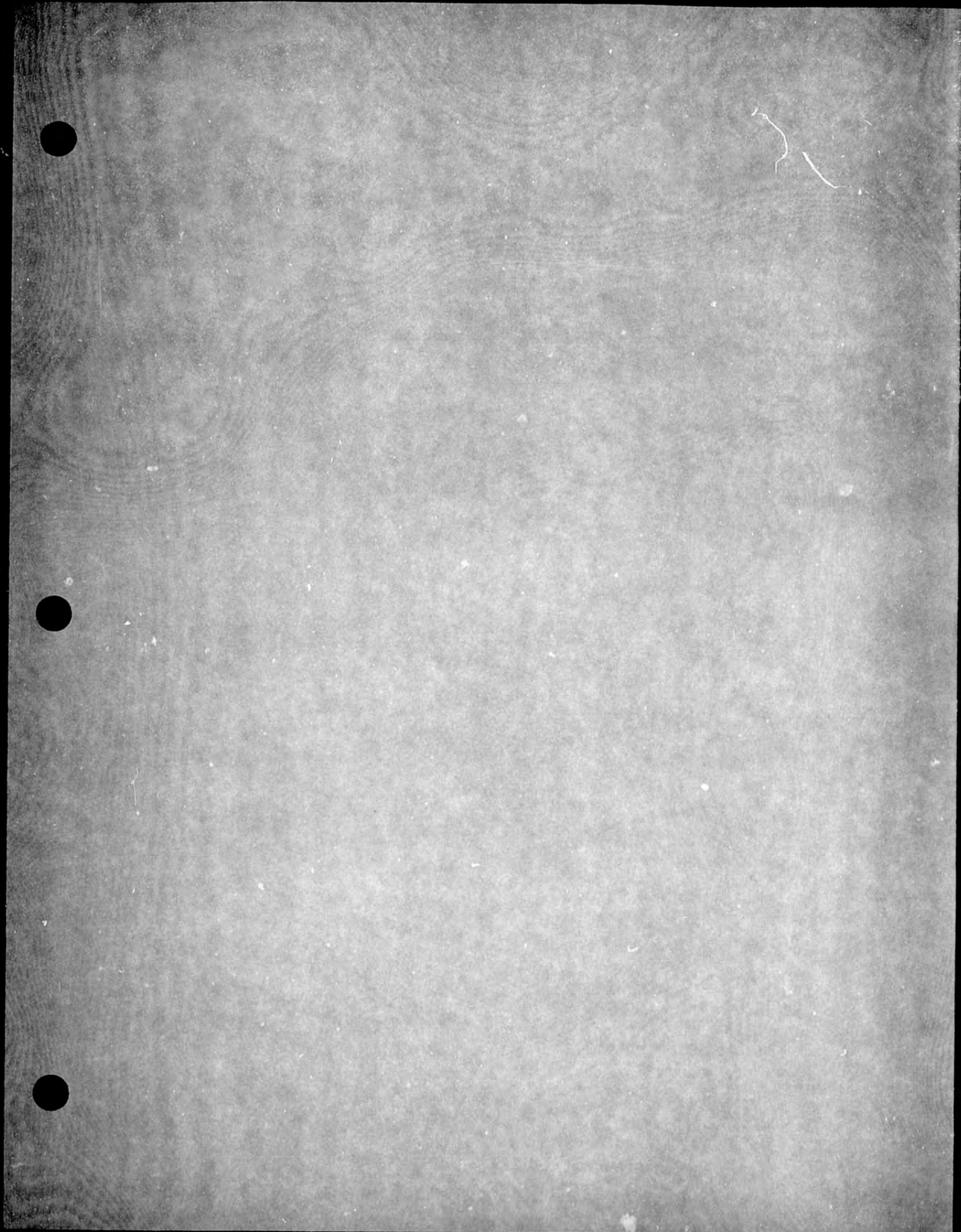


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ALASKA DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

MEMORANDUM

TO: John Hilsinger
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and
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Headquarters – Juneau

DATE: September 25, 2007

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SUBJECT: Upper Cook Inlet stocks
of concern recommendation

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FROM: Lowell F. Fair
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The Sustainable Salmon Fisheries Policy (SSFP, 5 AAC 39.222) directs the department to provide the Alaska Board of Fisheries (BOF), at regular meetings, with reports on the status of salmon stocks and identify any salmon stocks that present a concern related to yield, management, or conservation. In the Upper Cook Inlet (UCI) Management Area no stocks have been identified as such. However, this memorandum does provide the department's assessment of the Yentna River sockeye salmon run, which has had difficulty in recent years in reaching its SEG range.

Yentna River sockeye salmon

Stock Assessment

The Susitna River sockeye salmon run is thought to be a large contributor to major sockeye salmon runs in Upper Cook Inlet. During 1976-2001, estimated total UCI sockeye salmon runs ranged from 1.8-12.1 million, while estimated Susitna River sockeye salmon runs ranged from 280 thousand to 773 thousand, and averaged 492 thousand (Tobias and Willette 2001). Management of the Susitna River sockeye salmon run is based upon sonar estimates on the Yentna River, which is thought to be a major producer of sockeye salmon in the Susitna drainage and an indicator of run strength in the mainstem Susitna River. Technical challenges currently preclude operation of sonar on the lower main-stem Susitna River. Since 1981, based upon sonar estimates, the number of Yentna River spawners has ranged from approximately 37 thousand to 181 thousand sockeye salmon.

How well the sonar indexes total escapement has not been verified. The Yentna River is a large, dynamic glacial river that is difficult to assess using sonar, mid-river sections are not ensonified, and significant runs of other salmon species occur where fishwheels must be used to apportion the total sonar count by species. Any one of these issues will create biases in the estimation of species-specific escapement. Whether any of these biases are significant, or if they vary seasonally or annually, is unknown.

Currently, the Yentna River sockeye salmon escapement goal, 90,000 to 160,000 fish, is a sustainable escapement goal (SEG) that was adopted in 2002 (Bue and Hasbrouck *Unpublished*). An SEG is a level of escapement that is known to provide for sustained yield over a 5 to 10 year period and is used in situations where a biological escapement goal (BEG) cannot be estimated due to a concern about the spawner-return data (lack of age composition estimates and/or concern with stock-specific catch allocation) or there is a lack of information on stock productivity. In 2005, the Alaska Board of Fisheries defined an optimal escapement goal of 75,000-180,000 fish in the Yentna River that applies when the run of Kenai River sockeye salmon exceeds 4 million fish (5AAC21.358).

In January 2007, an interdivisional salmon escapement goal review team, including staff from the Division of Commercial Fisheries and Sport Fish Division, was formed to comprehensively review the existing salmon escapement goals in the Upper Cook Inlet Management Area based on the SSFP and the Policy for Statewide Salmon Escapement Goals (5 AAC 39.223). While this review is ongoing, the recommendation of the escapement goal review team is that the

current Yentna River sockeye salmon escapement goal should remain unchanged. Results of this escapement goal review will be available in a written report published by December 1, 2007.

Regulatory History

At this time, five of the last seven years of sonar escapement estimates of sockeye salmon into the Yentna River have fallen below the lower end of the SEG (Figure 1). This issue has been addressed in the immediate term by placing restrictions on fisheries that harvest this stock. For the last seven seasons the Northern District set gillnet fishery has been closed for one or more periods, except in 2000.

The drift gillnet fishery has also been restricted each year since 2001 for one or more periods in an attempt to meet the Yentna River sockeye salmon escapement goal. Additionally, in 2005, the department implemented a more conservative fishing schedule with the drift fleet than was allowed in regulation to conserve Northern District fish, including Yentna River sockeye salmon stocks. Restrictions to the drift fleet included: 1) closing areas where Yentna River sockeye salmon were thought to be; and 2) not exercising a third commercial opening that was allowed by the Central District Drift Gillnet Fishery Management Plan (5 AAC 21.353). In addition the Northern District set gillnet fishery was closed for five regular fishing periods from July 21 through August 4. Actions taken in the drift fishery may not be observed or realized until 10 to 14 days later and actions taken in the Northern District may not be realized for 7 to 10 days. Once the effects of the first actions are observed it is generally too late to take further corrective actions. The subsistence fishery in the Yentna River has not been restricted.

The sport fishery was also restricted in each of the last four seasons by closing the fishery to retention of sockeye salmon.

Stock of Concern Recommendation

Given the recent pattern of low sockeye salmon escapements to the Susitna River drainage, the department is working to resolve two uncertainties regarding this stock. The first uncertainty is our understanding of stock structure, and the harvest of these stocks in the mixed stock fishery. An ongoing comprehensive study includes processing genetic material to develop a DNA genetic baseline. Sockeye salmon caught in the drift and set gill net fisheries of Upper Cook Inlet will continue to be sampled and DNA analysis conducted to determine river of origin. The second uncertainty concerns the overall sockeye salmon escapement into the Susitna River. We currently have a sonar assessment project on the Yentna River to estimate escapement but it is uncertain how well the sonar indexes escapement in the Yentna River and what contribution escapement in the Yentna River makes to the overall Susitna River sockeye salmon escapement.

The ADF&G, with participation from Cook Inlet Aquaculture Association, is estimating adult sockeye salmon abundance within the entire Susitna River during 2006, 2007, and 2008. A mark-recapture and radio telemetry study will provide an estimate of sockeye salmon escapement in the Susitna River drainage (Yentna River and mainstem Susitna River) to compare with the existing Yentna River sonar and allow the identification of potential spawning areas in the drainage. Such abundance estimates will allow: 1) estimation of the total annual run of Susitna River sockeye salmon, when abundance estimates and genetics-based harvest allocation

estimates are combined, 2) evaluation of the accuracy of the Yentna River sonar estimate, and 3) the proportion of Yentna River sockeye salmon in the entire Susitna River sockeye salmon escapement. The uncertainties in the Yentna River sonar estimate and contribution of Yentna River sockeye salmon to the entire Susitna River escapement has questioned our assumptions of Susitna River drainage sockeye salmon productivity used in managing this mixed-stock fishery.

Additionally, the department is evaluating the current sockeye salmon escapement assessment tool, a Bendix single beam sonar system, with a more advanced and proven hydroacoustic system known as DIDSON. The transition from Bendix sonar to DIDSON is occurring throughout the Cook Inlet management area. The first full season comparison between the two sonar systems for the Yentna River began in 2006.

In summary, the department does not believe the sustainability of the Yentna River sockeye salmon stock, as defined by the *Sustainable Salmon Fisheries Policy* (5 AAC 39.222), is jeopardized despite the failure to reach escapement goals in five of the last seven years. As defined in this policy, sustained yield means an average annual yield that results from a level of salmon escapement that can be maintained on a continuing basis; a wide range of average annual yield levels is sustainable; a wide range of annual escapement levels can produce sustained yields. However, the department is treating the persistently low escapements of sockeye salmon to the Yentna River as a serious issue. This issue has been addressed in the short term by placing restrictions on fisheries that harvest this stock, and in the longer term by a suite of research programs intended to: 1) answer key questions regarding the productivity of the stock and 2) improve our knowledge of where and how many sockeye salmon from this stock are harvested through genetic studies.

Partial and preliminary information from these studies will be available to the Board at the next regular Cook Inlet cycle meeting in February 2008. However, the majority of the findings and conclusions from these studies will not be available until the 2010-2011 Cook Inlet Board meeting. This information will help determine if stock specific fishing strategies may be developed for Upper Cook Inlet, as well as guide the implementation of any such fishing strategies to better assure achievement of the Yentna River sockeye salmon escapement goal.

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- Bue, B. G., and J. J. Hasbrouck. *Unpublished*. Escapement goal review of salmon stocks of Upper Cook Inlet.. Alaska Department of Fish and Game, Report to the Alaska Board of Fisheries, November 2001 (and February 2002), Anchorage.
- Tobias, T., and T.M. Willette. 2001. An estimate of total return of sockeye salmon to upper Cook Inlet, Alaska 1976-2001. Alaska Department of Fish and Game, Susitna River Aquatic Studies Program, Anchorage, Alaska. Regional Information Report No. 2A01-06.

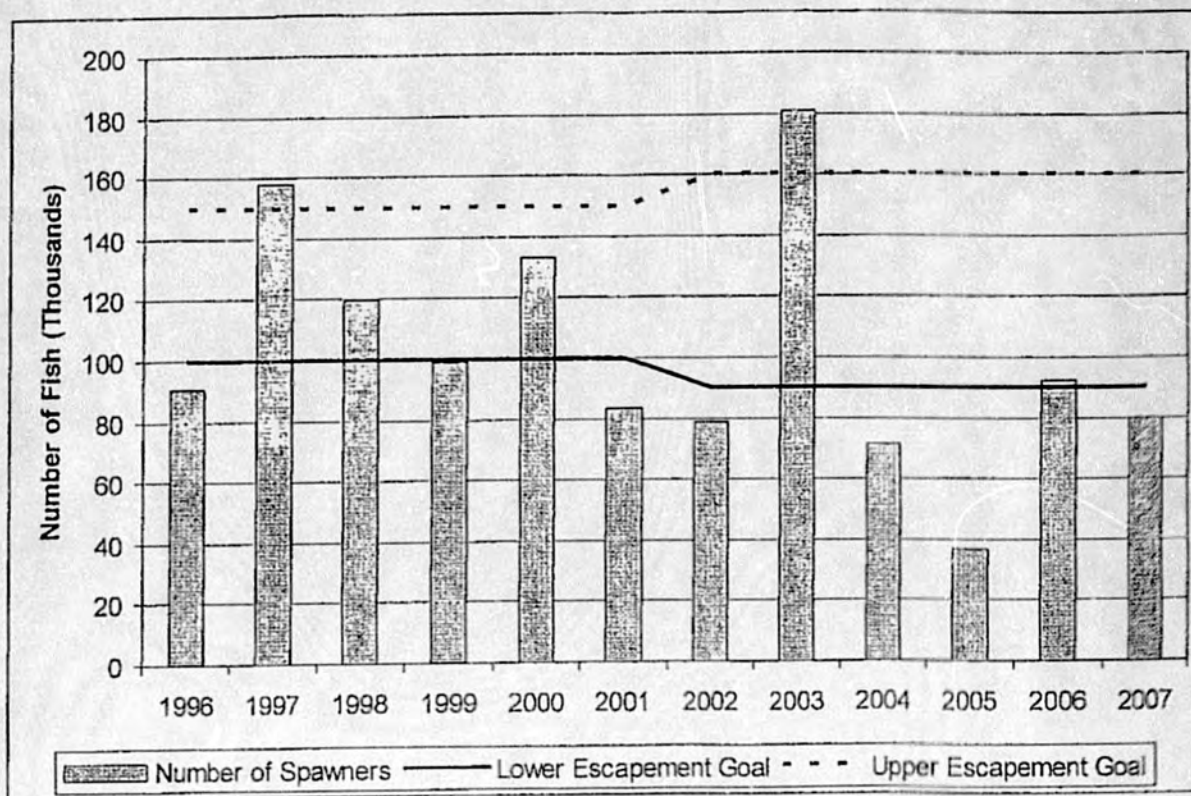
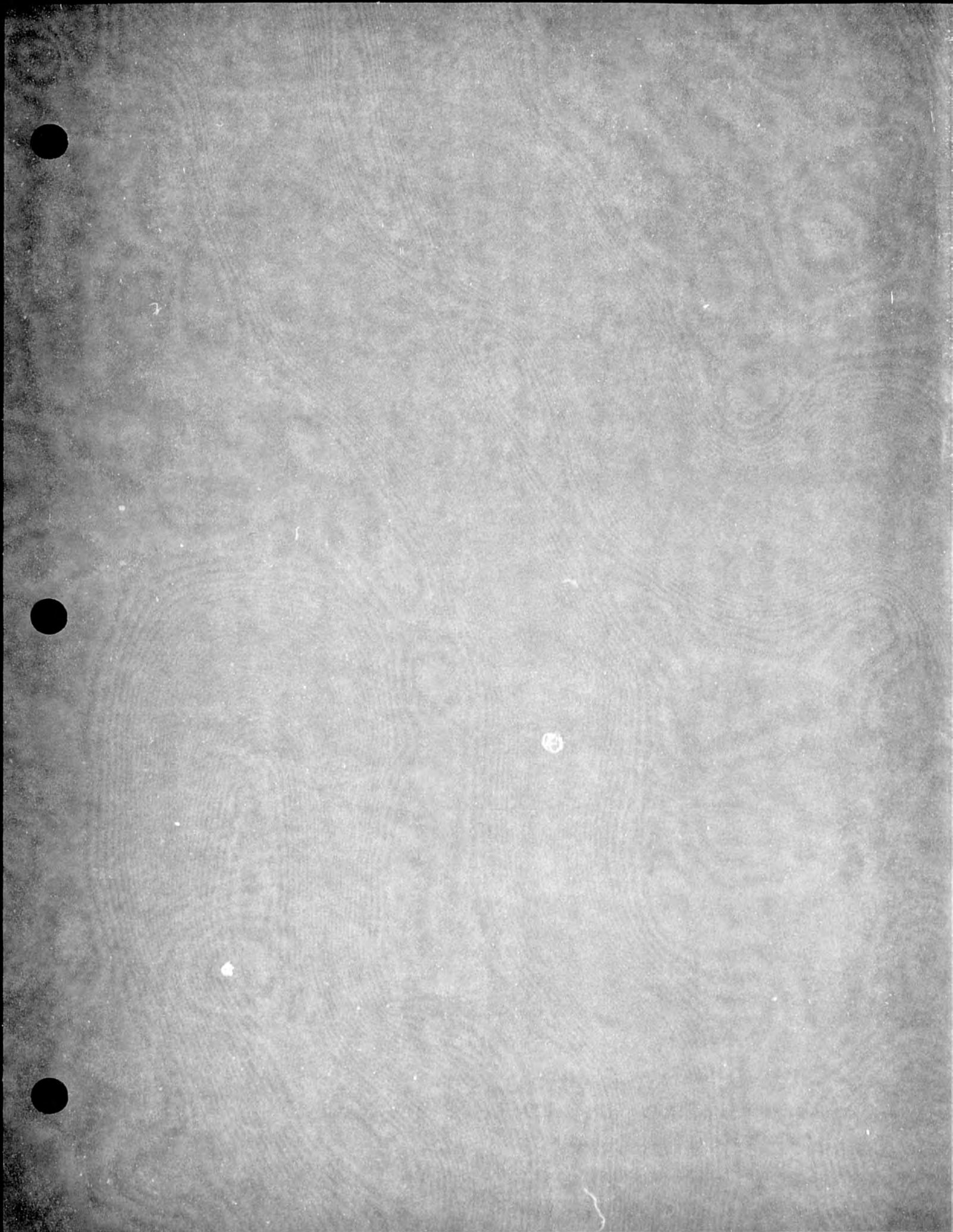


Figure 1. Yentna River sockeye salmon escapement goal range and number of spawners, 1996-2007.



STATE OF ALASKA

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TO: Mel Morris, Chairman - Alaska Board of Fisheries

FROM: John Hilsinger 
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And
Charles O. Swanton 
Director
Division of Sport Fish

DATE: January 24, 2008

SUBJECT: Upper Cook Inlet potential management options

At the Alaska Board of Fisheries (BOF) work session in October 2006, the board received numerous Agenda Change Requests (ACRs) that asked the board to re-evaluate many aspects of the Upper Cook Inlet (UCI) salmon fishery management plans. While the board declined to accept the ACR's, they created a committee of three board members to begin a comprehensive review of the management plans in preparation for the regular, in-cycle meeting for UCI during the winter of 2007/2008. With input from the Alaska Department of Fish and Game, the committee prepared an initial "issues paper" on the UCI management plans. This initial draft was made available to the public for written comment and was intended to stimulate discussion and to solicit additional comments from the public (i.e., various users). The committee received 12 written comments from the public which were incorporated into the issues paper. This paper was presented to the full Board by the committee during the March 2007 BOF meeting.

Based on comments from the public, the committee worked toward including as many issues as possible, not wanting to necessarily "screen" anything at the time. The committee also stated that an inclusion of any issue into the document did not necessarily imply an endorsement by the committee or the full BOF. This document was not intended to be an all-encompassing issues paper, and it was assumed that other issues would be brought forward through the BOF proposal process.

Although numerous issues concerning UCI management were identified, possible options addressing these issues were not listed. This memo outlines potential options from the department addressing some of the major issues.

8 09
GOVERNOR
5 AAC 21.363. Upper Cook Inlet Salmon Management Plan

Issue 1: In the various management plans, the BOF has adopted optimal escapement goals (OEG), inriver run goals, and established fishing time restrictions or other management actions that are often in conflict with each other. In general, this management plan does not provide direction to or describe management actions to the department.

Option: Eliminate this umbrella management plan.

5 AAC 21.353. Central District Drift Gillnet Fishery Management Plan

Issue 1: In medium to larger sockeye salmon runs (over 3 million to the Kenai River), the drift gillnet fishery is a necessary tool to harvest salmon in excess of the various goals (inriver run goals and biological, sustainable, or optimal escapement goals) in the Kenai and Kasilof rivers. However, in recent years, restrictions to the drift gillnet fishery have been implemented in an attempt to achieve the Yentna River sustainable escapement goal. This goal has been exceeded once, within the range twice, and below the range 6 times since 1999. During that time the Kenai River inriver run goal has been exceeded 5 of 9 years and the Kasilof River biological escapement goal (BEG) has been exceeded 8 of 9 years, and since the Kasilof River OEG (150,000-300,000) was adopted prior to the 2002 season, that goal has been met once and exceeded 5 of 6 years.

At run strengths greater than 2 million sockeye salmon to the Kenai River, one additional 12-hour fishing period in the Kenai and Kasilof Sections of the Upper Subdistrict and in Drift Gillnet Area 1 may be allowed by emergency order (EO) between July 9 and July 15. This additional time is likely never to be used because it is allowed prior to an inseason assessment of run strength to the Kenai or Yentna rivers. Implementing this additional time could be harmful if used in years with low runs to the Susitna River based on the forecast alone because it is generally not accurate for Susitna River sockeye salmon stocks.

Since 1999, the department's forecast of Kenai River run strength has been in the correct tier when compared to postseason total run assessment only in 2007. In early to mid July the department is required to put restrictions in place for the drift fishing fleet that are based on this forecast and the tiers within these management plans. The current regulations read as follows:

Weekly fishing periods are Monday and Thursday from 7:00 am to 7:00 pm, except that these fishing periods may be modified by emergency order.

The fishing season will open the third Monday in June or June 19, whichever is later, and from July 9 through July 15, (i) fishing during the two regular fishing periods is restricted to the Kenai and Kasilof Sections and Drift Gillnet Area 1; (ii) at run strengths greater than 2 million sockeye salmon to the Kenai River, the commissioner may, by emergency order, open one additional 12-hour fishing period in the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1.

From July 16 through July 31, (i) at run strengths of less than 2 million sockeye salmon to the Kenai River, fishing during the two regular 12-hour fishing periods is restricted to the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1; (ii) at run strengths of 2 million to 4 million sockeye salmon to the Kenai River, fishing during the two regular 12-hour fishing

periods is restricted to the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Areas 1 and 2; (iii) at run strengths greater than 4 million sockeye salmon to the Kenai River, there will be no mandatory restrictions during regular fishing periods.

Option: Reconsider the current regulated fishing time/area such that a more flexible management scenario is in place to harvest stocks based on run strength. Since many of these restrictions and other limitations were put in regulation, the number of EOs issued has doubled. Reducing or eliminating the mandatory drift restrictions prior to and after July 16, and eliminating the additional third period between July 9 and 15 in Drift Area Number 1, could provide flexibility and greatly simplify these plans. The department could then use EO authority to manage for escapement goals. Management actions taken in the drift gillnet fishery would remain dependent on meeting the Yentna River sockeye salmon sustainable escapement goal, as measured by the Yentna River sonar project.

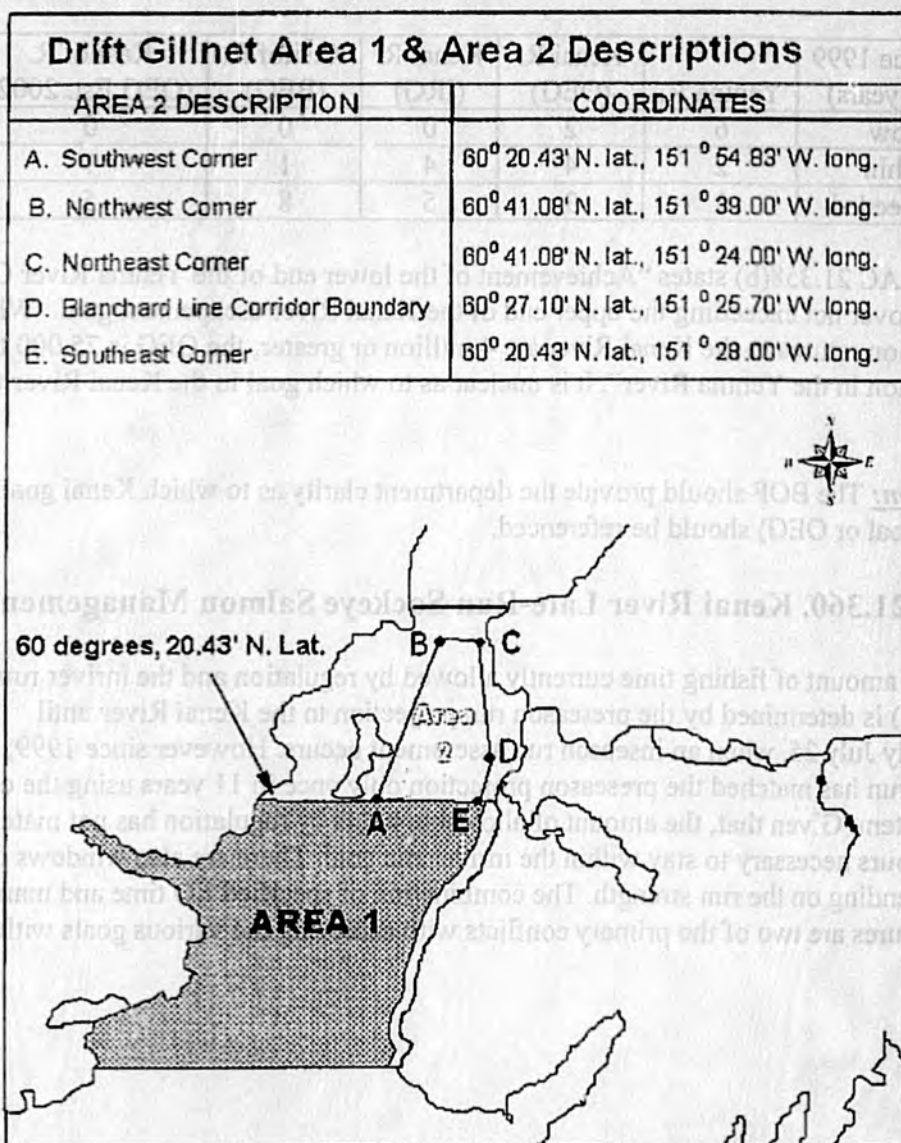


Figure 1.—Drift gillnet boundaries for fishing areas 1 and 2.

5 AAC 21.358. Northern District Salmon Management Plan

For the last 17 seasons, the Northern District set gillnet fishery has been closed for one or more periods, and the drift gillnet fishery has been restricted each year for one or more periods in an attempt to meet the Yentna River sustainable escapement goal. While these restrictions have taken place in an effort to meet the Yentna River sustainable escapement goal, the Kenai River inriver run goal has been exceeded 5 out of 9 years and the Kasilof River BEG has been exceeded 8 out of 9 years, and since the OEG (150,000–300,000) was adopted prior to the 2002 season, that goal has been met once and exceeded 5 of 6 years. The Yentna River sonar appears to be undercounting, by possibly a significant amount, and may be a poor indicator of abundance. The department needs to develop an alternative assessment to manage Northern District sockeye salmon fisheries and gain a better understanding of production and exploitation of Susitna River sockeye salmon stocks.

Since 1999 (8 years)	Yentna R.	Kenai R. (OEG)	Kenai R. (IRG)	Kasilof R. (BEG)	Kasilof R. (OEG Est. 2002)
Below	6	2	0	0	0
Within	2	4	4	1	1
Exceeded	1	3	5	8	5

Issue 1: 5 AAC 21.358(b) states “Achievement of the lower end of the Yentna River OEG shall take priority over not exceeding the upper end of the Kenai River escapement goal. When the sockeye salmon returns to the Kenai River are 4 million or greater, the OEG is 75,000 to 180,000 sockeye salmon in the Yentna River”. It is unclear as to which goal in the Kenai River the plan is referencing.

Option: The BOF should provide the department clarity as to which Kenai goal (inriver run goal or OEG) should be referenced.

5 AAC 21.360. Kenai River Late-Run Sockeye Salmon Management Plan

Issue 1: The amount of fishing time currently allowed by regulation and the inriver run goal (at river mile 19) is determined by the preseason run projection to the Kenai River until approximately July 25, when an inseason run assessment occurs. However since 1999, the end of season total run has matched the preseason projection only once in 11 years using the current three tier system. Given that, the amount of allowable hours by regulation has not matched the amount of hours necessary to stay within the inriver run goal. There are also windows of closure in place depending on the run strength. The combination of specified EO time and mandatory window closures are two of the primary conflicts with achieving the various goals within the plans.



Current UCI Mgmt. Plan (3 Tiers)

Kenai River			Actual Run in Same Tier as Forecast?
Year	Forecast	Actual	
1999	1.60	2.60	No
2000	2.50	1.50	No
2001	2.40	1.90	No
2002	1.70	3.10	No
2003	1.96	3.80	No
2004	3.20	5.00	No
2005	3.30	5.60	No
2006	1.85	2.53	No
2007	2.41	2.77	Yes
Correct			11%

Run < 2 million	Run 2-4 million	Run > 4 million
Inriver run goal: 650,000-850,000	Inriver run goal: 750,000-950,000	Inriver run goal: 850,000-1,100,000
24 hours of emergency order authority beyond the two regular periods	51 hours of emergency order authority beyond the two regular periods	84 hours of emergency order authority beyond the two regular periods
NA	24 hour floating window closure	NA
NA	36 hour window closure that has to start between 7pm Thursday and 7am Friday.	36 hour window closure that has to start between 7pm Thursday and 7am Friday.

Option: Based on the difficulty of accurately projecting the Kenai River sockeye salmon run, a possible solution would be to replace the current three tier system with a two tier system. Below is a plan outlining what a possible two-tiered system might resemble. Changing to a two-tier system may require modification of the inriver run goal in order to provide an allocation of fish to the inriver user. Kenai River late-run sockeye salmon sport fish harvests from 1997-2006 have averaged 224,758 fish. An inriver run goal set too low may result in restrictions or closures to the sport and personal use fisheries.

Plan With a 2 Tier system (3 million)			
Kenai River Run			Actual Run in Same Tier as Forecast?
Year	Forecast	Actual	
1999	1.60	2.60	Yes
2000	2.50	1.50	Yes
2001	2.40	1.90	Yes
2002	1.70	3.10	No
2003	1.96	3.80	No
2004	3.20	5.00	Yes
2005	3.30	5.60	Yes
2006	1.85	2.53	Yes
2007	2.41	2.77	Yes
Correct			78%

Run less than 3 million	Run greater than 3 million
Option 1: Inriver run goal: 650-850	Option 1: Inriver run goal: 850-1.100
Option 2: Inriver run goal: 750-950	
51 hours of emergency order authority	84 hours of emergency order authority
24 hour floating window	24 hour floating window deleted (as it is in runs greater than 4 million sockeye)
	36 hour window that can be fished into if needed to control escapement into the Kenai River
36 hour fixed window	

Issue 2: Specify which management objective in the plan is the priority when considering escapement goals (inriver run goal or OEG), window closures, or regulated fishing time via EO.

Option 1: Specify that the Kenai River inriver run goal found in the various tiers is the inseason target and priority for the department. The prescribed window closures and EO hours will be used to achieve the inriver run goal but the inriver run goal will not be compromised by a window closure or a set number of EO hours. It is the inriver run goal for which the department has inseason information and uses that information to make management decisions.

Option 2: Specify that the prescribed window closures found in the various tiers are the priority and that achieving the inriver run goals and potentially exceeding EO fishing hours will not compromise a window closure.

Issue 3: The sport fishing bag and possession limit is set in the management plan at 3 sockeye salmon. When bag and possession limits are set in management plans, the department cannot use EO authority to increase or decrease limits unless allowed by the management plan. This plan only allows a bag and possession limit increase to 6 sockeye salmon. Adding the flexibility of reducing the bag limit and possession limit by EO rather than total closure may reduce disruption to the sport fishery during years when the department projects that the inriver run goal will not be met but the OEG could be met if the sport fishing sockeye salmon bag and possession limit is lowered. In addition, when escapement goals are being exceeded, the bag and possession limit is confined to 6 fish. Increasing harvest limits beyond 6 fish may increase the opportunity to harvest fish in excess of the escapement goal.

Option: Provide the department EO authority to decrease limits rather than close the fishery and increase the bag and possession limit to increase harvest. Decreasing limits to 1 fish or 2 fish may allow the sport fishery to remain open at a very low level of harvest and effort while still achieving the OEG.

Issue: The language under 5 AAC 21.360 (b) relating to the sport and personal use fisheries is inconsistent with the language in (g) and (h). Under (b) of the management plan, it states that the Kenai River late-run sockeye salmon commercial, sport, and person use fisheries shall be managed to (1) meet an OEG of 500,000–1,000,000 sockeye salmon; (2) achieve inriver run goals; and (3) distribute the escapement of sockeye salmon evenly within the OEG range, in proportion to the size of the run. The plan further states under (g) and (h) which requirements are necessary in order to provide for sport and personal use fisheries. These two subsections essentially limit restrictions on these fisheries to those needed to ensure the lower end of the OEG is met.

Option 1: Delete the reference to sport and personal use fisheries under (b) of this section. This would be consistent with how the sport and personal use fishery have been previously managed.

Option 2: Modify (g) and (h) of this section to subject the sport and personal use fisheries to the requirement of meeting the inriver run goal instead of the OEG. This may require the personal use fishery and the sport fishery below the sonar site to be restricted or closed depending on how many fish pass the commercial fisheries and enter the river.

5 AAC 21.365. Kasilof River Salmon Management Plan

Issue 1: The Kasilof River BEG has been exceeded 8 of 9 years since 1999 while the OEG has been exceeded 5 of 6 years (OEG established in spring of 2002). Fishing time allotted in the current management plan prior to July 9 is not sufficient to harvest excess fish (two regular scheduled periods plus up to 48 hours of additional EO time). The 48 hour window closure has also been problematic because during that period of time large passage rates have occurred. These two factors have kept the department from being able to manage for the escapement goal. In order to meet the Kasilof River escapement goal, the above limitations also make it necessary

to use the Kasilof River Special Harvest Area (KRSHA) much more aggressively. This is also in conflict with the BOF intent to harvest salmon in fisheries that have historically harvested them including the methods, means, times, and locations of those fisheries.

Option: Reduce the 48 hour window closed to commercial fishing to a minimum of 24 hours and increase the amount of allowable EO fishing time from 48 hours to 63 hours (by 15 hours a week). This would provide the department the ability to manage for the Kasilof River sockeye salmon OEG prior to Kenai River sockeye salmon stocks entering the fishery. This change would make use of the KRSHA less likely.

Issue 2: Beginning July 9, the set gillnet fishery in the Kasilof Section is managed in concert with the Kenai and East Forelands sections. The date of July 9 may be too early to manage the Kasilof River sockeye salmon stock based on Kenai River sockeye salmon run strength.

Option: Begin managing the Kasilof River in concert with the Kenai and East Forelands sections July 15 instead of July 9. This would provide additional time to harvest Kasilof River sockeye salmon prior to the arrival of the majority of the Kenai River sockeye salmon entering the fishery. Additional Kenai River sockeye and king salmon could be harvested in the Kasilof section during this time frame. The regulations in place on June 25 in the Kasilof section would remain in effect until July 15. At that time, the Kasilof and Kenai areas would be managed in concert.

Issue 3: After July 15, if the department determines that the Kenai River late-run sockeye salmon run strength is projected to be less than 2 million fish and the 300,000 upper OEG bound for the Kasilof River sockeye salmon may be exceeded, an additional 24-hours of fishing per week in the Kasilof Section within one-half mile of shore is allowed by regulation. This date and the additional time may not be sufficient to harvest surplus Kasilof sockeye.

Option: Provide an additional 24 hours of fishing within one-half mile in the Kasilof Section after July 8.

STATE OF ALASKA

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MEMORANDUM

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James J. Hasbrouck
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SUBJECT: Upper Cook Inlet stocks of concern follow-up on Yentna River sockeye salmon

The Sustainable Salmon Fisheries Policy (SSFP; 5 AAC 39.222) directs the department to provide the Alaska Board of Fisheries (BOF), at regular meetings, with reports on the status of salmon stocks to identify any salmon stocks that present a concern related to yield, management, or conservation. For example, a "yield concern" means a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs. In the Upper Cook Inlet (UCI) Management Area no stock has been identified as a stock of concern. However, with the approaching UCI Alaska Board of Fisheries meeting in February and as a follow up to the September 2007 memorandum, we reviewed the department's stock of concern assessment of the Yentna River sockeye salmon run.

Escapement Assessment and Trends

Initial efforts to estimate the number of sockeye salmon spawning and rearing in the Susitna watershed were limited in scope and duration. Various lakes within the drainage were visited sporadically in the 1950s and 1960s by United States Fish and Wildlife Service and Alaska Department of Fish and Game (ADF&G) personnel to collect salmonid juvenile and adult data. Adult spawner counts were primarily the product of aerial surveys (King and Walker 1997). At various times since the early 1970s, weirs monitored sockeye salmon entering selected tributaries (Chelatna Lake, Fish Lakes, Judd Lake, Larson Lake, Shell Creek, and Talachulitna River) to spawn (King and Walker 1997).

Mark-recapture projects were conducted on the Susitna River in 1974 and 1975 as part of an effort to estimate juvenile and adult anadromous fish populations in the upper Susitna River between Devil's Canyon and the confluence of the Susitna and Chulitna rivers. These studies were part of the pre-authorization investigation for the proposed Susitna Hydroelectric Project (Barrett 1974; Friese 1975). The results of these studies indicated that the majority of sockeye salmon in the Susitna River basin were produced in the Yentna and Skwentna river drainages (Namtvedt et al. 1978). Mark-recapture projects were again conducted on the Susitna River during 1982-1985 to estimate the inriver run of sockeye salmon (Barrett et al. 1985; Thompson et al. 1986).

Adult salmon escapements into the Susitna River were monitored with sonar at Susitna Station (river kilometer [rkm] 52) from 1976 to 1980. However, changes in bottom characteristics at that sonar location precluded continuation of the project after 1980. Because no other site suitable for the existing sonar equipment was found in the mainstem of the Susitna River, the project was moved to the Yentna River, the largest tributary in the drainage. From 1981 to the present, the Yentna River daily sonar estimates have been used as an indicator of the sockeye salmon escapement into the Susitna River drainage. The sockeye salmon escapement bound for the Yentna River has been thought to be approximately one half of the total Susitna River sockeye salmon escapement based on a combination of 1981-1985 capture-recapture abundance estimates passing Sunshine (Susitna River rkm 116), and sonar abundance estimates passing Yentna (Yentna River; rkm 7) and Susitna Station (Westerman and Willette 2006).

Currently, the Yentna River sockeye salmon escapement goal, 90,000 to 160,000 fish, is a sustainable escapement goal (SEG) adopted in 2002 (Bue and Hasbrouck *Unpublished*). In 2007, an interdivisional salmon escapement goal team reviewed salmon escapement goals in the UCI Management Area based on the SSFP and the Policy for Statewide Salmon Escapement Goals (5 AAC 39.223). The team recommended that the current Yentna River sockeye salmon escapement goal remain unchanged (Fair et al. 2007).

Based on Bendix sonar estimates since 1981, the number of Yentna River spawners has ranged from approximately 37,000 to 181,000 sockeye salmon. The sonar estimate of sockeye salmon escapement into the Yentna River has not met the goal in 5 of the past 8 years (Table 1). Unfortunately, the accuracy of escapement enumeration based on sonar in the Yentna River has not been verified. The Yentna River is a large, dynamic glacial river that poses difficulties in assessing salmon escapement using sonar, and significant runs of other salmon species occur, requiring fish wheels to be used to apportion the total sonar count by species. Any one of these issues will create biases in the estimation of species-specific escapement. Whether any of these biases are significant, or if they vary seasonally or annually, is unknown. Additionally, a comparison of historical sockeye salmon escapements in the Yentna River and in four major rearing lakes (Chelatna, Shell, Judd, and Larson) suggests that production may have recently declined in the smaller rearing lakes in the watershed.

Yield Assessment

The sustained-yield principal requires an understanding of the relationship between the abundance of spawning fish and the abundance of their offspring that survive to adulthood (known as a brood table) by stock. The number of offspring that survive to adulthood is calculated by adding the number of spawning fish and the number of fish harvested for each parent generation.

Accurately estimating the composition of mixed-stock catch is critical to determining the total run of each stock. Age composition has historically been used to facilitate estimation of stock composition. Stock and age specific catch and escapement data have been the basis for development of long-term brood tables used for both pre-season forecasting and for scientific estimation of escapement goals.

Unfortunately, the allocation methodology used to apportion sockeye salmon catches to component stocks in UCI represents a coarse approximation of the actual catch by stock. Historically, a series of largely untested assumptions have been used to allocate stock composition. ADF&G currently uses age composition estimates from the harvest and escapement, and run timing to allocate the harvest to each stock (Bernard 1983). The current method assumes that the stocks present in a district are equally exploited. This untested assumption could greatly affect the estimated stock compositions. The current method probably underestimates the productivity of some stocks and overestimates the productivity of other stocks. As such, the less abundant stocks such as the Susitna River are prone to the greatest percentage error from the true stock composition of the mixture. To be accurate, the age composition method also requires a representative sampling of the harvest, and accurate estimates of escapement numbers and age composition.

In recent years (2005 to present), ADF&G has developed a genetics program for sockeye salmon in UCI. The primary goal of the program is to develop and apply genetic methods to identify stock composition of mixtures. The first comprehensive baseline using genetic markers in UCI employed microsatellites (Habicht et al. 2007). The need to differentiate among all the stocks led to the development of methods to screen single nucleotide polymorphism (SNP) loci under selection. In a recent study of UCI sockeye salmon genetic diversity, simulations indicated that seven regional groups (Kenai River, Susitna River, Yentna River, West Cook Inlet, Kasilof River, Northeast Cook Inlet, and Knik Arm) could be identified in mixtures at high levels of precision and accuracy (Habicht et al. 2007).

Given the potential errors outlined above for estimating the harvest of Susitna stocks in UCI using catch and escapement age composition information, we are hesitant to estimate the historical yield for Yentna stocks. There are many unsubstantiated assumptions involved in the estimation procedure. Nonetheless, in the context of "stock of concern" we have examined the historical estimates of Yentna River sockeye salmon yield in both the Central and Northern districts.

Conclusions and Recommendations

As explained in the September 2007 memorandum, the recent pattern of low sockeye salmon escapements to the Susitna River drainage has prompted the department to better understand stock productivity, errors in escapement estimation, and harvest in the mixed stock fishery of UCI using genetic markers (Habicht et al. 2007). Sockeye salmon rearing lake investigations are being conducted to estimate embryo-to-smolt survivals in the major lakes in the watershed. Additionally, we are assessing the sockeye salmon escapement into the Susitna River using new and improved methodology. ADF&G, with participation from Cook Inlet Aquaculture Association, is estimating the adult sockeye salmon abundance in the entire Susitna River in 2006, 2007, and 2008 with a mark-recapture and radio telemetry study. Such abundance estimates will allow: (1) estimation of the total annual run of Susitna River sockeye salmon, when abundance estimates and genetics-based harvest allocation estimates are combined, (2) evaluation of the accuracy of the Yentna River sonar estimate, and (3) the proportion of Yentna River sockeye salmon in the entire Susitna River sockeye salmon escapement. Additionally, the department is evaluating the current sockeye salmon escapement assessment tool, a Bendix single beam sonar system, with a more advanced and proven hydroacoustic system known as DIDSON (Dual frequency IDentification SONar). Preliminary spawning abundance estimates based on mark-recapture and DIDSON studies suggest that traditional Bendix estimates are much lower than the actual escapements. As shown in the table below, the high variability that we have observed between the various methods has added considerably greater uncertainty to our previous assessments.

Various sockeye salmon escapement estimates for the Susitna River drainage, 2006 and 2007.

2006				
System	Mark-Recapture	Weirs ^a	Bendix	DIDSON
Yentna	Unknown	126,000	93,000	160,000
Susitna	107,000 (95% CI 59-165)	60,000		
Sum		186,000		
2007^b				
System	Mark-Recapture	Weirs	Bendix	DIDSON
Yentna	250,000	97,000	80,000	130,000
Susitna	85,000	60,000		
Sum		157,000		

^a Weirs monitored escapement at a few select lakes and do not represent total river escapement.

^b The 2007 estimates are preliminary.

Similar to escapement, an accurate assessment of Susitna/Yentna River catch has been problematic given the available methodology (age composition method) and limited resources for catch sampling. The sources of error in estimating the stock-specific catch in UCI are many, and this is especially true for the less abundant stocks such as Yentna River sockeye salmon, which are susceptible to the greatest relative errors (Bernard 1983). Although genetic markers have given us

the ability to accurately determine stock composition for portions of the past 3 years, this data will not be applied to historical harvests of UCI until the full season analyses have been completed, and we have gained a better understanding of stock vulnerability through time and space.

In the Central District drift fishery, the estimated Yentna River commercial harvest for the most recent 5-year average (2003–2007) is 59% of the previous 10-year (1993–2002) average and 49% of the previous 20-year (1983–2002) average (Table 1). In the Northern District, the most recent 5-year average is 31% of the previous 10-year average and 22% of the previous 20-year average. Since the total UCI commercial harvest averages 2.9 million sockeye salmon and our age composition allocation model estimate of the Yentna sockeye salmon harvest is only 8.4% of the total, we have low confidence in the accuracy of our estimate of the Yentna sockeye salmon harvest. The difference (53,309 fish) between the 5-year (2003–2007) average yield and the 10-year (1993–2002) average yield for the Yentna stock is only 2% of the average UCI commercial harvest. The errors in our stock composition estimates are likely greater than 2%, since we know from comparisons to partial weir counts that the error in our Yentna sonar estimate is at least 28%.

The department continues to treat the persistently low escapements of sockeye salmon to the Yentna River as a serious issue. At this juncture, we are hesitant to make a stock of concern recommendation for Yentna River sockeye salmon given the assumptions and unknowns outlined above, in the memo of September 2007, and in various scientific reports prepared for the BOF meeting in February. With the ongoing studies of escapement assessment and improved stock composition in the catch, we will better understand the productivity and sustainability of the stock. Partial and preliminary information from the DIDSON, mark-recapture, and lake productivity studies will be available to the Board at the Upper Cook Inlet meeting this February.

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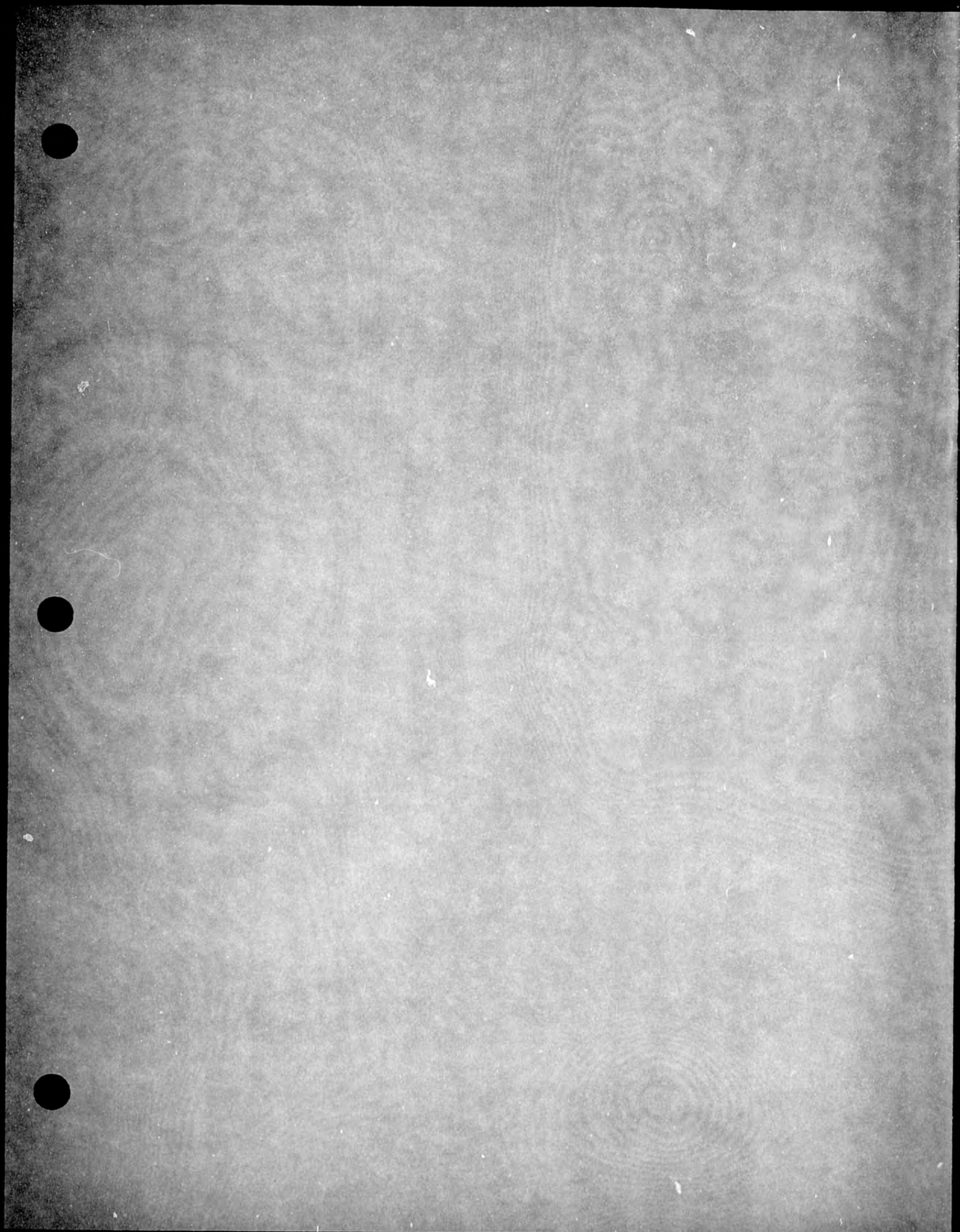
Table 1. Yentna River sockeye salmon catch and escapement, 1983–2007.

Year	Commercial Catch ^a		Escapement ^b	Lower Escapement Goal
	Central District	Northern District		
1983	153,417	34,486	104,414	100,000
1984	149,776	49,254	149,375	100,000
1985	150,827	38,473	107,124	100,000
1986	240,686	34,333	92,076	100,000
1987	142,040	18,828	66,054	100,000
1988	120,069	11,545	52,330	100,000
1989	3,343	40,549	96,269	100,000
1990	234,378	19,011	140,290	100,000
1991	107,291	25,193	109,632	100,000
1992	170,969	8,507	66,074	100,000
1993	193,450	20,689	141,694	100,000
1994	131,844	24,349	128,032	100,000
1995	160,320	21,447	121,220	100,000
1996	117,337	13,124	90,660	100,000
1997	136,803	20,814	157,822	100,000
1998	48,113	14,299	119,623	100,000
1999	83,812	12,951	99,029	100,000
2000	66,782	12,144	133,094	100,000
2001	46,431	10,774	83,532	100,000
2002	58,383	5,548	78,591	90,000
2003	116,154	11,535	180,813	90,000
2004	68,546	3,918	71,281	90,000
2005	32,197	3,572	36,921	75,000
2006 ^c	11,610	1,985	92,045	90,000
2007 ^c	80,306	3,333	79,901	90,000
2003-2007 Avg.	61,763	4,869	92,192	
1993-2002 Avg.	104,327	15,614	115,330	
1983-2002 Avg.	125,804	21,816	106,847	

^a Catch estimates are based on age composition methodology that (1) assumes equal exploitation of stocks in the fishery, (2) requires representative sampling of the harvest, and (3) accurate estimates of escapement numbers and age composition.

^b Sonar estimates of escapement are based on Bendix.

^c Preliminary estimates.



ALASKA DEPARTMENT OF FISH & GAME



SUSITNA SOCKEYE SALMON ACTION PLAN

February 8, 2008

Since 1981 the Yentna River daily sonar estimates have been used as an indicator of sockeye salmon escapement into the Susitna River. The Yentna River has been thought to be approximately one half of the total Susitna River sockeye salmon escapement based on a comparison of 1981-1985 capture-recapture abundance estimates passing Sunshine (1982-1985 Susitna River km 116) and sonar abundance estimates passing Yentna (1981-1985 Yentna River km 7) and Susitna Station (1981, Susitna River km 116; Westerman and Willette 2006).

Based on Bendix sonar estimates since 1981, the number of Yentna River spawners has ranged from approximately 37,000 to 181,000 sockeye salmon. The sonar estimate of sockeye salmon escapement into the Yentna River has not met the current SED range of 90,000 to 160,000 for 2 of the past 8 years.

Although sockeye salmon escapements are estimated via a Bendix sonar system, there is great uncertainty surrounding their accuracy and precision. The high variability observed between

SUSITNA RIVER SOCKEYE SALMON STOCK STATUS AND ACTION PLAN, 2008

INTRODUCTION

SYNOPSIS

In response to the guidelines established in the Sustainable Salmon Fisheries Policy (SSFP; 5 AAC 39.222), the Board of Fisheries has identified the Susitna River sockeye salmon stock as a stock of yield concern. For this determination, the estimated Susitna River commercial harvest for the most recent 5-year average was compared to the previous 10- and 20-year averages for the Central District drift and Northern District fisheries. Identification of Susitna River sockeye salmon as a stock of yield concern is based on the definition of "yield concern" contained in SSFP. A "yield concern" is defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern, which is less severe than a conservation concern" [5 AAC 39.222 (f) (42)]. The policy defines "chronic inability" as "the continuing or anticipated inability to meet escapement thresholds over a four to five year period, which is approximately the generation time of most salmon species" [5 AAC 39.222 (f) (5)].

This report describes the existing management plans and Emergency Order authority that the department follows to conserve Susitna River sockeye salmon. In addition to the existing management plans, options have been presented regarding management of the Northern District set gillnet fishery and Susitna River sport fishery. In light of increased uncertainty of the department's ability to accurately assess escapements of sockeye salmon into the Susitna River, a research plan has been developed to improve the department's ability to assess sockeye salmon stocks within the drainage. With these ongoing studies, the department will have better information on the productivity and sustainability of the stock at the 2011 Upper Cook Inlet Board of Fisheries meeting.

STOCK ASSESSMENT

Since 1981 the Yentna River daily sonar estimates have been used as an indicator of sockeye salmon escapement into the Susitna River drainage. The sockeye salmon escapement in the Yentna River has been thought to be approximately one half of the total Susitna River sockeye salmon escapement based on a combination of 1981-1985 capture-recapture abundance estimates passing Sunshine (1982-1985; Susitna River rkm 116), and sonar abundance estimates passing Yentna (1981-1985; Yentna River rkm 7) and Susitna Station (1981; Susitna River rkm 116; Westerman and Willette 2006).

Based on Bendix sonar estimates since 1981, the number of Yentna River spawners has ranged from approximately 37,000 to 181,000 sockeye salmon. The sonar estimate of sockeye salmon escapement into the Yentna River has not met the current SEG range of 90,000 to 160,000 for 5 of the past 8 years.

Although sockeye salmon escapements are estimated via a Bendix sonar system, there is great uncertainty surrounding their accuracy and precision. The high variability observed between

various methods of escapement assessment (i.e., ongoing Bendix estimates compared with recent estimates from capture-recapture and DIDSON sonar projects; Yanusz et al. 2007) has added to the uncertainty regarding our previous assessments.

In the Central District drift gillnet fishery, the estimated commercial harvest of Susitna River sockeye salmon for the most recent 5-year average (2003–2007) is 59% of the previous 10-year (1993–2002) average and 49% of the previous 20-year (1983–2002) average. In the Northern District, the most recent 5-year average is 31% of the previous 10-year average and 22% of the previous 20-year average. Since the total Upper Cook Inlet (UCI) commercial harvest averages 2.9 million sockeye salmon and the age composition allocation model estimate of the Susitna sockeye salmon harvest is only 8.4% of the total, the department has low confidence in the accuracy of our estimate of the Susitna sockeye salmon harvest.

ESCAPEMENT GOAL HISTORY

An escapement goal of 200,000 sockeye salmon was established for the Susitna River in 1979. It was set using a return-per-spawner value of 4, and an assumption that the Susitna River could produce about 800,000 adult sockeye salmon. A review of the goal in 1989 based on euphotic volume of rearing lakes suggested the existing goal was valid. In 1986, the sonar site at Susitna Station was destroyed by a flood, and no alternative hydroacoustic site could be found on the mainstem of the Susitna. Therefore, hydroacoustic estimates from a Yentna River site were used to assess total Susitna River escapement. Based on comparisons of estimates for the Yentna and the Susitna Rivers over 5 years, 1981–1985, it was decided that an escapement of 100,000 to 150,000 sockeye salmon into the Yentna River should result in a total escapement of at least 200,000 sockeye salmon into the entire Susitna drainage (Fried 1994). This was based on the average proportion of the total Susitna River escapement, which entered the Yentna River (49%) during the 5 years studied, as well as the range of annual proportions (41–59%) for these 5 years.

In 2001, the biological escapement goal for the Yentna River was changed to a sustainable escapement goal of 90,000–160,000 sockeye salmon based on Yentna sonar data from 1981–2000, because reliable estimates of total return to the system were not available (Bue and Hasbrouck *Unpublished*). Escapement goal reviews since 2001 have resulted in no change recommended to this goal type or range (Hasbrouck and Edmundson 2007, Fair et al. 2007). In 2005, an optimal escapement goal of 75,000–180,000 Yentna River sockeye salmon was adopted by the Alaska Board of Fisheries contingent on the sockeye salmon run to the Kenai River being projected to exceed 4 million.

ACTION PLAN FOR ADDRESSING STOCK OF CONCERN

MANAGEMENT ACTIONS

Commercial Fisheries

There are currently no actions in the Central District Upper Subdistrict (Eastside) set gillnet fishery for the conservation of northern bound salmon stocks. However, in the Northern District set gillnet fishery, the department's primary tools to reduce exploitation on Susitna stocks is to reduce gear from three nets to two or one from July 20 through July 31, or to close the commercial fishery. In practice, the department has done both concurrently, but most commonly the fishery has been closed. For example, from 2005 through 2007, the department closed the

entire Northern District 17 times. In the Central District drift gillnet fishery two regular drift gillnet fishing periods between July 9-15 are restricted to Area 1 (Figure 1) to conserve Susitna sockeye salmon stocks. Furthermore, from July 16-31 the drift gillnet fishery is to be restricted for two regular fishing periods to drift Area 1 when Kenai River sockeye salmon runs are less than two million fish, or drift Area 1 & 2 (Figure 1) when Kenai runs are between two and four million sockeye salmon. These restrictions are for both sockeye and coho salmon conservation. The department will continue to conserve Susitna River sockeye salmon through prescribed management plans and the use of Emergency Order authority.

CURRENT ACTIONS IN NORTHERN DISTRICT SALMON PLAN FOR SALMON CONSERVATION

5 AAC 21.358 Northern District Salmon Management Plan (a) The purposes of this management plan are to minimize the harvest of coho salmon bound for the Northern District of upper Cook Inlet and to provide the department direction for management of salmon stocks. The department shall manage the chum, pink, and sockeye salmon stocks primarily for commercial uses to provide commercial fisherman with an economic yield from the harvest of these salmon resources based on abundance. The department shall also manage the chum, pink, and sockeye salmon stocks to minimize the harvest of Northern District coho salmon, to provide sport and guided sport fisherman a reasonable opportunity to harvest these salmon resources over the entire run, as measured by the frequency of inriver restrictions, or as specified in this section and other regulations.

(b) The department shall manage the Northern District commercial salmon fisheries based on the abundance of Yentna River sockeye salmon, the Yentna River escapement goal, or other salmon abundance indices as it deems appropriate. Achievement of the lower end of the Yentna River optimal escapement goal shall take priority over not exceeding the upper end of the Kenai River escapement goal. When the sockeye salmon returns to the Kenai River are four million or greater, the optimal escapement goal is 75,000 to 180,000 sockeye salmon in the Yentna River.

(c) From July 20 through July 31, if the department's assessment of abundance indicates that restrictions are necessary to achieve the escapement goal, the commissioner may, by emergency order, close the commercial set gillnet fishery in the Northern District and immediately reopen the season during which the number of set gillnets that may be used is limited to the following options selected at the discretion of the commissioner:

- (1) three set gillnets that are not more than 105 fathoms in aggregate length;
- (2) two set gillnets that are not more than 70 fathoms in aggregate length;
- (3) one set gillnet that is not more than 35 fathoms in length.

(d) In addition to the provisions specified in (b) and (c) of this section, the department shall manage the Northern District commercial salmon fisheries to minimize the incidental take of coho salmon stocks bound for the Northern District in the following manner:

- (1) additional fishing periods, other than the weekly fishing periods described in 5 AAC 21.320(a) (1), may not be provided when coho salmon are expected to be the most abundant species harvested during that period; additional fishing periods may not be provided based on the abundance of Northern District coho salmon;
- (2) after August 15, the department shall limit the harvest of coho salmon in the Northern

District by limiting commercial fishing time to the weekly fishing periods described in 5 AAC 21.320(a) (1).

Potential Modifications to 5 AAC 21.358 Northern District Salmon Management Plan

(c) In light of recent department data revealing concerns about the validity of Yentna River sockeye salmon enumeration data, it is the intent of the Board that Susitna River sockeye salmon stocks will be conservatively managed while the Department continues its studies in this drainage. Until the UCI BOF finfish meeting in 2011, Susitna River sockeye salmon will be managed as follows:

(1) From the beginning of the regular commercial salmon fishing season, which occurs on or after June 25, through July 19, the Northern District set gillnet fishery will fish no more than two regular 12-hour Monday and Thursday fishing periods per week.

(2) From July 20 through August 7, the Northern District set gillnet fishery will fish regular 12-hour Monday and Thursday fishing periods, but will be limited to no more than one 35-fathom set gillnet per permit. If it is determined by the Department that the Yentna River sockeye salmon [SEG or OEG] will be achieved during this time frame, the Department may increase the allowable fishing gear from one 35-fathom set gillnet per permit to two 35-fathom set gillnets per permit or the full complement of three set gillnets that are not more than 105 fathoms in aggregate length per permit.

(3) On the first regular fishing period after August 7, and thereafter, the Northern District set gillnet fishery will again return to a full complement of fishing gear of three set gillnets that are not more than 105 fathoms in aggregate length per permit, unless restricted or closed by emergency order.

(4) The Central District drift gillnet fishery will be managed to conserve Susitna drainage sockeye salmon as follows:

(i) The Department will implement all of the provisions of 5AAC 21.353 Central District Drift Gillnet Fishery management plan.

CURRENT ACTIONS IN DRIFT GILLNET PLAN FOR SALMON CONSERVATION

For the Central District drift gillnet fishery, there are two types of possible restrictions currently in place designed to conserve northern bound stocks. First, beginning July 9 the department must restrict the drift gillnet fishing fleet to Area 1 (Figure 1) of the Central District (section A below), which is that area south of the south end of Kalgin Island, and to the Kenai and Kasilof Sections (the corridor). Prior to 2005, restrictions were made to the drift fleet for one period to the Kenai and Kasilof Sections during this time frame, and for one inlet-wide period. In 2005 the BOF also provided the department with an option of an additional period in Area 1 during this time, if the Kenai River sockeye salmon run was greater than 2 million. This option has never been used.

Secondly, restrictions to the drift fleet for the conservation of Susitna stocks can occur from July 16-31 (section B below). For Kenai River sockeye salmon runs less than 2 million, the department must restrict the drift fleet to Area 1 (and the Kenai and Kasilof Sections); for runs of 2 million to 4 million, the drift fleet is restricted to Area 1 and Area 2 (and the Kenai and Kasilof Sections); and for runs greater than 4 million there are no mandatory restrictions. These restrictions apply to any two regular periods during this time frame. The purpose of the July 9-15 restrictions are to allow for the passage of northern-bound sockeye salmon, while the July 16-31 restrictions are primarily for northern-bound sockeye and coho salmon.

5 AAC 21.353. Central District Drift Gillnet Fishery Management Plan

(a) The department shall manage the Central District commercial drift gillnet fishery as follows:

(1) weekly fishing periods are as described in 5 AAC 21.320(b) ;

(2) the fishing season will open the third Monday in June or June 19, whichever is later, and

(A) from July 9 through July 15,

(i) fishing during the two regular fishing periods is restricted to the Kenai and Kasilof Sections and Drift Gillnet Area 1;

(ii) at run strengths greater than 2,000,000 sockeye salmon to the Kenai River, the commissioner may, by emergency order, open one additional 12-hour fishing period in the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1;

(B) from July 16 through July 31

(i) at run strengths of less than 2,000,000 sockeye salmon to the Kenai River, fishing during the two regular 12-hour fishing periods is restricted to the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1;

(ii) at run strengths of 2,000,000 to 4,000,000 sockeye salmon to the Kenai River, fishing during the two regular 12-hour fishing periods is restricted to the Kenai and Kasilof Sections of the Upper Subdistrict and Drift Gillnet Areas 1 and 2;

(iii) at run strengths greater than 4,000,000 sockeye salmon to the Kenai River, there will be no mandatory restrictions during regular fishing periods;

(C) from August 11 until closed by emergency order,

(i) Drift Gillnet Areas 3 and 4 are open for fishing during regular fishing periods;

(ii) through the 2007 fishing season, Chinitna Bay may be opened by emergency order.

(b) For the purposes of this section,

(1) "Drift Gillnet Area 1" means those waters of the Central District south of Kalgin Island at 60° 20.43' N. lat.;

- (2) "Drift Gillnet Area 2" means those waters of the Central District enclosed by a line from 60° 20.43' N. lat., 151° 54.83' W. long. to a point at 60° 41.08' N. lat., 151° 39.00' W. long. to a point at 60° 41.08' N. lat., 151° 24.00' W. long. to a point at 60° 27.10' N. lat., 151° 25.70' W. long. to a point at 60° 20.43' N. lat., 151° 28.55' W. long.;
- (3) "Drift Gillnet Area 3" means those waters of the Central District within one mile of mean lower low water (zero tide) south of a point on the West Foreland at 60° 42.70' N. lat., 151° 42.30' W. long.;
- (4) "Drift Gillnet Area 4" means those waters of the Central District enclosed by a line from 60° 04.70' N. lat., 152° 34.74' W. long. to the Kalgin Buoy at 60° 04.70' N. lat., 152° 09.90' W. long. to a point at 59° 46.15' N. lat., 152° 18.62' W. long. to a point on the western shore at 59° 46.15' N. lat., 153° 00.20' W. long., not including the waters of the Chinitna Bay Subdistrict.

Sport Fisheries

5 AAC 75.003. Emergency order authority

The commissioner may, by emergency order, change bag and possession limits and annual limits and alter methods and means in sport fisheries. These changes may not reduce the allocation of harvest among other user groups. An emergency order may not supersede bag and possession limits or methods and means established in regulatory management plans established by the Board of Fisheries. The commissioner will use emergency order authority to manage sport fishing opportunity in the following circumstances:

- (1) The commissioner or an authorized designee may decrease sport fish bag and possession limits and annual limits and restrict methods and means of harvest by emergency order when

(A) the total escapement of a species of anadromous fish is projected to be less than the escapement goal for that species listed in management plans that have been adopted by the Board of Fisheries or established by the department; or

(B) the recreational harvest must be curtailed in any fishery for conservation reasons; the department may issue a "catch and release only" emergency order when the estimated hooking mortality is not projected to reduce the population of fish below the number required for spawning escapement or, in the case of resident species, below the level required for maintenance of the desired age and size distribution of the population; "catch and release" as a tool to address conservation under this section shall be labeled "conservation catch and release" to differentiate from catch and release regulations adopted by the Board of Fisheries for special management to create diversity in sport fisheries.

- (2) The commissioner or an authorized designee may increase sport fish bag and possession limits and annual limits and liberalize methods and means of harvest by emergency order when

(A) the total escapement of a species of anadromous fish is projected to exceed the escapement goal for that species listed in management plans that have been adopted by the Board of Fisheries or established by the department, if the total harvest under the increased bag and possession limit will not reduce the escapement below the escapement goal; or

(B) hatchery-produced fish escape through existing fisheries to designated harvest areas in numbers that exceed broodstock needs, any natural spawning requirements, or cost recovery goals of private nonprofit hatcheries; the intent of this subparagraph is to allow harvest when there are no other competing user groups.

(3) For purposes of data collection to improve harvest or stock assessment, or for purposes of enforcement of bag and size limits, the commissioner or an authorized designee may establish, by emergency order, times and areas when anglers may not fillet, mutilate, or otherwise disfigure a specific species of fish in a manner that would prevent species identification, examination of the adipose fin of salmonids, recovery of tags, or determination of the number, sex, age, or length of fish taken until the fish are brought to shore and offloaded from a vessel or removed from a shoreline fishing site. The commissioner or an authorized designee may also require in the emergency order that certain parts of a fish remain attached for the purpose of species identification or data collection. However, during these periods, an angler may gill and gut a fish before the fish is brought to shore and offloaded from a vessel or removed from a shoreline fishing site. This section does not prohibit the consumption or preservation of fish aboard a vessel. For the purposes of this section, "shoreline fishing site" means the shoreline where the fish is hooked and removed from the water and becomes part of the angler's bag limit.

Potential Modification to Sport Fishery in Susitna River drainage

(5) The sockeye salmon sport fishery in the Susitna River drainage will be prosecuted with a bag limit of 3 fish. If the Northern District set gillnet fishery is closed to conserve sockeye salmon, the Susitna River drainage sport fisheries will remain open unless the board directs otherwise. The Susitna River sport harvest is not used to determine spawning escapement or in the development of escapement goals.

RESEARCH PLAN

The department currently assesses Yentna River sockeye salmon escapement and commercial and sport harvests annually. The following research projects include current and proposed projects used to gather detailed information about sockeye salmon stocks in the Susitna River.

CURRENT SUSITNA RIVER DRAINAGE SOCKEYE SALMON RESEARCH PROJECTS

YENTNA RIVER SALMON ESCAPEMENT

Objectives: The primary objectives of this project are to estimate (1) the daily and cumulative escapement of sockeye salmon into the Yentna River, and (2) the age, length, and sex composition of those escapements.

Description: Fish passage into the Yentna River is estimated using side-looking (formerly referred to as side-scanning) Bendix sonar. Fish caught and sampled at companion fish wheels are used to apportion sonar counts to estimate species composition of fish passage (i.e., estimate abundance of sockeye salmon) and the age, length, and sex composition of the inriver sockeye salmon run.

COMPARING BENDIX AND DIDSON SONAR PASSAGE ESTIMATES IN THE YENTNA RIVER

Objective: The primary objective of this project is to compare the Bendix sonar estimates of migrating salmon in the Yentna River with estimates from a Dual frequency Identification SONar (DIDSON).

Description: A DIDSON sonar is placed on both banks of the Yentna River to collect fish passage data independent of the existing Bendix sonar. Both types of sonar equipment are operated at the same time and ensonify the same/similar area of the river so that the passage data is directly comparable.

INRIVER ABUNDANCE AND SPAWNER DISTRIBUTION OF SUSITNA RIVER SOCKEYE SALMON

Objectives: The primary objectives of this study are to (1) estimate the inriver abundance of adult sockeye salmon migrating into the Susitna River with a capture-recapture experiment, and (2) identify sockeye salmon spawning areas in the Susitna River.

Description: In 2006-2008, a capture-recapture experiment is conducted to estimate sockeye salmon abundance in the entire Susitna River. Radio telemetry is used to estimate the spawning distribution throughout the watershed.

EVALUATION OF SOCKEYE SALMON PRODUCTION FROM LAKES IN THE SUSITNA RIVER WATERSHED

Objectives: The primary objectives of this study are to (1) evaluate limnological conditions in seven lakes considered important (major) to sockeye salmon production and compare current conditions to those observed in the 1980s and 1990s, (2) estimate the abundance and mean body size of juvenile sockeye salmon and other juvenile fishes rearing in each lake in the fall, (3) estimate the age composition of the juvenile sockeye salmon in each lake, and (4) evaluate the survival from potential egg deposition to fall fry and from fall fry to smolt.

Description: Estimates of smolt and fall fry abundance, and limnological characteristics such as water chemistry and zooplankton abundance by species are collected (Chelatna, Shell, Byers, Swan, Larson, Stephan, and Judd lakes). Analyses focus on determining carrying capacity of the lakes for sockeye salmon fry and assessing the adequacy of spawning escapements over time.

BIOLOGICAL COMPOSITION OF COMMERCIAL SOCKEYE SALMON HARVEST IN UPPER COOK INLET

Objective: The primary objective of this project is to estimate the age and sex composition of the commercial salmon harvest.

Description: Sockeye salmon harvested in various commercial fisheries in UCI are sampled using a stratified systematic sampling design. Area strata are determined *a priori* using established fishery districts and subdistricts. Temporal stratification is determined post season based on catch patterns in each fishery and the number of samples collected.

STOCK COMPOSITION OF THE UPPER COOK INLET SOCKEYE SALMON COMMERCIAL HARVEST

Objectives: The primary objectives of this study are to (1) estimate the stock composition of sockeye salmon harvested in major commercial fisheries in spatial/time strata, and (2) compare

stock composition among substrata (i.e., fish processors for the drift gillnet fishery and beaches within each management subdistrict for the set gillnet fishery).

Description: This project uses new single nucleotide polymorphism (SNPs) genetic stock identification (GSI) methods to estimate stock-specific composition of the commercial harvest in UCI.

PROPOSED SUSITNA RIVER DRAINAGE SOCKEYE SALMON RESEARCH PROJECTS

A recent review of Division of Commercial Fisheries and Sport Fish Division programs in the Susitna River drainage identified the need for improved escapement, smolt, and habitat information for sockeye salmon. The following research programs are planned to gather further detailed information about sockeye salmon stocks in the Susitna River drainage:

SUSITNA RIVER SOCKEYE SALMON MAJOR SYSTEM ADULT WEIRS

Objective: The primary objective of this project is to estimate the abundance of sockeye salmon spawners entering 7 major rearing lakes in the Susitna River watershed.

Description: Adult weirs will be collaboratively operated by the Department and the Cook Inlet Aquaculture Association (CIAA) on 7 major sockeye salmon rearing lakes (Chelatna, Shell, Byers, Swan, Larson, Stephan, and Judd lakes) in the Susitna River watershed to estimate spawner abundance. The age, sex, and length composition of the adult sockeye salmon escapement will be estimated at each weir. Environmental conditions will be recorded daily (i.e., percent cloud cover, precipitation, and stream and air temperature). Sockeye salmon spawner abundance estimates will be used to (1) evaluate the accuracy of sockeye salmon passage estimates from the Yentna River sonar project, (2) help set escapement goals, and (3) estimate freshwater production of sockeye salmon in the watershed (in conjunction with smolt production project described below).

SUSITNA RIVER SOCKEYE SALMON ADDITIONAL SYSTEM ADULT WEIRS

Objective: The primary objective of this project is to estimate the abundance of sockeye salmon spawners entering 7 additional rearing lakes in the Susitna River watershed.

Description: Adult weirs will be collaboratively operated by the Department and CIAA on 7 additional sockeye salmon rearing lakes (Whiskey, Hewitt, Lockwood, Trapper, Red Shirt, Spink, and Trinity lakes) in the Susitna River watershed to estimate spawner abundance. The age, sex, and length composition of the adult sockeye salmon escapement will be estimated at each weir. Environmental conditions will be recorded daily (i.e., percent cloud cover, precipitation, and stream and air temperature). Sockeye salmon spawner abundance estimates will be used to (1) evaluate the accuracy of sockeye salmon passage estimates from the Yentna River sonar project, (2) help set escapement goals, and (3) estimate freshwater production of sockeye salmon in the watershed (in conjunction with smolt production project described below).

SUSITNA RIVER SOCKEYE SALMON MAJOR SYSTEM SMOLT PRODUCTION

Objective: The primary objective of this project is to estimate the abundance of sockeye salmon smolt emigrating from 7 major rearing lakes in the Susitna River watershed.

Description: The abundance of sockeye salmon smolt emigrating from 7 major sockeye salmon rearing lakes (Chelatna, Shell, Byers, Swan, Larson, Stephan, and Judd lakes) in the Susitna River watershed will be collaboratively estimated by the Department and CIAA. Fyke nets will be operated from late May through June at 6 of the lakes to provide a total smolt enumeration. At the remaining lake (Chelatna Lake), three inclined-plane traps will be operated from late May

through August, and smolt population size will be estimated using standard mark-recapture techniques. Age, weight and length of smolts will be estimated from samples collected daily at each site. Smolt abundance estimates will be used to (1) forecast adult returns, and (2) estimate freshwater production of sockeye salmon in the watershed (in conjunction with adult escapement estimates).

SUSITNA RIVER SOCKEYE SALMON ADDITIONAL SYSTEM SMOLT PRODUCTION

Objective: The primary objective of this project is to estimate the abundance of sockeye salmon smolt emigrating from 7 additional rearing lakes in the Susitna River watershed.

Description: The abundance of sockeye salmon smolt emigrating from 7 additional sockeye salmon rearing lakes (Whiskey, Hewitt, Lockwood, Trapper, Red Shirt, Spink, and Trinity lakes) in the Susitna River watershed will be collaboratively estimated by the Department and CIAA. Flyke nets will be operated from late May through June at all of these lakes to provide a total smolt enumeration. Age, weight and length of smolts will be estimated from samples collected daily at each site. Smolt abundance estimates will be used to (1) forecast adult returns, and (2) estimate freshwater production of sockeye salmon in the watershed (in conjunction with adult escapement estimates).

SUSITNA RIVER FISH PASSAGE RESTORATION

Objective: The primary objective of this project is to restore and improve salmonid access to upstream spawning and rearing habitats in the lower Susitna River.

Description: Upstream access to historically occupied salmonid habitats will be evaluated in the lower Susitna River to facilitate removal of culvert barriers or other in-stream obstructions. As many as 10 upstream fish passage barriers will be identified, prioritized according to cost-benefit analyses of fishery values and project costs, and upstream access improved and restored. During construction and after the fish passage restoration projects have been completed, an established monitoring protocol will be used to track individual restoration project performance.

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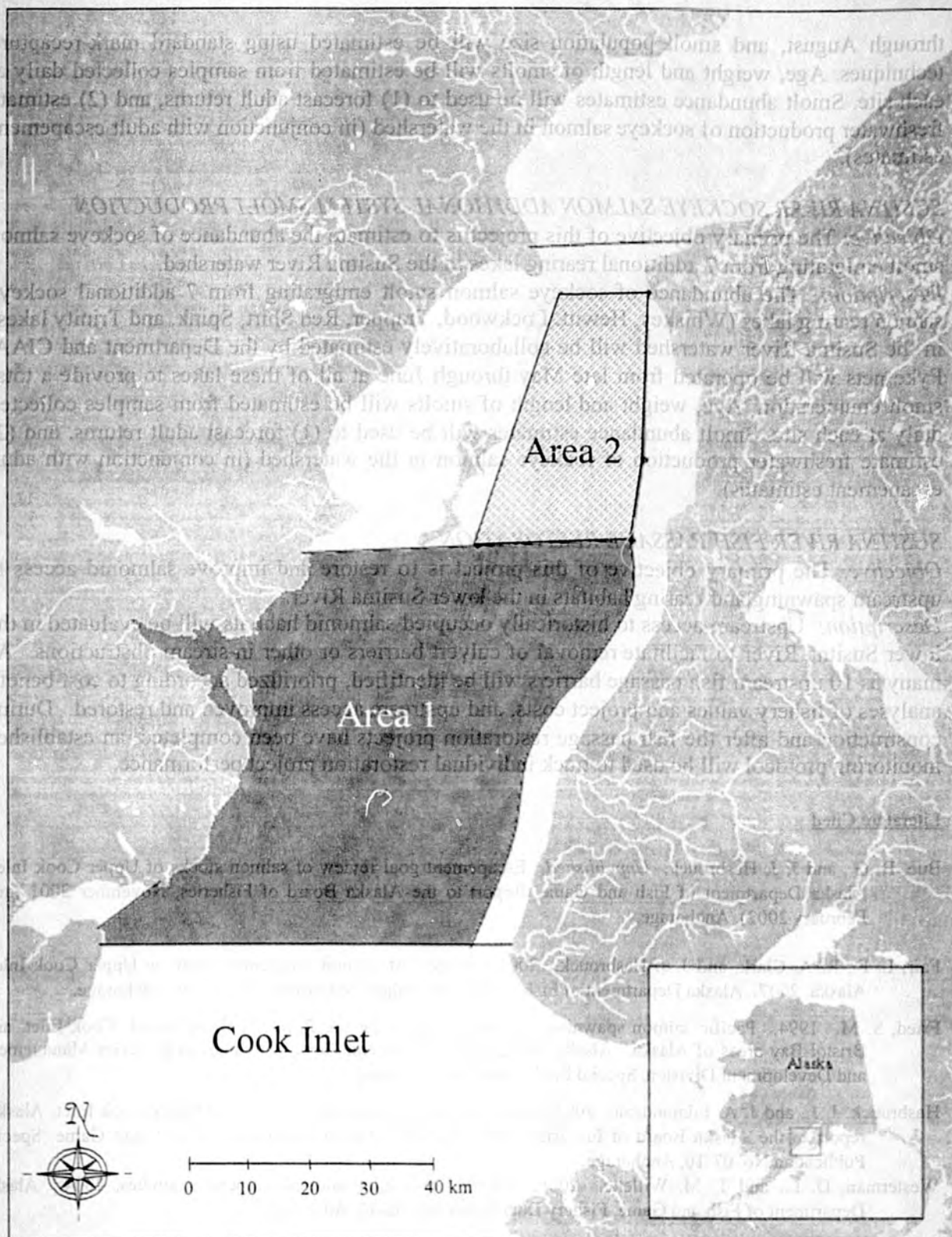
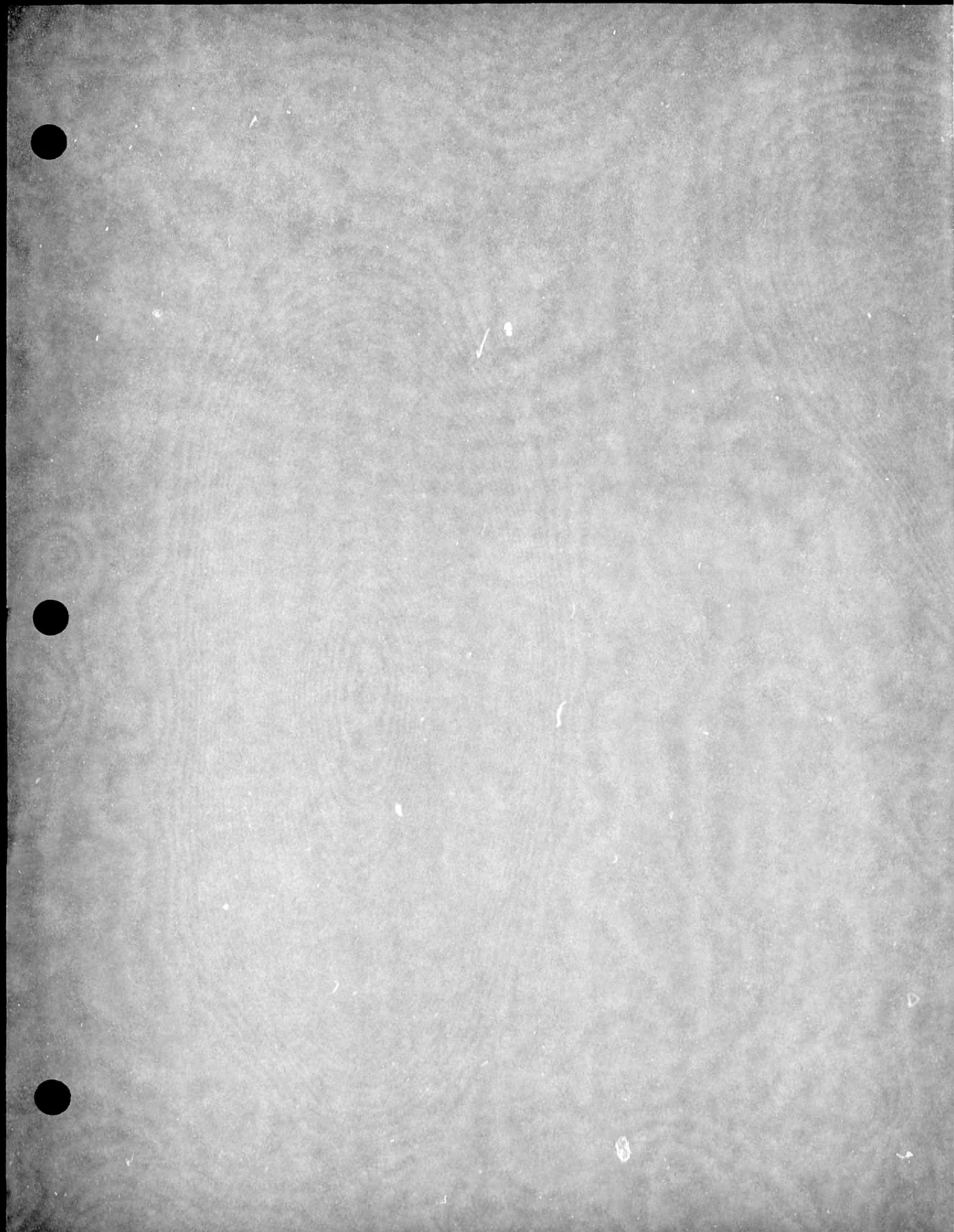


Figure 1.—Map of Central Cook Inlet showing management fishing boundaries for Area 1 and Area 2 for drift gillnet fisheries.



/ *Final*

MATANUSKA-SUSITNA REGION SALMON RESEARCH PLAN

Prepared by

Alaska Department of Fish and Game

and

Cook Inlet Aquaculture Association

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Executive Summary

This salmon research plan will provide information important for management of sockeye, coho, chum, and Chinook salmon in the Matanuska-Susitna region.

The sockeye salmon portion of the plan describes a collaborative effort between Alaska Department of Fish and Game (ADF&G) and Cook Inlet Aquaculture Association (CIAA). Research focuses on estimating sockeye salmon production in 15 major sockeye salmon rearing lakes in the Susitna River and Fish Creek watersheds where production has apparently declined in recent years. These investigations will also seek to determine the cause of observed changes in sockeye salmon production through limnological and predator-prey studies in each lake, restore sockeye salmon production through removal of seasonal barriers (mostly beaver dams) to adult salmon migration into spawning habitats, and develop methods for controlling invasive northern pike that feed on juvenile salmon.

CIAA is currently conducting a complete enumeration of both juvenile and adult migrations on seven lakes thought to be key sockeye salmon producers in the Susitna River system and collecting water quality data to better understand the entire salmon life cycle by isolating variables in the lakes that may be limiting productivity. CIAA and ADF&G realize the current cooperative studies need to be expanded to encompass the scale and duration fisheries research demands to build accurate models and management strategies. These projects extend the time frame of the current study and identify additional lakes and creeks where analysis is critical to understanding factors limiting production in the Susitna River basin.

Six projects also provide information important for management of coho, chum, and Chinook salmon in the Susitna and Little Susitna rivers. Attention is focused on these watersheds because they represent the major salmon producing and recreation areas in the Matanuska-Susitna Borough. Two projects would provide information on coho, chum, and Chinook salmon distribution in the Susitna River watershed to better understand salmon spawning distribution in the watershed, and evaluate stock composition of escapements throughout the watershed. Two projects would improve coho and chum salmon escapement estimates through a weir on the Little Susitna River, and a final project would provide information on chum salmon spawner distribution in the Little Susitna watershed.

Annual costs for these projects are projected out over a five year period (Table 1). A number of these projects need to be run well beyond five years in order to provide full value, while the Little Susitna chum salmon spawner distribution could be completed earlier than five years.

Table 1. Summary of annual project budgets for Matanuska-Susitna Salmon Research Plan projects.

PROJECT TITLE	AGENCY	FY09	FY10	FY11	FY12	FY13	TOTAL
SUSITNA SOCKEYE SALMON ADULT WEIRS	CIAA	\$422.4	\$254.6	\$254.6	\$254.6	\$254.6	\$1,441.0
SUSITNA SOCKEYE SALMON SMOLT PRODUCTION	CIAA	\$288.8	\$256.2	\$256.2	\$256.2	\$256.2	\$1,313.5
SUSITNA SOCKEYE SALMON FISH PASSAGE REMEDIATION	CIAA	\$58.3	\$58.3	\$58.3	\$58.3	\$58.3	\$291.5
SUSITNA SOCKEYE SALMON INVASIVE SPECIES CONTROL	CIAA	\$193.0	\$193.0	\$193.0	\$193.0	\$193.0	\$965.0
FISH CREEK SOCKEYE SALMON PRODUCTION	CIAA	\$20.2	\$20.2	\$20.2	\$20.2	\$20.2	\$101.0
FISH CREEK SOCKEYE SALMON PRODUCTION	ADFG	\$48.1	\$47.8	\$47.8	\$47.8	\$47.8	\$239.4
SYNTHESIS & OVERSIGHT OF SOCKEYE SALMON LAKE INVESTIGATIONS	ADFG	\$98.2	\$98.2	\$98.2	\$98.2	\$98.2	\$491.0
SUSITNA RIVER COHO AND CHUM SALMON DISTRIBUTION	ADFG	\$276.7	\$450.3	\$467.6	\$484.9	\$502.2	\$2,181.6
SUSITNA RIVER CHINOOK SALMON DISTRIBUTION	ADFG	\$273.0	\$394.1	\$409.3	\$424.4	\$439.6	\$1,940.4
LITTLE SUSITNA RIVER WEIR INSEASON ASSESSMENT	ADFG	\$98.0	\$51.8	\$53.3	\$54.9	\$56.6	\$314.6
LITTLE SUSITNA RIVER CHUM SALMON ESCAPEMENT	ADFG	\$13.2	\$13.6	\$14.0	\$14.4	\$14.9	\$70.1
LITTLE SUSITNA RIVER CHUM SALMON SPAWNER DISTRIBUTION	ADFG	\$126.0	\$121.3	\$124.9	\$128.7	\$0.0	\$500.9
TOTAL		\$1,915.9	\$1,959.4	\$1,997.4	\$2,035.6	\$1,941.7	\$9,850.0

Introduction

Cook Inlet Aquaculture Association (CIAA) in a joint effort with Alaska Department of Fish and Game (ADF&G) is currently in the midst of a three year study to evaluate and better understand the apparent failure of recent sockeye salmon runs to the Susitna River (Figure 1). Susitna River maintains a high profile in the Matanuska-Susitna Borough focusing the attention of resource managers, local, and state officials. Concerned citizens are actively engaged and looking to CIAA and ADF&G for leadership on this issue.

Recent sockeye salmon returns to the Northern District of Upper Cook Inlet have been substantially less than expected. Sonar estimates of sockeye salmon escapements into Yentna River have been below the escapement goal in 5 of the past 10 years. There could be a number of causes for this recent trend which can be addressed by two broad questions. The first is whether or not the system is producing juvenile salmon that succeed in migrating to sea. The second question is whether or not a sufficient number of adult fish are failing to reach the spawning grounds.

Future studies, mitigation, and rehabilitation strategies in the Susitna River basin must isolate and remediate obvious changes in habitat and rearing conditions. Since the 1980s several key variables that directly impact productivity in the Susitna River system have become obvious to resource managers. Urbanization, migration barriers, and invasive species have all impacted productivity in the Susitna River system in recent years. These variables will continue to deteriorate the productivity of the system unless mitigation efforts are funded to address the problem. Preliminary data collected by CIAA and ADF&G already indicates the Susitna River system salmonid productivity has changed. Additional studies must be proactive in rehabilitation strategy focused on increasing productivity and monitoring the success of these mitigation efforts.

ADF&G is also focusing on management of Susitna River sockeye salmon by improving (1) estimates of escapement goal ranges that will maximize yields, (2) estimates of spawner abundance and adult production, and (3) forecasts of adult returns used to achieve escapement goals. Projects described in this plan address all three of these concerns. Better estimates of sockeye salmon production from spawners (potential egg deposition) to smolt in major rearing lakes will provide data needed to set escapement goals to maximize yields. Estimates of numbers of adult spawners entering major rearing lake systems will be used to evaluate accuracy of sockeye salmon escapement estimates from the Yentna River sonar project. Finally, sockeye salmon smolt abundance estimates from major rearing lakes will be used to improve forecasts of adult returns.

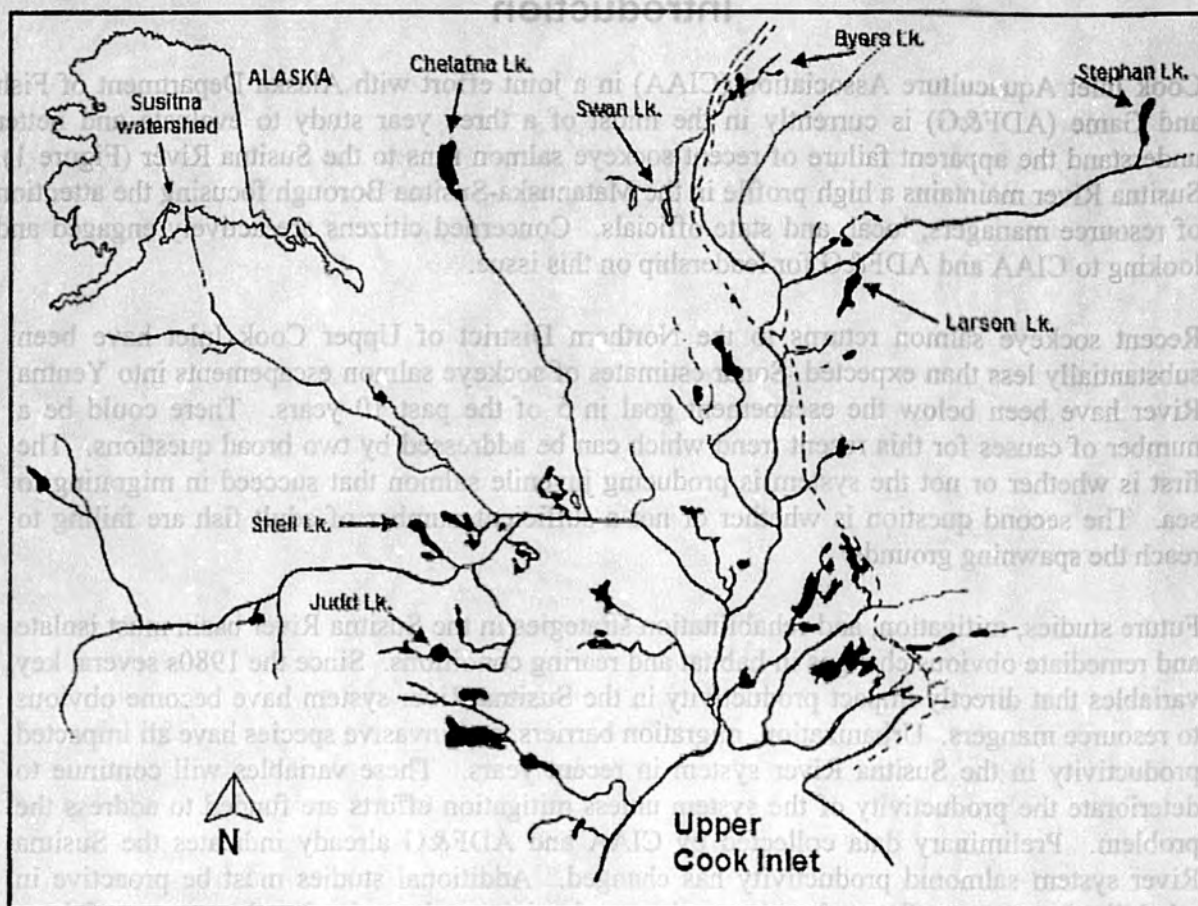


Figure 1. - Susitna River Basin and Study Lakes

Sockeye Salmon Research and Recovery Plan

Continuation of Existing Studies

ADF&G has implemented a program that focuses primarily on adult fish and management's ability to enumerate the return through a mark recapture study. CIAA is conducting a complete enumeration of both juvenile and adult migrations on seven lakes thought to be key sockeye salmon producers in the system. It is this adult to juvenile relationship that allows us to analyze and evaluate production and rearing conditions of each lake in the study. In addition to collection of physical data on juvenile and adult salmon, CIAA is also collecting water quality data to better understand the entire freshwater salmon life cycle by isolating variables in the study lakes that may be limiting productivity. The goal is to collect sound biological data to provide the foundation on which decisions for management and rehabilitation strategies will be drawn.

Funding the current ongoing partnership in 2008 (FY09) between CIAA and ADF&G is the first step towards the assimilation of key data instrumental in designing future projects to mitigate sockeye salmon yield concerns in the Susitna River basin. Weirs operated over the past two years have provided accurate simple counts that complement studies by ADF&G. It is the combination of these strategies and the reliability of weir counts that focus future efforts and rehabilitation strategies that will produce results. CIAA is seeking the final installment of \$150,000 in FY09 to operate the enumeration weirs and complete our initial study. For these reasons it is vital the current ongoing study be funded in full to formulate the questions at the basis of future studies.

Current Susitna Sockeye Salmon Studies

Primary Objective: To estimate abundance of sockeye salmon in seven (7) major rearing lakes in the Susitna River watershed.

Description: Investigation involves studies on seven lakes. Four of the lakes are along the mainstem Susitna River and Talkeetna River (Larson, Stephan, Swan and Byers Lakes); and three are on tributaries of the Yentna River (Judd, Shell, and Chelatna Lakes). Studies include enumeration of adult salmon escapement and smolt emigrations at each lake. Age, sex, weight, and length composition of smolt emigrations will be estimated at each weir from samples collected each day. Age, sex, and length composition of adult sockeye salmon escapement will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light and temperature profiles within each lake.

Future Studies

CIAA and ADF&G realize current cooperative studies need to be expanded to encompass the scale and duration fisheries research demands to build accurate models and management strategies. These proposals extend the time frame of the current study and identify additional lakes and creeks where analysis is critical to understanding factors limiting production in the Susitna River basin.

CIAA supports the studies identified in ADF&G's document *Preliminary Draft of Susitna Sockeye Salmon Action Plan*. These studies document vital information needed to investigate and manage the Susitna River system but should be expanded to include additional assessment of the lake rearing systems. This information is essential to understanding factors limiting production throughout the Susitna River basin, since remedial efforts may not be effective if this remains unknown. After just two years of investigation, two such issues have surfaced - fish passage restrictions and invasive predatory pike. Addressing these issues provides proactive mitigation today. We have included two proposals in this plan to ensure adult salmon can transit their natal creeks unabated by excessive fish passage restrictions and invasive species.

Susitna Sockeye Salmon Adult Weirs

Primary Objective: To estimate abundance of sockeye salmon spawners entering fourteen (14) rearing lakes in the Susitna River watershed.

Description: CIAA will conduct adult salmon investigations on fourteen (14) lakes; Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey. Studies include enumeration of adult sockeye salmon escapement at each lake. Age, sex, and length composition will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light, and temperature profiles within each lake.

Susitna Sockeye Salmon Smolt Production

Primary Objective: To estimate abundance of sockeye salmon smolt emigrating from fourteen (14) rearing lakes in the Susitna River watershed.

Description: CIAA will conduct salmon smolt investigative studies on fourteen (14) lakes; Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey. Studies include enumeration of smolt emigration at each lake. Age, sex, weight, and length composition will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light, and temperature profiles within each lake.

Susitna Sockeye Salmon Fish Passage Remediation

Primary Objective: Identification and remediation by notching of beaver dams blocking fish passage into spawning lakes, creeks, and sloughs.

Description: CIAA will survey major sockeye salmon migration corridors and implement remediation strategies to enable fish passage into critical spawning locations where adult fish are failing to reach spawning grounds due to beaver dams.

Susitna Sockeye Salmon Invasive Species Control

Primary Objective: Identification of invasive species in fourteen (14) lake systems.

Description: CIAA will survey major sockeye salmon producing rearing lakes; Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey in the Susitna River watershed for invasive northern pike and assess fish community structure. CIAA will identify predator prey relationships that may be contributing to the decline in system productivity from historical record. Alaska Dept. of Fish and Game (2007) identified 64 water bodies in the Matanuska-Susitna Borough region where invasive northern pike were either confirmed or suspected to occur. CIAA will develop control techniques to abate northern pike infestation.

Fish Creek Sockeye Salmon Production

Primary Objective: To estimate freshwater production of sockeye salmon in the Fish Creek watershed and determine limits to production.

Description: CIAA and ADFG will jointly estimate freshwater production of sockeye salmon in the Fish Creek watershed from potential egg deposition to smolt over five years. ADFG will conduct limnological sampling monthly from May through September each year to estimate the rearing potential of Big Lake. Hydroacoustic and townet surveys will be conducted in September to estimate abundance of sockeye salmon fry and other juvenile fishes in Big Lake. Abundance of sockeye salmon smolts emigrating from the watershed will be estimated by CIAA. Project results will be used to (1) estimate survival from potential egg deposition to smolt, (2) evaluate limits to sockeye salmon production and identify potential restoration actions, (3) help set an escapement goal, and (4) forecast adult returns.

Synthesis & Oversight of Sockeye Salmon Lake Investigations

Primary Objective: To provide training of field crews at smolt and adult weir camps, coordinate activities among projects, and synthesize results of lake investigations.

Description: This project will fund a seasonal ADF&G biologist to coordinate activities among sockeye salmon lake investigation projects improving efficiency and consistency of research efforts. Each smolt and adult weir field camp will be visited several times per month to provide training for field crews, data quality assurance, and other assistance where needed. After the field season, results from various lake investigations (limnology, predator-prey, fall

fry, smolt, and adult production data) will be assembled into a database and synthesized into a useful product for resource managers.

Coho, Chum, and Chinook Salmon Projects

Projects listed here would provide information important for management of coho, chum, and Chinook salmon in the Susitna and Little Susitna rivers. Attention is focused on these watersheds because they represent the major salmon producing and recreation areas in the Matanuska-Susitna Borough. Annual costs for these projects are projected out over a five year period. A number of these projects need to be run well beyond five years in order to provide full value, while the Little Susitna chum salmon spawner distribution could be completed earlier than five years.

Susitna River Coho and Chum Salmon Distribution

Primary Objective: To estimate spawning distribution and stock composition of coho and chum salmon in the Susitna River watershed.

Description: Four fish wheels will be operated at Flathorn (Susitna River kilometer 31) each year to capture and apply radio tags to coho (*Oncorhynchus kisutch*) and chum (*O. keta*) salmon for the duration of the run (July through mid-September). Radio tagged salmon will be tracked using a fixed-wing aircraft multiple times throughout the season. Coho and chum salmon distribution estimates will be used to 1) better understand coho and chum salmon spawning distribution in the Susitna River watershed, and 2) evaluate stock composition of escapements throughout the Susitna watershed.

Susitna River Chinook Salmon Distribution

Primary Objective: To estimate spawning distribution and stock composition of Chinook salmon in the Susitna River watershed.

Description: Drift gillnets will be used at Flathorn (Susitna River kilometer 31) each year to capture and apply radio tags to Chinook salmon (*Oncorhynchus tshawytscha*) for the duration of the run (May through July). Tissue samples will also be collected for genetic baseline development. Tissue samples will also be collected for genetic baseline development. Radio tagged salmon will be tracked using a fixed-wing aircraft multiple times throughout the season. Chinook salmon distribution estimates will be used to 1) better understand Chinook salmon spawning distribution in the Susitna River watershed, and 2) evaluate stock composition of escapements throughout the Susitna watershed.

Little Susitna River Weir Inseason Assessment

Primary Objective: To count coho salmon escapement and obtain a partial count of chum salmon escapement into the Little Susitna River.

Description: A weir to count coho salmon currently operates on the Little Susitna River at river kilometer 115. However, weir counts at river kilometer 115 are too late for inseason

management and it is not certain what proportion of coho and chum salmon escapements spawn below river kilometer 115. The weir will be moved back to river kilometer 51 to remedy these concerns.

Little Susitna River Chum Salmon Escapement

Primary Objective: To count escapement of chum salmon in the Little Susitna River.

Description: A weir is currently used to count escapement of coho salmon into the Little Susitna River. But, the weir is installed in late July, which provides only a partial count of chum salmon escapement. This project would initiate weir activities on approximately July 10 to count the entire chum salmon escapement.

Little Susitna River Chum Salmon Spawner Distribution

Primary Objective: To estimate distribution of spawning chum salmon in the Little Susitna River.

Description: Adult chum salmon will be captured in the lower Little Susitna River and marked with a radio tag throughout the run. Mobile tracking will be done by boat and aircraft to identify and define important spawning areas.

Budget Summary

Table 1. Summary of annual project budgets for Matanuska-Susitna Salmon Research Plan projects.

PROJECT TITLE	AGENCY	FY09	FY10	FY11	FY12	FY13	TOTAL
SUSITNA SOCKEYE SALMON ADULT WEIRS	CIAA	\$422.4	\$254.6	\$254.6	\$254.6	\$254.6	\$1,441.0
SUSITNA SOCKEYE SALMON SMOLT PRODUCTION	CIAA	\$288.8	\$256.2	\$256.2	\$256.2	\$256.2	\$1,313.5
SUSITNA SOCKEYE SALMON FISH PASSAGE REMEDIATION	CIAA	\$58.3	\$58.3	\$58.3	\$58.3	\$58.3	\$291.5
SUSITNA SOCKEYE SALMON INVASIVE SPECIES CONTROL	CIAA	\$193.0	\$193.0	\$193.0	\$193.0	\$193.0	\$965.0
FISH CREEK SOCKEYE SALMON PRODUCTION	CIAA	\$20.2	\$20.2	\$20.2	\$20.2	\$20.2	\$101.0
FISH CREEK SOCKEYE SALMON PRODUCTION	ADFG	\$48.1	\$47.8	\$47.8	\$47.8	\$47.8	\$239.4
SYNTHESIS & OVERSIGHT OF SOCKEYE SALMON LAKE INVESTIGATIONS	ADFG	\$98.2	\$98.2	\$98.2	\$98.2	\$98.2	\$491.0
SUSITNA RIVER COHO AND CHUM SALMON DISTRIBUTION	ADFG	\$276.7	\$450.3	\$467.6	\$484.9	\$502.2	\$2,181.6
SUSITNA RIVER CHINOOK SALMON DISTRIBUTION	ADFG	\$273.0	\$394.1	\$409.3	\$424.4	\$439.6	\$1,940.4
LITTLE SUSITNA RIVER WEIR INSEASON ASSESSMENT	ADFG	\$98.0	\$51.8	\$53.3	\$54.9	\$56.6	\$314.6
LITTLE SUSITNA RIVER CHUM SALMON ESCAPEMENT	ADFG	\$13.2	\$13.6	\$14.0	\$14.4	\$14.9	\$70.1
LITTLE SUSITNA RIVER CHUM SALMON SPAWNER DISTRIBUTION	ADFG	\$126.0	\$121.3	\$124.9	\$128.7	\$0.0	\$500.9
TOTAL		\$1,915.9	\$1,959.4	\$1,997.4	\$2,035.6	\$1,941.7	\$9,850.0

Literature Cited

Alaska Department of Fish and Game. 2007. Management Plan for Invasive Northern Pike in Alaska. Alaska Department of Fish and Game. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage. 58 pp.

Appendices

Alaska Department of Fish and Game. 2007. Management Plan for Invasive Northern Pike in Alaska. Alaska Department of Fish and Game. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage. 28 pp.

CURRENT SUSITNA SOCKEYE SALMON STUDIES

Primary Objective: To estimate abundance of sockeye salmon in seven (7) major rearing lakes in the Susitna River watershed.

Description: Investigation involves studies on seven lakes. Four of the lakes are along the mainstem Susitna River and Talkeetna River (Larson, Stephan, Swan and Byers Lakes); and three are on tributaries of the Yentna River (Judd, Shell, and Chelatna Lakes). Studies include the enumeration of adult salmon escapement and smolt emigrations at each lake. Age, sex, weight, and length composition of smolt emigrations will be estimated at each weir from samples collected each day. Age, sex, and length composition of adult sockeye salmon escapement will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light and temperature profiles within each lake.

Duration: One Year

Budget Summary: Total cost of the CIAA component of the current ongoing study is budgeted at \$750,000. In 2006 CIAA requested \$500,000, a two-to-one match for our commitment of \$250,000 to be used over the three year study to make this joint effort possible. In 2006 CIAA received \$200,000 of the CIP funding request, in 2007 CIAA received \$150,000. CIAA is asking for the allocation of the **remaining \$150,000** in funding to match our commitment to the current ongoing Susitna River sockeye salmon study.

SUSITNA SOCKEYE SALMON ADULT WEIRS

Primary Objective: To estimate abundance of sockeye salmon spawners entering fourteen (14) rearing lakes in the Susitna River watershed.

Description: CIAA will conduct adult salmon investigative studies on fourteen (14) lakes; Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey. Studies include enumeration of adult sockeye salmon escapement at each lake. Age, sex, and length composition will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light, and temperature profiles within each lake.

Duration: Five Years

CIAA Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$134.1	\$115.0	\$115.0	\$115.0	\$115.0	\$593.9
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$119.7	\$104.3	\$104.3	\$104.3	\$104.3	\$536.9
400 Supplies	\$168.7	\$35.4	\$35.4	\$35.4	\$35.4	\$310.1
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$422.4	\$254.6	\$254.6	\$254.6	\$254.6	\$1,441.0

SUSITNA SOCKEYE SALMON SMOLT PRODUCTION

Primary Objective: To estimate abundance of sockeye salmon smolt emigrating from fourteen (14) rearing lakes in the Susitna River watershed.

Description: CIAA will conduct salmon smolt investigative studies on fourteen (14) lakes; Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey. Studies include enumeration of smolt emigration at each lake. Age, sex, weight, and length composition will be estimated at each weir from samples collected each day. Environmental conditions will also be measured each day, i.e. percent cloud cover, precipitation (nearest mm), stream and air temperature. The study includes limnological sampling (water chemistry and zooplankton) and collection of dissolved oxygen, light, and temperature profiles within each lake.

Duration: Five Years

CIAA Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$128.0	\$115.0	\$115.0	\$115.0	\$115.0	\$588.1
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$104.3	\$104.3	\$104.3	\$104.3	\$104.3	\$521.5
400 Supplies	\$56.5	\$36.8	\$36.8	\$36.8	\$36.8	\$203.9
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$288.8	\$256.2	\$256.2	\$256.2	\$256.2	\$1,313.5

SUSITNA SOCKEYE SALMON FISH PASSAGE REMEDIATION

Primary Objective: Identification and remediation (notching) of beaver dams blocking fish passage into spawning lakes, creeks, and slews.

Description: CIAA will survey major sockeye salmon migration corridors and implement remediation strategies to enable fish passage into critical spawning habitats where adult fish are failing to reach spawning grounds due to beaver dams.

Duration: Five Years

CIAA Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$14.7	\$14.7	\$14.7	\$14.7	\$14.7	\$73.3
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$40.0	\$40.0	\$40.0	\$40.0	\$40.0	\$200.0
400 Supplies	\$3.7	\$3.7	\$3.7	\$3.7	\$3.7	\$18.3
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$58.3	\$58.3	\$58.3	\$58.3	\$58.3	\$291.5

SUSITNA SOCKEYE SALMON INVASIVE SPECIES CONTROL

Primary Objective: Assess impacts of invasive species on sockeye salmon production in fourteen (14) lake systems.

Description: CIAA will survey major sockeye salmon rearing lakes (Byers, Chelatna, Hewitt, Judd, Larson, Lockwood, Red Shirt, Shell, Spink, Stephan, Swan, Trapper, Trinity, and Whiskey) in the Susitna River watershed to assess invasive northern pike populations and fish community structure. CIAA will identify predator-prey relationships that may be contributing to decline in sockeye salmon productivity. CIAA will investigate control techniques to reduce northern pike abundance. A blue-ribbon panel will be assembled to develop a detailed research plan for these investigations.

Duration: Five Years

CIAA Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$40.3	\$40.3	\$40.3	\$40.3	\$40.3	\$201.3
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$110.0	\$110.0	\$110.0	\$110.0	\$110.0	\$550.0
400 Supplies	\$42.8	\$42.8	\$42.8	\$42.8	\$42.8	\$213.8
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$193.0	\$193.0	\$193.0	\$193.0	\$193.0	\$965.0

FISH CREEK SOCKEYE SALMON PRODUCTION

Primary Objective: To estimate freshwater production of sockeye salmon in the Fish Creek watershed and determine limits to production.

Description: CIAA and ADFG will jointly estimate freshwater production of sockeye salmon in the Fish Creek watershed from potential egg deposition to smolt over a five year period. An adult weir, currently operated by ADF&G on Fish Creek, will provide estimates of spawner abundance, as well as, age, sex, and length composition of escapement. Otoliths will be collected from escapement to estimate hatchery contribution. ADF&G will conduct limnological sampling monthly from May through September each year to estimate rearing potential of Big Lake. Measured parameters will include water temperature, dissolved oxygen, light penetration, phytoplankton and zooplankton density and species composition. ADF&G will conduct hydroacoustic and tow net surveys in September to estimate abundance of sockeye salmon fry and other juvenile fishes in Big Lake. Tow netting with a mid-water trawl will be conducted in conjunction with acoustic surveys at night to estimate species composition of ensonified targets, mean size of each species of juvenile fish and age composition of juvenile sockeye salmon in the lake. Abundance of sockeye salmon smolts emigrating from the watershed will be estimated by CIAA using a fyke net. All smolts will be directed into the live box by wings extending from the shoreline to the front of the fyke trap providing a total smolt enumeration. Otoliths will be collected from a sample of fall fry and smolts to estimate hatchery contribution. Fall fry and smolt samples will be analyzed at the ADF&G Pathology Laboratory to estimate incidence of disease and parasites in juveniles. Fall fry samples will also be analyzed to estimate occurrence of enzymes produced when fish are exposed to hydrocarbons. Project results will be used to (1) estimate survival from potential egg deposition to smolt, (2) evaluate limits to sockeye salmon production and identify potential restoration actions, (3) help set an escapement goal, and (4) forecast adult returns.

Duration: Five Years

CIAA Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$16.0	\$16.0	\$16.0	\$16.0	\$16.0	\$80.0
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$6.0
400 Supplies	\$3.0	\$3.0	\$3.0	\$3.0	\$3.0	\$15.0
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$20.2	\$20.2	\$20.2	\$20.2	\$20.2	\$101.0

FISH CREEK SOCKEYE SALMON PRODUCTION, (continued).

ADFG Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$13.3	\$13.3	\$13.3	\$13.3	\$13.3	\$66.7
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$33.2	\$33.2	\$33.2	\$33.2	\$33.2	\$166.1
400 Supplies	\$1.6	\$1.3	\$1.3	\$1.3	\$1.3	\$6.6
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$48.1	\$47.8	\$47.8	\$47.8	\$47.8	\$239.4

Project Total Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$29.3	\$29.3	\$29.3	\$29.3	\$29.3	\$146.7
200 Travel	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
300 Contractual	\$34.4	\$34.4	\$34.4	\$34.4	\$34.4	\$172.1
400 Supplies	\$4.6	\$4.3	\$4.3	\$4.3	\$4.3	\$21.6
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$68.3	\$68.0	\$68.0	\$68.0	\$68.0	\$340.4

SYNTHESIS and OVERSIGHT of SOCKEYE SALMON LAKE INVESTIGATIONS

Primary Objective: To provide training of field crews at smolt and adult weir camps, coordinate activities among projects, and synthesize results of lake investigations.

Description: This project will fund a seasonal ADF&G biologist to coordinate activities among sockeye salmon lake investigation projects improving efficiency and consistency of research efforts. Each smolt and adult weir field camp will be visited several times per month to provide training for field crews, data quality assurance, and other assistance where needed. After the field season, results from various lake investigations (limnology, predator-prey, fall fry, smolt, and adult production data) will be assembled into a database and synthesized into a useful product for resource managers.

Duration: Five Years

ADFG Budget:

Line Item	FY09	FY10	FY11	FY12	FY13	Total
100 Personnel	\$31.0	\$31.0	\$31.0	\$31.0	\$31.0	\$155.0
200 Travel	\$2.4	\$2.4	\$2.4	\$2.4	\$2.4	\$12.0
300 Contractual	\$62.0	\$62.0	\$62.0	\$62.0	\$62.0	\$310.0
400 Supplies	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$14.0
500 Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Total Direct Costs	\$98.2	\$98.2	\$98.2	\$98.2	\$98.2	\$491.0