

**Supplement to the Environmental Assessment
May 2000**

**Hidden Lake Sockeye Salmon
Enhancement Project**

Kenai National Wildlife Refuge

August 2, 2005

For:
Amendment of
Special Use Permit
KN-05-0001

1.0 Introduction

In 1976, the Alaska Department of Fish and Game (Department) initiated activities to enhance the sockeye salmon population rearing in Hidden Lake through the supplemental stocking of salmon fry. The objective was to increase the number of salmon available in Cook Inlet for harvest by all user groups: subsistence, personal use, recreational, and commercial. The Hidden Lake enhancement project has been operating for approximately 29 years, and, as a result, the number of adult salmon from Hidden Lake available for harvest increased substantially. Hidden Lake is located within Kenai National Wildlife Refuge (Refuge) and the project operates under the conditions of a Special Use Permit (SUP) issued to the Department by the Refuge.

An amendment to the Hidden Lake SUP is sought by the Department to mitigate the effects of the recent suspension of another sockeye salmon enhancement program, the Tustumena Project, that also was located in the Refuge. In 1974 the Department initiated the Tustumena Lake sockeye salmon enhancement project; Cook Inlet Aquaculture Association (CIAA) assumed operation of the project between 1993 and 2003. The purpose of the project was the enhancement of the Tustumena Lake sockeye return for the common property fisheries, and enhancement support for the Lower Cook Inlet barrier lakes project which currently utilizes three lakes (ten lakes were in the original program) located outside of the Refuge. The Tustumena Lake Project also operated historically under the provisions of an environmental assessment and Refuge SUP.

In December 2003, the Ninth Circuit Court of Appeals ruled the Tustumena Lake enhancement project violated the 1964 Wilderness Act, and the project was terminated. Termination of the Tustumena Lake project eliminated the egg source for the Lower Cook Inlet Lakes enhancement project, that is located well outside of the Refuge.

Under the Department's oversight, CIAA proposes to establish a sustaining run of sockeye salmon at Tutka Bay (outside the Refuge) to supply lakes in Lower Cook Inlet,

but CIAA needs a temporary egg source to proceed and maintain the project in the interim. CIAA, in cooperation with the Department, investigated alternative egg sources for this project and identified Hidden Lake as the best temporary egg source for the Lower Inlet Lakes Project, which would establish a return in Lower Cook Inlet to serve as its own future egg source. The proposed use of Hidden Lake stock would not alter the impacts of the existing enhancement project within the Refuge, which were analyzed in the current (2000) Environmental Assessment.

1.1 Genetic Consideration of Sockeye Salmon Stock Selection for the Lower Cook Inlet Lakes Project and Tutka Bay program

One of the Department's key genetics concerns with any proposed hatchery activity is the risk to adjacent wild stocks posed by the straying of hatchery or enhanced stocks. Genetic risks from the broodstock development at Tutka Bay Hatchery and the stocking of the three lakes are mitigated by the fact that all fry rearing is conducted in freshwater, a process demonstrated to produce very high fidelity (very little or no straying). Even given this caveat, according to the Department's Genetics Policy requirements, the egg source should originate from a local stock. Long-distance transport of stocks has been demonstrated to promote straying and general poor performance in the recipient hatchery. Hidden Lake was one of several sources of local stocks that was considered and met this requirement (Table 1).

Sockeye probably have the highest affinity of all salmon to home to their rearing/release site. Use of the Hidden Lake stock is expected to have minimal risk to wild stocks, but the Department would conduct straying evaluations to verify this assumption.

1.2 ADF&G Selection Matrix for a Brood Source for the Lower Cook Inlet Lakes Project and to Establish a Return to Lower Cook Inlet as a Future Brood Source.

In consultation with the Department, CIAA conducted a search of potential brood sources for the Lower Inlet Lakes Project and to develop a return to serve as a future

brood source. The list of potential brood sources was submitted to the Department for review. After reviewing all the potential brood sources, the Department identified Hidden Lake as the best brood source to replace Tustumena Lake. This decision was based primarily on biological and management considerations. The decision process is outlined in a matrix in Table 1.

2.0 Purpose of the Action

Sockeye salmon enhancement at Hidden Lake was identified in the Cook Inlet Regional Salmon Enhancement Plan 1981 - 2000 and considered an integral component of meeting the salmon production goals set in the plan. The project has been in operation for approximately 29 years and has been sized to contribute additional salmon to Cook Inlet subsistence, personal use, recreational, and commercial salmon fisheries with minimal impact to Hidden Lake and the surrounding environment. At the current level of enhancement, the project was determined to minimize conflicts with applicable Refuge goals and objectives. The U.S. Fish and Wildlife Service (FWS) issued a Finding of No Significant Impact for the sockeye salmon enhancement project at Hidden Lake on May 26, 2000, based on an Environmental Assessment and other supporting documents.

This document considers the Department's request for an amendment to the Special Use Permit issued for the Hidden Lake enhancement project that would allow the additional take of eggs but effect no other changes. This request is being made because broodstock and eggs for the Lower Cook Inlet Lakes salmon stocking project that were historically collected in conjunction with the Tustumena Lake sockeye salmon population enhancement project are no longer available. Because the Ninth Circuit Court of Appeals ruling effectively eliminated the source of fry for the Lower Cook Inlet Lakes Project and threatens its continuation, an alternative adult sockeye return is needed to temporarily provide a brood source to maintain the project while a new, self-sustaining returning stock is established to support the program long-term.

To provide a reliable, long-term brood source that would allow the continuation of the Lower Cook Inlet Lakes enhancement project, CIAA proposed to develop a sockeye return to Tutka Bay Lagoon. Both the Lower Cook Inlet Lakes and Tutka Bay Lagoon are outside of the Kenai National Wildlife Refuge. CIAA and the Department mutually agreed that Hidden Lake broodstock represent the best alternative brood source for the Lower Cook Inlet Lakes stocking project due to run timing, genetic, and logistical considerations. Additional broodstock and eggs from Hidden Lake would be required for no more than 5 years.

Current permitted egg take for the Hidden Lake Sockeye Salmon Enhancement Project requires approximately 660 adult salmon that are seined from the northwest end of the lake from mid- to late September each year. Males and females are taken in equal numbers, resulting in approximately 800,000 fertilized eggs. The eggs are kept under controlled conditions through hatching at the Trail Lakes Hatchery, and the fry are released back into the lake the following May. The proposed amendment to the current project would increase the take of adult sockeyes by approximately 4,000 additional fish in order to produce an estimated additional 5 million eggs. The additional 5 million eggs would also be incubated and reared at the Trail Lakes Hatchery and should result in an estimated 4 million fry. Of these, approximately 3,500,000 fry would be released into Leisure, Hazel, and Kirschner Lakes (the Lower Cook Inlet Enhancement Project Lakes located off the Refuge). The remaining 500,000 fry would be reared to smolt for release at Trail Lakes Hatchery (estimated to result in approximately 250,000 smolt annually). The fish released at Trail Lakes Hatchery would be reared at the hatchery until March or April and then transferred to net pens in Tutka Bay Lagoon for final rearing, imprinting, and release in May or June. Freshwater from Tutka Creek would be supplied to the net pens for imprinting. The additional egg take from Hidden Lake would only be required from 2005 through 2008 or 2009. By 2010, a self-sustaining return of sockeye salmon to Tutka Bay Lagoon would provide all of the necessary eggs for the Lower Cook Inlet Lakes Enhancement Project.

2.1 Project Purpose

The importance of salmon as a valuable, harvestable, and renewable resource dates back to the last century. The importance of the salmon resource to the State of Alaska was officially recognized at statehood when the Constitution (Article VIII, Section 5) authorized the legislature to “*Provide for facilities, improvements and services . . . to assure further utilization and development of the fisheries.*” The importance of the Cook Inlet salmon resource was recognized in 1972, when Alaska Senate Resolution No. 27 directed the Alaska Department of Fish and Game to expedite the rebuilding of Cook Inlet sockeye salmon stocks.

In 1976, in a committee substitute for Senate Bill No. 688, the Department’s Commissioner was authorized to

. . . designate regions of the state for the purpose of enhancing salmon production and shall develop and amend as necessary a comprehensive salmon enhancement plan for each region

In 1976, the Department began efforts to increase salmon production throughout the Cook Inlet drainage, and, in 1982, approved the Cook Inlet Regional Salmon Enhancement Plan 1981-2000 (Cook Inlet Regional Planning Team, 1981). Sockeye salmon enhancement at Hidden Lake and the Lower Cook Inlet Lakes was identified in that plan and considered an integral component of meeting the salmon production goals set in the plan.

The Department’s objective for the Hidden Lake project is:

to plan, implement and evaluate efforts to enhance the Hidden Lake sockeye salmon run to an optimum level commensurate with its high productivity and potential rearing capacity.

Subsequent to the Salmon Enhancement Plan, but consistent with the principles of the

plan, the Department's Division of Fisheries Rehabilitation, Enhancement, and Development initiated the Lower Cook Inlet Lakes Project. The primary purpose of this project was to use unused sockeye rearing habitat to maximize the salmon resource for the common property fisheries. The Lower Cook Inlet Lakes sockeye fry project provides sockeye salmon for harvest by subsistence, recreational, and personal use fisheries in the Southern District, by the Lower Cook Inlet commercial fishery; and by CIAA for cost recovery harvest in the Southern and Kamishak Bay Districts. Since 1998, the Lower Cook Inlet Lakes Project provided an average annual return of nearly 215,000 adult sockeye to waters of Lower Cook Inlet.

2.2 Project Goal

The goal of the Hidden Lake Sockeye Salmon Enhancement Project is to increase the production of adult fish for harvest by Cook Inlet user groups while maintaining and conserving the fry-rearing environment. This goal can be accomplished by continuing to maintain an average annual escapement of 30,000 adult sockeye salmon to Hidden Lake, as addressed in the current (May 2000) Environmental Assessment.

When the current Hidden Lake project sockeye egg requirements of 800,000 are added to the Lower Cook Inlet lakes and Tutka Bay projects' need for 5.031 million eggs, the cumulative proposed egg-take from Hidden Lake would be 5.83 million beginning in 2005. The temporary additional egg takes would occur for 5 years, after which time the egg take level would return to that authorized under the current SUP to meet the requirements of the Hidden Lake stocking project itself. Cumulative egg take levels would be adjusted annually to account for the variable release strategy of the Hidden Lake stocking project only. If the additional egg take is conducted in 2005, a return of adult sockeye salmon to Tutka Bay Lagoon sufficient to provide eggs for the proposed project could occur as early as 2008. In this case, the collection of additional eggs from Hidden Lake would not be required in 2009.

2.3 Laws, Goals, Directives and Interrelationships

The Alaska National Interest Conservation Act of 1980 (ANILCA, also commonly called “Alaska Lands Act”) re-designated the Kenai National Moose Range as the Kenai National Wildlife Refuge and established the Refuge purposes, which include:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, moose, bears, mountain goats, Dall sheep, wolves and other furbearers, salmonoids and other fish, waterfowl and other migratory and nonmigratory birds; (ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats; (iii) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge; (iv) to provide in a manner consistent with subparagraphs (i) and (ii), opportunities for scientific research, interpretation, environmental education, and land management training; and (v) to provide, in a manner compatible with these purposes, opportunities for fish and wildlife-oriented recreation.

The Alaska Lands Act also required development of a Comprehensive Management Plan for the Refuge. The U. S. Fish & Wildlife Service (FWS) developed the Comprehensive Conservation Plan, which designated Skilak Lake and the Skilak Lake Loop Road area as an intensive management area and planned for recreational development and wildlife viewing opportunities. The Plan also provided for developments, including hiking trails, improved campgrounds, and boat launching facilities at Hidden and Skilak Lakes.

Under the Alaska Lands Act Section 304(e), fishery enhancement projects may be allowed on a case-by-case basis if compatible with the purposes for which the refuge was established. A separate compatibility determination is being prepared for the proposed action.

3.0 Need for the Action

The need for this action is to allow the use of Hidden Lake sockeye salmon as a temporary brood source to: (1) maintain the Lower Cook Inlet Lakes Project at its current level, and (2) create a brood source return to Tutka Bay Lagoon (located outside the refuge), to supply future brood source for the Lower Cook Inlet Lakes Project. Other than the collection of additional broodstock, the activities in this request will result in no changes to the existing Hidden Lake stocking project (i.e. juvenile sockeye stocking and expected adult returns at Hidden Lake will remain at levels already agreed upon by ADF&G, CIAA and FWS and addressed in the existing Environmental Assessment). Other than switching from Tustumena Lake to Hidden Lake stock as the brood source within the Refuge, this request will also result in no changes to the current Lower Cook Inlet Lakes Project (located outside the Refuge).

4.0 Alternatives to the Action

This Environmental Assessment describes three alternatives for the future of the Hidden Lake Sockeye Salmon Enhancement Project. The alternatives are: 1) termination of the existing enhancement project, 2) continuation of the current project or status quo, and 3) the current project with an additional 5 million egg-take (4,000 extra fish beyond the current *SUP KN-05-0001* issued to the Department for 2005) for a period of up to 5 years to support the Lower Cook Inlet Lakes Project and to develop a return to serve as a future egg source.

4.1 Alternative 1 - Terminate Current Project

The FWS would cancel the existing Special Use Permit issued to the Department for Hidden Lake enhancement activities in Kenai National Wildlife Refuge, and the ongoing project would be discontinued. Routine collection of gametes, fry releases, enumeration and characterization of smolt and adult migrations, zooplankton, water chemistry and physical limnological monitoring would be discontinued.

4.2 Alternative 2 - Current Project (Status Quo)

The Hidden Lake Salmon Enhancement Project under the current Refuge SUP consists of gamete collection, egg incubation, fry release, determination of smolt and adult population characteristics, enumeration of smolt and adult migrations, routine monitoring of the Hidden Lake zooplankton, water chemistry and physical limnological characteristics. In general, all methods and techniques for the Hidden Lake project follow accepted Department policies (e.g., Genetics Policy) and procedures. The egg take goal for fry released to Hidden Lake represents the number of eggs required to produce an estimated adult return of 30,000 fish. The return is calculated based on four year floating average survival rates for green egg-to-fry (82%), fry-to-smolt (24%), smolt-to-adult (41%) and the four year floating average estimated harvest rate (72%) (Trail Lakes Hatchery Annual Management Plan, 2005).

A detailed description of project activities can be found in the annual Hidden lake Project Progress Report (Dodson, 2005), The Trail Lakes Hatchery Manual (Wilson and Hetrick, 1992), the Hidden Lake Project Procedures Manual (CIAA, 2002), CIAA's Egg-take Procedures manual (CIAA, Revised January 25, 2001) and the Trail Lakes Hatchery Annual Management Plan (*draft*, 2005).

4.3 Alternative 3 – Current Project plus Permit Temporary Additional Egg Take (Preferred Alternative)

The Hidden Lake Salmon Enhancement Project under the current Refuge SUP, as described in 4.2 Alternate 2 above, would continue with the addition of a temporary permit for additional gamete collection of 5 million eggs for up to five years. Resultant fry will be stocked exclusively outside the Refuge into: (1) Leisure, Hazel, and Kirschner Lakes, located in Lower Cook Inlet; and (2) Tutka Bay Lagoon, which would be established as the future brood source location for the Lower Cook Inlet Lakes project.

Under the Department's oversight, CIAA will continue to capture brood stock to secure eggs for hatchery operations by beach seine, as permitted in the current project. Under this alternative, the 2005 total sockeye egg take goal for Hidden Lake would be 5,830,000 green eggs. This egg take goal includes 4,269,000 eggs for Lower Cook Inlet Lakes fry release (Kirschner, Hazel, and Leisure Lakes), 762,000 eggs for Tutka Bay Lagoon smolt release, and 800,000 eggs for the currently permitted Hidden Lake fry release. The egg take would require approximately 660 adult salmon for the existing enhancement effort plus an additional approximate 4,000 adult sockeye salmon for the proposed amendment.

The Department proposes eggs be collected from Hidden Lake for fry releases to the three Lower Cook Inlet lakes and a smolt release to Tutka Bay Lagoon through no later than 2009. The Department's goal is for CIAA to develop a return to Tutka Bay Lagoon to serve as a long-term brood source as quickly as possible.

Enumeration and characterization of smolt and adult migrations, zooplankton, water chemistry and physical limnological monitoring would continue as outlined in the present project description.

5.0 Affected Environment

5.1 Physical Environment

Hidden Lake is located on the Kenai Peninsula 69 kilometers east of Soldotna, Alaska and lies entirely within the Kenai National Wildlife Refuge. The lake is accessible by the Sterling Highway and the Skilak Loop Road (Figure 1).

Hidden Lake (Figure 2) is steep-sided with two major basins. It has a surface area of 6.8 km², a mean depth of 20.1 m, a maximum depth of 45.1 m, and a volume of 138.1 X 10⁶ m³. The mean euphotic zone depth (EZD), the algal light compensation point, is 20

m (Kyle, et al. 1990).

The lake's watershed area is 37.4 km² and has an average annual precipitation of 44 cm. The estimated water residence time, the time it takes for a water molecule to be replaced, is 11.7 years. During the open water season, the total phosphorus concentration averages 7 µg L⁻¹, the total nitrogen concentration 178 µg L⁻¹ and the chlorophyll a concentration 0.6 µg L⁻¹. Based on these concentrations, Hidden Lake is considered an oligotrophic-mesotrophic (nutrient poor) system (Kyle, et al. 1990).

Two cladocerans, (*Bosima longirostris* and *Daphnia longiremus*), three copepoda (*Diaptomis pribilofensis*, *Epishura navadensis* and *Cyclops columbians*), and numerous species of rotifers make up the zooplankton community of Hidden Lake. Fish present in Hidden Lake include five species of Pacific salmon (*Onchoryncus nerka*, *O. kisutch*, *O. tshawytscha*, *O. gorbuscha*, and *O. mykiss*), lake trout (*Salvelinus namaycush*), Dolly Varden char (*S. malma*), threespine stickleback (*Gasterosteus aculeatus*), and coastrange sculpin (*Cottus aleuticus*) (Kyle, et al. 1990). The most numerous salmon species in Hidden Lake is sockeye salmon (*O. nerka*).

The following wildlife species inhabit the Hidden Lake watershed and use the returning sockeye salmon as a food source: black and brown bear, bald eagles, terns, coyotes and lynx, among others.

There is one outlet from Hidden Lake: Hidden Creek, which flows 5 km to Skilak Lake, the Kenai River and Cook Inlet. The Kenai River drains more than 2,000 square miles of diverse landscape and habitat. The Kenai River watershed, resources and uses are described in the Kenai River Comprehensive Management Plan (Alaska Department of Natural Resources, 1998).

5.2 Hidden Lake Sockeye Salmon Enhancement

In 1972 and 1973, the Department's Division of Commercial Fisheries conducted biological, chemical, and physical inventories of numerous lakes throughout the Cook Inlet basin (Bill, et al. 1972; Barton and Barrett, 1973). Based on these investigations, the Department identified Hidden Lake as a good candidate for increased production of sockeye salmon (*Oncorhynchus nerka*).

Based on the information collected from Hidden Lake, the Department concluded that, at an adult escapement of 10,000 sockeye, wild smolt production leveled off because the natural spawning area was limited and/or egg-to-fry survival was poor (Kyle, et al. 1990). Based on additional observations since 1980, that conclusion has not changed (Fig. 3). The Department also concluded Hidden Lake's zooplankton community was underutilized by sockeye salmon fry rearing in the lake and the lake could rear more fry than that produced by natural spawning.

In 1976, the Department's Division of Fisheries Rehabilitation, Enhancement and Development began activities to enhance the production of sockeye salmon in Hidden Lake. Initial enhancement activities involved the collection of basic fisheries and limnological data and gathering of a small number of sockeye salmon eggs to evaluate incubation and fry rearing procedures (Kyle, et al. 1990). In 1977, a draft Environmental Impact Statement was also completed and test wells drilled near the outlet of Hidden Lake to evaluate the area's potential for siting a hatchery; however, the proposal was never finalized.

In 1986, the Department presented their Hidden Lake enhancement program plan to the Refuge. At that time, the Department felt Hidden Lake was capable of rearing sockeye at stocking levels of up to 7.0 million fry.

During the development of the Hidden Lake enhancement project, there were concerns that salmon enhancement itself could be detrimental to the fry-rearing environment. Theoretically, the escapement of large numbers of enhanced fish might, by increasing the available nutrients, alter the level of primary productivity and shift the zooplankton

community to species not utilized by rearing sockeye fry.

To address these concerns, the Department reviewed Hidden Lake's ability to support an enhancement program based on the lake's chemical and physical characteristics. In 1991, the Department concluded that Hidden Lake sockeye enhancement could produce returns to the lake of 30,000 to 50,000 adults without a change in water quality. This conclusion was reaffirmed by the Department in a 1999 review of the Hidden Lake project (Simpson and Edmundson, 1999).

Based on the potential of Hidden Lake to rear sockeye fry and the limitations imposed by large adult escapement, the objective of the Hidden Lake Sockeye Salmon Enhancement Project became the increased production of adult fish and maintenance of the fry-rearing environment. A long-term project goal of a four-year floating average escapement of 30,000 adult sockeye salmon is currently in place. This conservative goal assures protection of the lake rearing environment. Currently less than 1 million fry are put back into the lake each year.

5.3 Project Accomplishments

Since 1976, Hidden Lake has been enhanced by collecting eggs from adult sockeye salmon that return to the lake, incubating them, and then releasing the resulting fry back to the lake. Enhancement by collecting eggs and releasing fry back to Hidden Lake bypasses the initial life stages that occur in the lake and takes advantage of the lake's abundant zooplankton community.

To date, a total of 64,988,000 sockeye eggs have been collected for incubation at Crooked Creek, Big Lake, and Trail Lakes Hatcheries, while sockeye fry releases into Hidden Lake have cumulatively totaled 37,560,000. Since 1988, annual fry releases have averaged 1,436,000 and have been sized to allow an escapement of 30,000 adults into the lake. Annual gamete collections, fry releases, and smolt migrations are summarized in Tables 2 and 3.

Estimates of the number of adult sockeye escaping to Hidden Lake have been made since 1947 (Table 4). Total enumeration of escaping fish based on weir counts began in 1971 and has continued annually since 1976. Prior to enhancement activities, annual escapement into Hidden Lake averaged 2,000 sockeye (Kyle et al., 1990). The number of fish escaping into Hidden Lake since enhancement has averaged 31,749.

Results of the Hidden Lake Sockeye Salmon Enhancement Project are presented in Kyle et al. (1990) and Dodson (2005).

5.4 CIAA Involvement

Hidden Lake enhancement activities were initiated by the Department; and, initially, all the activities were conducted by the Department. In 1988, Cook Inlet Aquaculture Association began working cooperatively with the Department on the Hidden Lake salmon enhancement project through gamete collection, egg incubation, and fry stocking activities. By 1991, CIAA was completing all phases of the enhancement project under the Department's guidance. For data consistency, CIAA has completed the water chemistry and plankton analyses while the Department will continue adult scale analysis.

Project activities are presented in the Trail Lakes Hatchery Annual Management Plan and reviewed annually through the Regional Planning Team process.

6.0 Environmental Consequences

6.1 Alternative 1 - Terminate Current Project

Under this alternative, the Kenai National Wildlife Refuge would discontinue the existing Special Use Permit issued to the Department for the Hidden Lake enhancement project,

ending the collection of eggs. Supplemental fry releases to Hidden Lake would not continue and adult returns to Hidden Lake would decline.

Since 1980, the first year enhanced sockeye salmon returned to Hidden Lake, adult sockeye escapement has averaged approximately 33,000 fish. Without annual supplemental fry releases, the number of fish returning to Hidden Lake would decline to an estimated average of 6,000 to 7,000, or fewer, fish annually. This would represent a loss of approximately 26,000 sockeye to the Hidden Lake system and a substantial decline in the number of fish and fish carcasses available to brown and black bears, bald eagles, coyotes and lynx. In addition, approximately 75,000 sockeye salmon would be unavailable for harvest by all user groups (CIAA 2004 Progress Report, Dodson).

Not only would the approximately 29 year enhancement efforts at Hidden Lake cease, but the Lower Cook Inlet Lakes Enhancement Project would be hampered by not having a source for stocking in the near future, and could be terminated ultimately if a suitable alternative source for sockeye salmon eggs was not located.

No change to Hidden Lake physical characteristics, water chemistry, plankton, and other resident fish species would be expected.

This alternative is rejected because of the loss of fish to wildlife and the loss of harvest opportunities for all user groups, including commercial, recreational, subsistence, and personal use.

6.2 Alternative 2 - Current Project (Status Quo)

The Hidden Lake Sockeye Salmon Enhancement Project has been successfully conducted for approximately 29 years. During this period, adult sockeye escapement to Hidden Lake has increased from 2,000 fish prior to the project to 33,000 fish. Brown and black bears, bald eagles, coyotes, and lynx use these fish and fish carcasses. Between 2000 and 2004, the project provided an average of approximately 75,000 fish

annually to commercial, recreational, subsistence, and personal use harvests.

The technical aspects of the Hidden Lake supplemental fry-stocking project were reviewed by the Department (Simpson and Edmundson, 1999). The evaluation was undertaken to satisfy a condition in the 1998 Refuge SUP. The Department reviewed five aspects of the project, made recommendations, and identified areas that needed more study. The Hidden Lake Project has been managed consistent with the results of Department review-identified tasks and recommendations contained in the 2000 Environmental Assessment, except as required by Special Use Permit stipulations.

Continuation of the status quo would allow the benefits from the Hidden Lake Sockeye Salmon Enhancement Project to continue; however, the Lake would not be available as an egg source for the continuation of the Lower Cook Inlet Sockeye Enhancement Project and would result in certain near term impacts to this project, and possible long-term termination of the project should no other suitable source of eggs be found in the future.

6.3 Alternative 3 –Current Project plus Permit Temporary Additional Egg Take (Preferred Alternative)

This alternative continues the existing permitted enhancement project in Hidden Lake within the Refuge and amends the permit to temporarily allow increased brood source acquisition for enhancement outside of the Refuge in the Lower Cook Inlet Lakes Project and Tutka Bay Lagoon.

The extra eggs taken under this alternative will be stocked outside of the Kenai National Wildlife Refuge in three lakes in Lower Cook Inlet and at Tutka Bay Lagoon, which is the brood source development site. This extra egg-take will not result in an increased adult return to Hidden Lake, thus, there will be no net change in the environmental impact from that of the approved, permitted project currently being conducted on the Refuge. The egg take activity itself (to take approximately 4,660 fish rather than the

current take of only 660 fish) from Hidden Lake is not expected to have any significant increased effects on Refuge resources. It is estimated that the egg take activity may be spread over five days rather than three during a three week period (starting mid-September) to help spread out the collection over the run, but actual time on site each of these days would be similar whether additional eggs are being collected or not. Carcasses would be hauled away from shore and sunk, providing nutrients and carcass disposition similar to what occurs without the additional egg take. Accordingly, the Hidden Lake project, as proposed to be temporarily modified, remains consistent with the existing environmental assessment and should continue to be "...found not to have significant environmental effects " (FWS 2000).

Approval of the request to temporarily increase the egg-take from 0.8 to 5.8 million eggs, will not alter the environmental impact of the current Hidden Lake sockeye salmon enhancement project for the following reasons:

1. There will be no change to the number of sockeye fry stocked into Hidden Lake within the Refuge. All additional egg-take will be stocked to systems outside the Refuge.
2. There will be no measurable change to the projected number of adult sockeye salmon returning to Hidden Lake. Adult returns on average are in excess of the number of fish that successfully spawn in the lake. The removal of 4,000 fish from the escapements greater than 10,000 to support the increased egg-take will not alter the number of smolt produced by fish spawning in the lake and future returns of wild adult sockeye.
3. There will be no change to the adult salmon carcass levels in Hidden Lake within the Refuge.
4. There will be no change to the present goal of achieving a 4-year floating average escapement of 30,000 fish into Hidden Lake.

5. There will be no measurable change to the expected hatchery-to-wild ratio of adult salmon returning to Hidden Lake. Fish are selected for brood at random throughout the period of spawning with no preference for morphological or other characteristics.

To maintain the current Hidden Lakes project, the egg removal schedule contained in the draft 2005 Trail Lakes Hatchery Annual Management Plan allows CIAA to collect 80 % of the fish in excess of 1.6k escapement into Hidden Lake. The request for a permit amendment to secure additional eggs for the Lower Cook Inlet Lakes project requires no change to this schedule; however, Refuge permit conditions will further restrict the egg removal schedule for securing additional eggs (in the unlikely event that low returns to Hidden Lake are realized).

The proposed temporary increase in broodstock acquisition will provide the means to continue the Lower Cook Inlet Lakes Project while a self-sustaining brood source is developed. The Hidden Lake Enhancement Project itself will be unaffected. Because this benefit is obtained without negative effect, it is the preferred alternative.

7.0 Other Issues

7.1 Refuge Compatibility

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee) requires that all uses of national wildlife refuges be found to be compatible with individual Refuge purposes and the Refuge System mission. A compatibility determination will be prepared for the preferred alternative outlined within this supplemental environmental assessment.

7.2 Public Involvement

This environmental document will be made available for public review and comment in order to provide background information to interested publics while the Refuge completes the compatibility determination on the proposal. A 30-day comment period will be provided.

7.3 Subsistence

There is nothing in the proposed action that is new that will impact any ongoing subsistence activity. Continued enhancement of Hidden Lake and Lower Cook Inlet lakes is proposed at current levels with no anticipated change in the number or availability of returning salmon that may be available for commercial, sport, personal use, or subsistence fisheries. Because of this, no additional documentation or review under Section 810 of the Alaska Lands Act is being undertaken.

8.0 List of Preparers

The first draft of this supplemental environmental assessment was prepared by the Alaska Department of Fish and Game. A subsequent revision was completed by Kenai National Wildlife Refuge.

9.0 References

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10.0 Tables and Figures

Table 1. Decision Matrix explaining why Hidden Lake stock is the most acceptable for use in Lower Cook Inlet Lakes Project and Tutka Bay .

<i>Stock</i>	<i>Management Considerations</i>				<i>Biological Considerations</i>			<i>Economic Considerations</i>		
	Run	Surplus	Safety	Allocation	Genetics	Pathology	Culture	Harvest	Egg Take	Monitoring
	Timing	Available	Issues	Issues						
Bear Lake	Early	Occasionally	Low	High	High	Mod-High+	Moderate	High	Low	Low
Big River Lakes	Early	Yes	Moderate	Moderate	Moderate	Low*	Moderate	High	Moderate	High
Chelatna Lake	Mid	Yes	Moderate	Moderate	High	Low-High + outdated	Moderate	High	Moderate	High
Chenik Lake	Mid	Questionable	High	High	Moderate	Low *	Unknown	Low	High	High
Delight/Desire Lks	Mid	Occasionally	High	High	Moderate	Low */High* outdated	Unknown	High	High	High
English Bay Lks	Early	No	Low	High	Low	High +	Moderate	High	Moderate	Moderate
Hidden Lake	Mid	Yes	Low	Low	Moderate	Mod-High	Good	Moderate	Low	Low
Packers Lake	Late	Yes	Moderate	Moderate	Moderate	Mod-High	Good	High	Moderate	Moderate
Tustumena Lake	Mid	Yes	Low	Low	Moderate	Low	Good	Moderate	Low	Low

Management Considerations:

Run Timing: "Early" = late May - early July; "Mid" = mid-June - late July; "Late" = early July - mid-August
 Surplus Available: Yes = most years; No = very few years; Occasionally = some years, no regularity; Questionable = inadequate recent history to predict
 Safety Issues: The safety of crew working remote while conducting egg-take
 Allocation Issues: Use of this stock would essentially take a portion of the harvestable surplus from one user group (commercial fishermen) and allocate it to CIAA; for use as broodstock AND/OR use of this broodstock could cause conflicts with other user group (sport fishermen) by increasing the incidental commercial catch of fish intended to benefit the non-commercial group.

Biological Considerations:

Genetics: Minimize the risk to adjacent wild stocks posed by the straying of hatchery or enhanced stocks. Genetic risks from the broodstock development at Tutka Bay Hatchery and the stocking of the three lakes are mitigated by the fact that all four projects are done with fry/smolt rearing in freshwater, a process demonstrated to produce very high fidelity (very little or no straying).

Pathology: Minimize disease risk in the hatchery by selecting stocks having low prevalences and proportions of fish with high titers of IHNV and little or no evidence of the BKD agent* no samples for BKD agent; + IHNV only

Culture: This category ranks basic knowledge of fish culture for this stock. Stocks considered good respond well to the hatchery environment, those ranked moderate can be cultured, but are sensitive to hatchery rearing systems and those ranked poor do not rear well.

Economic Considerations:

Harvest: To take fish for food, sport, or cost recovery purposes

Egg Take: Removing male and female gametes for salmon hatchery operations

Comments:

Bear Lake Susitna River Basin, non-local stock, most geographically distant. Broodstock collection may conflict with fishermen.

Big River Lakes Susitna River Basin, non-local stock, most geographically distant. Broodstock collection may conflict with fishermen.

Chelatna Lake Susitna River Basin, non-local stock, most geographically distant. Broodstock collection may conflict with fishermen.

Chenik Lake Not the closest local stock. Broodstock collection may conflict with fishermen. . Reliability of a return large enough to accommodate egg take questionable, returns prior to 2003 were poor. Timing is similar to Tustumena stock used in the past in Lower Cook Inlet lake projects

Delight/Desire Lks Not the closest local stock. No established egg take site, shoreline topography would make brood collection logistically difficult, maybe impossible and broodstock collection may conflict with fishermen. Broodstock may not be available in all years due to return size. Timing is similar to Tustumena stock used in the past in Lower Cook Inlet lake projects.

English Bay Lks Closest local stock and established egg take site. Early run timing conflicts with current management. Broodstock may not be available every year due to inconsistent return size. Also may be inadequate if Nanwalek, Port Graham, and CIAA projects all attempt to simultaneously draw brood from the system. Broodstock collection may conflict with fishermen.

Hidden Lake CIAA has an established egg take program in place. Timing is similar to Tustumena stock used in the past in Lower Cook Inlet lake projects. Broodstock collection does not conflict with fishermen. Escapement likely to be adequate for egg take for five years. Hatchery performance of this stock is successful and well documented. Not the closest local stock.

Packers Lake Not the closest local stock.

Tustumena Lake CIAA can no longer access the historical egg take sites due to the Ninth Circuit Court of Appeals decision in 2003.

Table 2. Hidden Lake gamete collections, supplemental fry releases, and smolt production, 1976 - 2004.

Brood Year	No. eggs taken	No. females used	Fecundity	Receiving hatchery	No. fry released	Egg-to-fry survival (%)	No. smolt produced	Fry-to-smolt survival (%)
1976	832,880	274	3,091	Crooked Cr.	330,228	39.6	58,800	17.8
1977	406,878	200		Big L.	308,704	75.9	40,600	13.2
1978	311,808	100	3,118	Crooked Cr.	8,258	2.7		
1979								
1980								
1981								
1982	1,579,188	576	2,741	Trail L.	1,086,000	68.8	231,300	21.3
1983	1,928,000	639	3,017	Trail L.	1,236,900	64.2	289,100	23.4
1984	3,766,000	1,310	2,875	Trail L.	1,805,792	47.9		
1985	7,019,000	2,330	3,012	Trail L.	0			
1986	4,740,000	1,580	3,000	Trail L.	3,718,311	78.5		
1987	7,000,184	2,434	2,876	Trail L.	6,085,307	86.9		
1988	2,718,853	891	3,046	Trail L.	2,470,012	91.0	194,400	7.9
1989	2,220,467	647	2,669	Trail L.	1,747,900	79.0	203,800	11.7
1990	2,189,000	956	2,290	Trail L.	1,600,000	64.6	214,100	13.4
1991	2,652,000	1,119	2,370	Trail L.	1,716,000	64.7	330,200	19.2
1992	2,293,000	1,007	2,277	Trail L.	1,901,000	82.9	365,300	19.2
1993	2,200,000	934	2,355	Trail L.	1,800,000	81.8	195,000	10.8
1994	2,156,000	1,017	2,120	Trail L.	1,700,000	78.8	326,600	19.2
1995	1,893,000	849	2,230	Trail L.	1,600,000	84.5	184,700	11.5
1996	2,048,000	817	2,507	Trail L.	1,501,000	73.3	305,300	20.3
1997	2,166,000	936	2,314	Trail L.	1,035,000	47.8	182,900	17.7
1998	2,303,000	859	2,681	Trail L.	1,507,100	65.4	352,300	23.4
1999	2,297,000	954	2,408	Trail L.	1,242,000	54.1	284,200	22.9
2000	1,486,000	607	2,448	Trail L.	905,500	60.9	218,000	24.1
2001	1,326,000	504	2,631	Trail L.	980,200	73.9	249,200	25.4
2002	1,118,000	433	2,582	Trail L.	628,900	56.3	33,720	5.4
2003*	893,000	371	2,407	Trail L.	646,000	89.4		
2004	5,445,000	2,045	2,663	Trail L.				
Total	64,988,000	24,389			37,560,000		4,260,000	
Mean			2,470		1,436,288	71.8	242,648	16.8

The 1977 sockeye salmon were taken from anadromous and residual fish.

BY 1977 eggs suffered high mortality due to complications with the hatchery source water.

The 1985 hatchery broodstock (fry) became infected with IHN virus and were destroyed.

Egg collection data prior to 1989 is from on Kyle, et al. 1990.

Mean calculation is based on broodyear 1988 to present.

The number of smolt produced was derived from the recovery of marked fish.

*Survival from eyed egg to emergent fry was 89%. Only 646,000 fry released, 152,000 raised to smolt.

incomplete broodyear

Table 3. Hidden Lake smolt production, 1976 - 2004.

Smolt Year	Total		Wild	Hatchery	% Hatchery	
	No.	95% C.I.			%	95% C.I.
1976	29,639		29,639	0	0	
1977	17,670		17,670	0	0	
1978	111,466		52,745	58,721	53	
1979	94,347		46,828	47,519	50	
1980	81,748		79,458	2,290	3	
1981	161,522		161,522	0	0	
1982	222,673		222,673	0	0	
1983	235,233		235,233	0	0	
1984	419,376		175,876	243,500	58	
1985	396,000		98,000	298,000	75	
1986	651,889		140,965	510,924	78	
1987	68,980		68,980	0	0	
1988	471,625					
1989	719,527					
1990	231,300					
1991	208,500					
1992	191,900					
1993	388,500	(±21,100)	62,200	326,300	84	(+4.8)
1994	414,700	(±40,400)	53,900	360,800	87	(+3.9)
1995	293,700	(±33,400)	79,300	214,400	73	(+6.5)
1996	428,100	(±15,700)	94,200	333,900	78	(+3.6)
1997	228,800	(±0)	65,000	163,000	71	(+5.1)
1998	385,300	(±45,000)	85,600	299,700	78	(+3.7)
1999	313,100	(±13,390)	94,300	218,800	70	(+4.2)
2000	475,600	(± 52,609)	108,500	367,100	77	(+3.2)
2001	324,900	(±0)	94,000	230,900	71	(+4.4)
2002	369,900	(±51,400)	133,200	236,700	64	(+4.4)
2003	309,180	(±17,300)	63,800	245,400	79	(+3.1)
2004	192,800	(±0)	140,800	53,000	27	(+3.9)
Mean	343,700		89,600	254,200	72	

Prior to 1993, estimates of smolts originating from hatchery fry releases based on CWT studies.

Since 1993, estimates of smolts originating from hatchery fry releases based on otolith thermal marks.

The mean percent hatchery contribution excludes the 1980 smolt, years when hatchery smolt were not released, and years when no estimate of hatchery smolt was made.

Mean calculated from 1993 to 2003.

Prior to 1990, data summary is from Kyle et al. (1990).

Table 4. Adult sockeye returns to Hidden Lake, 1947-2004.

Pre-enhancement			Post-enhancement		
Year	Reported Adult Return	Hatchery Broodstock	Year	Escapement	Hatchery Broodstock
1947	1,200		1980	27,488	
1948	1,000		1981	15,939	
1949			1982	9,790	1,152
1950	800		1983	11,297	1,278
1951			1984	27,784	2,620
1952	2,500		1985	24,784	4,660
1953	2,328		1986	17,530	3,760
1954	1,500		1987	43,487	4,868
1955	1,543		1988	50,907	1,782
1956	1,522		1989	7,770	1,294
1957	1,737		1990	77,959	1,912
1958	200		1991	35,576	2,226
1959	2,486		1992	32,912	1,994
1960	2,006		1993	11,582	1,856
1961	3,568		1994	6,086	2,034
1962	820		1995	7,542	1,655
1963	3,700		1996	55,526	1,630
1964	2,494		1997	56,053	1,872
1965	792		1998	67,727	1,852
1966			1999	49,406	2,096
1967			2000	45,685	1,342
1968	601		2001	42,462	1,005
1969	500		2002	71,983	852
1970	323		2003	11,734	742
1971	1,958		2004	18,172	4,090
1972	4,956		Mean	33,087	2,112
1973	690				
1974	1,150				
1975	1,375				
1976	4,860	548			
1977	1,055	400			
1978	4,647	200			
1979	5,762				
Mean	2,003	383			

Data prior to 1990 from Kyle, et al. 1990.

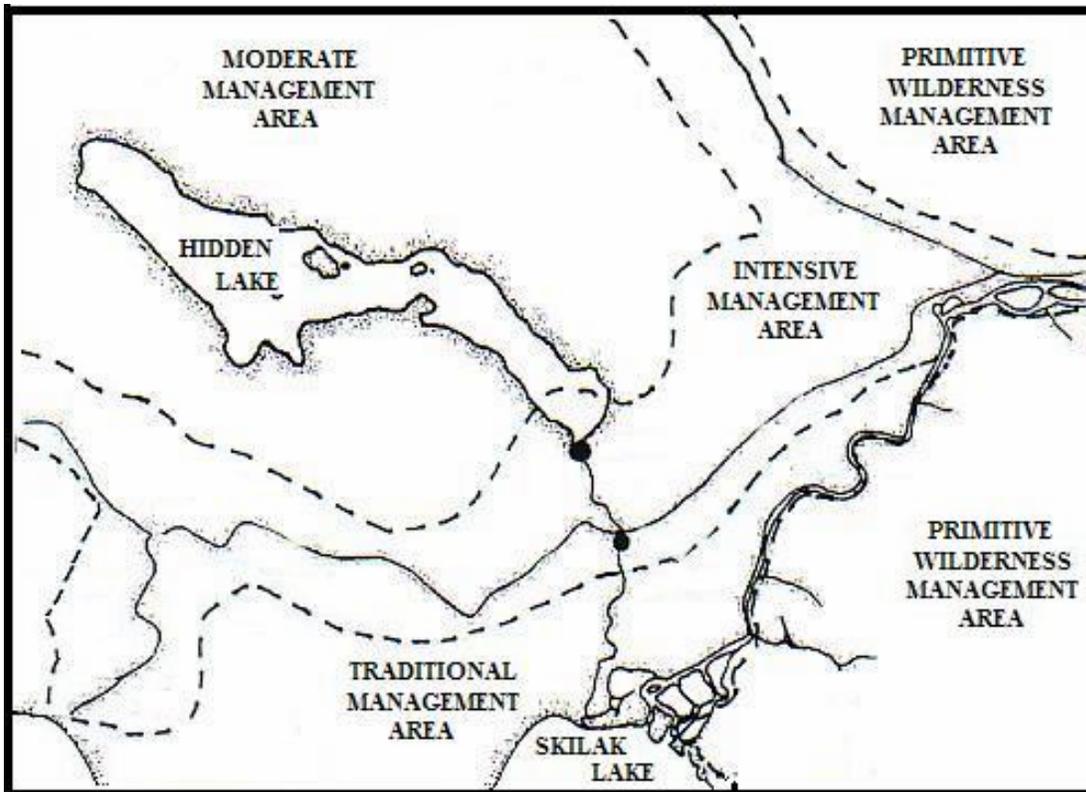


Figure 1. Area map of Hidden Lake, Kenai Peninsula, Southcentral Alaska.

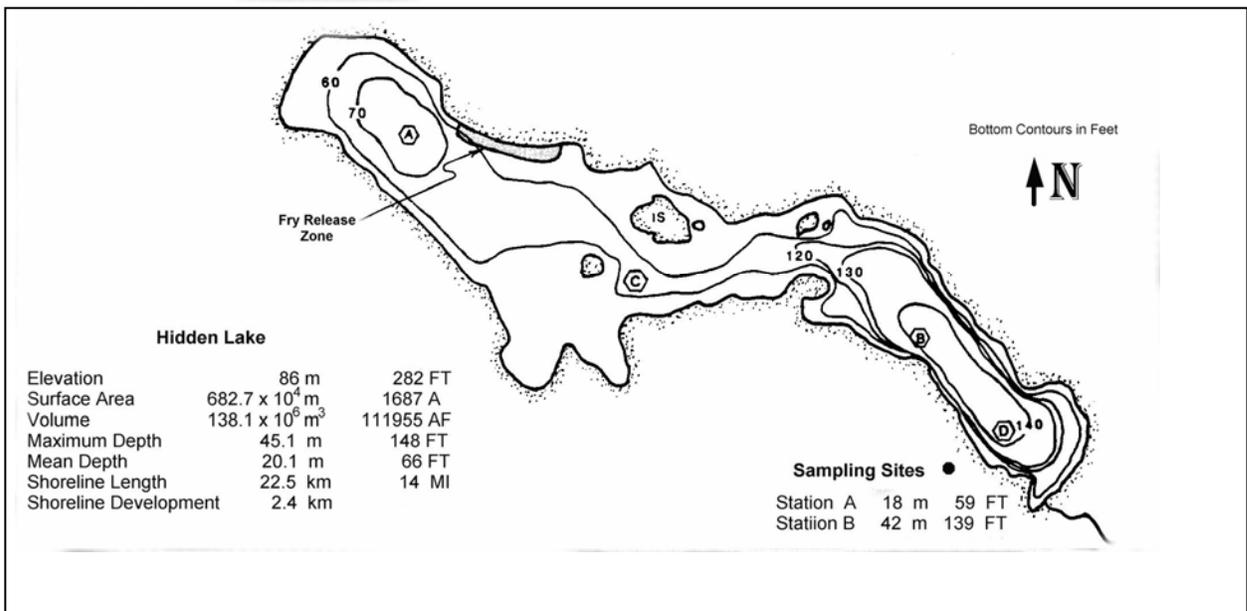


Figure 2. Morphometric map of Hidden Lake showing the two major basins.

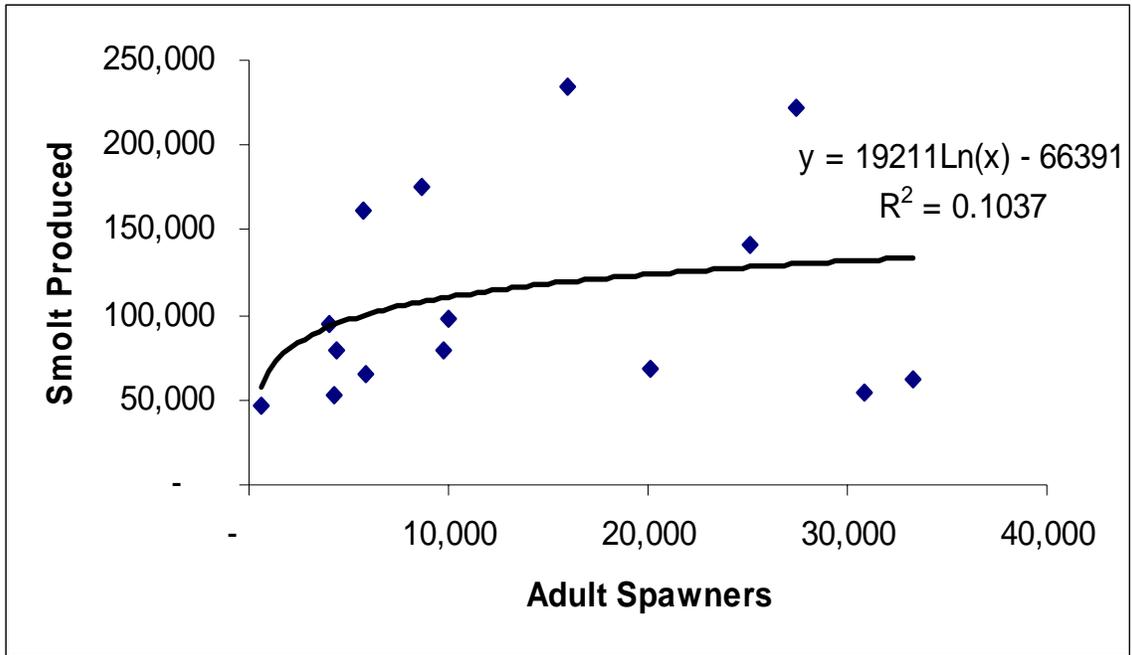


Figure 3. The number of smolt produced based on the number of adult spawners from 650 to 33,000.

11.0 Contributing Information

1. Special Use Permit KN99-28117.
2. CIAA/ADF&G Cooperative Agreement.
3. ADF&G letter to KNR from Loren Flagg - March 18, 1986.
4. KNWR letter to ADF&G from Daniel Doshier - September 16, 1987.
5. ADF&G memorandum to Distribution from Gary Kyle - July 16, 1991.
6. Cook Inlet Regional Salmon Enhancement Plan 1981 -2000.
7. Hidden Lake Procedures - Amended (CIAA Manual).
8. Egg Takes Procedures (CIAA Manual).
9. Trail Lakes Hatchery Annual Management Plan 1999.
10. Hidden Lake Sockeye Salmon Enhancement Report 1999 (CIAA Report).
11. Enhancement of Hidden Lake ... 1976-1989 (ADF&G Report)
12. Hidden Lake Sockeye Enhancement Project Technical Review (ADF&G Report).
13. ADF&G letter to Gary Fandrei (CIAA) from Frank Rue - March 22, 1999,
14. Hidden Lake Permits.
15. Trail Lakes Hatchery Annual Management Plan, 2005 (*draft*).
16. Environmental Assessment of Hidden Lake Sockeye Salmon Enhancement Project 2000