveys	\$20.0/yr	Long term
Yukon area projects		
Yukon River summer chum radiotelemetry mark–recapture	\$1,869.0	3 Years
Yukon River coho radiotelemetry mark–recapture	\$1,922.0	3 Years
Anvik River chum sonar project	\$100.0/yr	Long term
Anvik River Chinook salmon carcass sampling	\$10.0/yr	Long term
Sheenjek River fall chum sonar project	\$112.0/yr	Long term
Upper Yukon River salmon aging consistency	\$20.0 yr1; \$15.0/yr	1–3 Years
Yukon River whitefish monitoring and assessment	\$38.0	Long term
Yukon River lamprey assessment	\$57.0 yr1, \$47.0 /yr	Long term
Kuskokwim area projects		
Kuskokwim River postseason salmon ASL analysis	\$75.0 /yr	Long term
Telaquana Lake weir and Kuskokwim River sockeye salmon escapement enumeration	\$115.0 /yr	Long term
Salmon River (Aniak R.) escapement enumeration	\$150.0 /yr	Long term
Bethel test fishery ASL and genetic sampling	\$40.0 /yr	Long term
Kuskokwim River chum salmon escapement estimation	\$300.0/yr	3 Years
Kuskokwim River whitefish ASL collection	\$50.0 /yr	Long term
Upper Kuskokwim River tributary salmon escapement enumeration	\$150.0/yr	Long term
Kanektok River Chinook and chum salmon radiotelemetry study	\$250.0 yr1; \$150/yr	3 Years
Middle Fork Goodnews River coho salmon escapement	\$40.0/yr	Long term
Arolik River weir	\$300.0 yr1; \$140.0 /yr	Long term
Goodnews River drainage sockeye and Chinook salmon radiotelemetry study	\$250.0 yr1; \$150/yr	3 Years
Kanektok River drainage sonar enumeration of salmon species	\$300.0 yr1; \$150.0 /yr	Long term
Commercial harvest ASL sampling at Platinum plant	\$85.0 /yr	Long term
Kuskokwim gillnet mesh size study	\$145.0	2 Years
Permanent full time staff funding	\$82.0 /yr	Long term
Kuskokwim Area budget supplement	\$50.0/hr	Long term
Bethel Facility Maintenance	\$74.0	1 Year
Regional projects		
AYK salmon aging quality assurance and control	\$30.0 /yr	Long term
Stock biology data collection training	\$10.0/yr	Long term
Marine salmon surveys	\$481.0 yr1; 421.0/yr	Long term

Table 2.–Summary of Arctic area projects and estimated costs.

<i>Proposed projects for Arctic Area</i>	<i>Estimated Cost</i>		<i>Duration</i>
	<i>Start-up; first year</i>	<i>Annual; continuing</i>	
<i>I. Arctic area salmon projects</i>			
A. Unalakleet subdistrict Chinook salmon test fishery		\$22,000 annually	Long term
B. Tracking salmon movement in Norton Sound		\$300,000 annually	3 Years
C. Coho salmon escapement at Unalakleet River weir	\$35,000	\$30,000	Long term
D. Noatak River sonar	\$280,000	\$80,000	Long term
E. Glacial Lake sockeye salmon adult enumeration		\$12,000 annually	Long term
F. Bonanza River coho salmon adult enumeration	\$20,000	\$7,000	Long term
<i>II. Arctic area marine projects</i>			
A. Benthic mapping for crab habitat		\$150,000 annually	3 Years
B. Capelin spawning abundance and distribution		\$80,000 annually	3 Years
<i>III. Miscellaneous Arctic area projects</i>			
A. Norton Sound subsistence surveys and management supplement		\$50,000 annually	Long term
B. Kotzebue Sound management supplement		\$25,000 annually	Long term
C. Management supplement for Norton and Kotzebue Sound aerial surveys		\$20,000 annually	Long term

Table 3.–Summary of Yukon area projects and estimated costs.

<i>Proposed projects for Yukon area</i>	<i>Estimated Cost</i>		
	<i>Start-up; first year</i>	<i>Annual; continuing</i>	<i>Duration</i>
<i>I. Yukon River salmon assessments</i>			
A. Yukon River summer chum radiotelemetry mark–recapture	\$1,025,000	\$563,000 year 2, \$281,000 year 3	3 Years
B. Yukon River coho radiotelemetry mark–recapture	\$903,000	\$738,000 year 2, 281,000 year 3	3 Years
C. Anvik River chum sonar project	\$100,000 annually		Long term
D. Anvik River Chinook salmon carcass sampling	\$10,000 annually		Long term
E. Sheenjek River fall chum sonar project	\$112,000 annually		Long term
F. Upper Yukon River Chinook salmon aging consistency	\$20,000	\$15,000 as needed	1–3 Years
<i>II. Yukon River nonsalmon species assessments</i>			
A. Yukon River whitefish monitoring and assessment	\$38,000 annually		Long term
B. Yukon River lamprey assessment	\$57,000 start-up	\$47,000 annually	Long term

Table 4.–Summary of Kuskokwim area projects and estimated costs.

<i>Proposed projects for Kuskokwim area</i>	<i>Estimated Cost</i>		<i>Duration</i>
	<i>Start-up; first year</i>	<i>Annual; continuing</i>	
<i>I. Kuskokwim River salmon and whitefish assessments</i>			
A. Kuskokwim River postseason salmon age-sex-length (ASL) analysis		\$75,000 annually	Long term
B. Telaquana Lake weir and Kuskokwim River sockeye salmon escapement enumeration		\$115,000 annually	Long term
C. Salmon (Aniak) River escapement enumeration		\$150,000 annually	Long term
D. Bethel test fishery ASL and genetic sampling		\$40,000 annually	Long term
E. Kuskokwim River chum salmon escapement estimation		\$300,000 annually	3 Years
F. Kuskokwim River whitefish ASL collection		\$50,000 annually	Long term
G. Upper Kuskokwim River tributary salmon escapement enumeration		\$150,000 annually	Long term
<i>II. Kuskokwim Bay salmon assessments</i>			
A. Kanektok River Chinook and chum salmon radiotelemetry study	\$250,000	\$150,000	3 Years
B. Middle Fork Goodnews River coho salmon escapement enumeration		\$40,000 annually	Long term
C. Arolik River weir	\$300,000	\$140,000	Long term
D. Goodnews River drainage sockeye and Chinook and salmon radiotelemetry study	\$250,000	\$150,000	3 Years
E. Kanektok River drainage sonar enumeration of salmon species	\$300,000	\$150,000	Long term
<i>III. Other Kuskokwim Area salmon studies</i>			
A. Commercial harvest ASL sampling at Platinum plant		\$85,000 annually	Long term
B. Kuskokwim gillnet mesh size study	\$80,000	\$65,000	2 years
<i>IV. Kuskokwim Area staffing and infrastructure</i>			
A. Permanent full time staff funding		\$82,000 annually	Long term
B. Kuskokwim Area budget supplement		\$50,000 annually	Long term
C. Bethel facility maintenance		\$74,000	1 Year

Table 5.–Summary of AYK Region projects and estimated costs.

<i>Proposed regional projects</i>	<i>Estimated Cost</i>		<i>Duration</i>
	<i>Start-up; first year</i>	<i>Annual; continuing</i>	
<i>I. AYK Region salmon age-sex-length data collection program</i>			
A. AYK salmon aging quality assurance and control (QA/QC)		\$30,000 annually	Long term
B. Stock biology data collection training		\$10,000 annually	Long term
<i>II. AYK Region juvenile salmon marine research program</i>			
A. Marine salmon surveys for Yukon River and other juvenile salmon	\$481,000	\$421,000	Long term