

**Agency: Commerce, Community and Economic Development****Grants to Named Recipients (AS 37.05.316)****Grant Recipient: Kodiak Regional Aquaculture Association****Federal Tax ID: 92-0115279****Project Title:****Project Type: Equipment and Materials**

# Kodiak Regional Aquaculture Association - Lake Nutrient Enrichment Project

**State Funding Requested: \$720,000****House District: 36 / R**

Future Funding May Be Requested

**Brief Project Description:**

Aerial application of essential nutrients, research and monitoring for Kodiak Island sockeye salmon producing lakes which have been shown to be nutrient limited.

**Funding Plan:**

Total Project Cost:	\$770,000
Funding Already Secured:	(\$50,000)
FY2012 State Funding Request:	<u>(\$720,000)</u>
Project Deficit:	\$0

*Funding Details:*

*FY 2010 and FY2011, funded by KRAA, \$65,000; Database creation and analysis of nutrient status for Kodiak area lakes.*

**Detailed Project Description and Justification:**

A number of important Kodiak sockeye salmon systems, both natural and enhanced, have experienced a significant reduction in returns and harvestable surplus of adult sockeye salmon. This has had a significant economic effect on the communities of Kodiak Island. A contributing factor to these depressed returns is likely reduced availability of the primary food source, zooplankton, for juvenile sockeye salmon. As freshwater zooplankton is the primary forage base for juvenile sockeye salmon, this translates to depressed smolt survival and subsequent poor adult returns. Zooplankton in the lake rely on freshwater algae/phytoplankton populations as their food source. These, in turn, rely on available nutrients in the lake. When nutrients become limited, so do algal and plankton populations. By adding nutrients to lakes in carefully controlled amounts, optimal conditions for the production of phytoplankton and zooplankton can be achieved. Lake enrichment of Karluk, Frazer and other lakes on Kodiak Island would thus increase the forage base for juvenile salmon, increase survival and condition of juvenile salmon entering the marine environment and bolster adult returns and increase fishing opportunity.

Kodiak Regional Aquaculture Association initiated the first phases of this project to create a comprehensive water chemistry, limnology and zooplankton database and the analysis of key sockeye salmon lakes as candidates for nutrient enrichment. Through this analysis it has been determined that the addition of the nutrients to nutrient limited lakes could produce a cost/benefit ratio greater than 10:1.

Nutrient enrichment is an enhancement and rehabilitation strategy that has been utilized in the Kodiak Management area previously and throughout other parts of Alaska, the Western states, and Canada. In fact, in the late 1980s and 1990s

Karluk, Frazer and other Kodiak lakes proposed were enriched with positive results. This project seeks to add nutrients at controlled rates and amounts in order to achieve productivity levels (nutrient availability) of approximately 90% of historic levels recorded during times of greater productivity, and thereby more robust salmon returns and fishing opportunity.

This project would fund consultation and project development, nutrient application, water quality and limnology monitoring, and provide for the purchase and operation of hydroacoustic monitoring equipment for assessment of juvenile salmon biomass in the lakes in this and subsequent years.

Seasonally, water quality and limnological sampling begins in early to mid-May as allowed by ice cover on the lakes. Sampling continues through the summer typically through September. Aerial applications of nutrients will begin in early to mid-May as well--shortly after the first sampling event. Hydroacoustic surveys and species apportionment studies to determine species composition and total fish biomass in each lake will be conducted in the fall. These studies and monitoring activities give a measure of the results of nutrient additions to the lake both in-season and in the long term aspects of the project.

The project will continue for approximately 5 years with monitoring components continuing for a minimum of 2 years following the cessation of nutrient applications. KRAA is in the process of gaining the support of the Kodiak Island Borough Assembly and area Native groups, finalizing the project plan and coordinating efforts with the ADF&G and gaining compatibility determinations and approval from the Kodiak National Wildlife Refuge following a public review process. It is anticipated that nutrient applications could take place as early as May, 2011. Additional equipment and materials would be purchased in July and August, 2011.

### Project Timeline:

FY2012 and FY2013

### Entity Responsible for the Ongoing Operation and Maintenance of this Project:

Kodiak Regional Aquaculture Association

### Grant Recipient Contact Information:

Name: Kevin Brennan  
 Title: Executive Director  
 Address: 104 Center Avenue, Suite 200  
 Kodiak, Alaska 99615  
 Phone Number: (907)486-6555  
 Email: kraa@gci.net

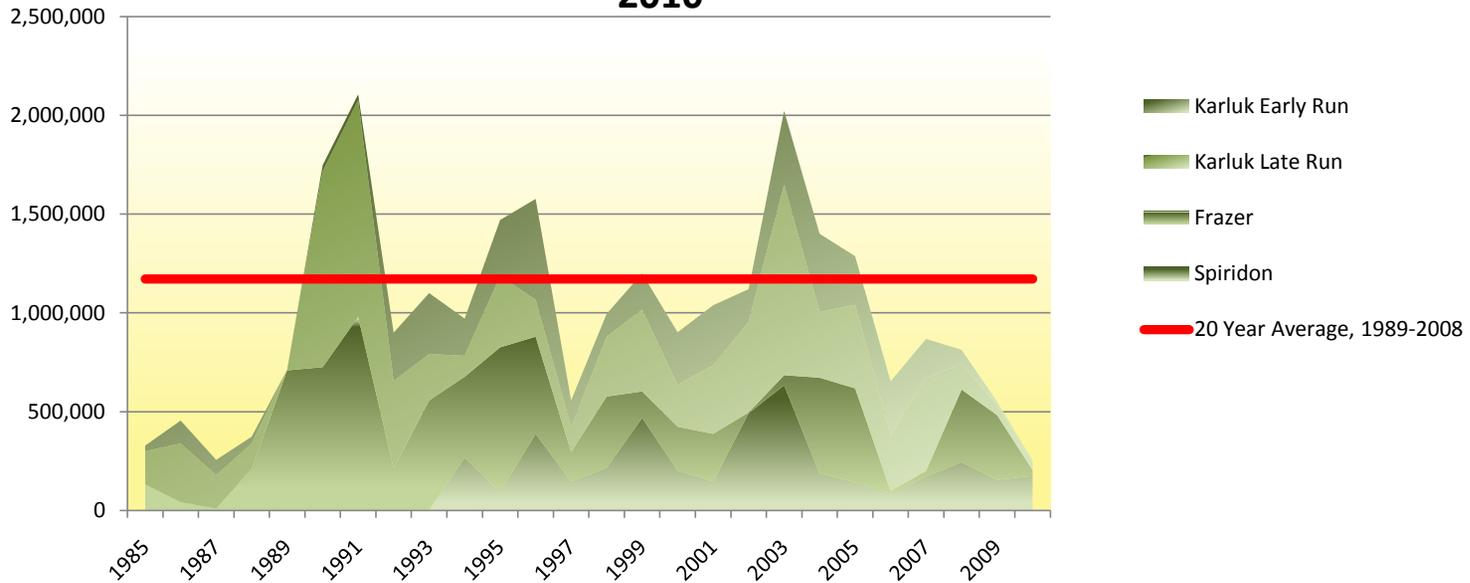
Has this project been through a public review process at the local level and is it a community priority?  Yes  No

State Legislators' offices have requested that Kodiak Regional Aquaculture Association provide a concise, bulleted description of the depressed state of sockeye salmon production from some of the largest historical contributors to the Kodiak Management Area fishery, our proposed action to help restore those runs to historic levels, and cost/ benefit projections.

- **Recent low sockeye salmon returns have had a devastating effect on Kodiak commercial salmon fishing and, and upon the Kodiak economy.**
- Spiridon Lake average annual sockeye returns over the past five years (167,000) are approximately half the previous ten year average (302,000). The 2011 return is projected to be the worst on record (83,000).
- Frazer Lake average annual return for the ten year period ending in 2010 (361,000 sockeye) is about half that of the average return over the 1990s (710,000).
- Karluk Lake sockeye returns crashed in 2008, falling 68% from the average annual return of the preceding 20 years. Returns in 2009 and 2010 were even worse.
- **The difference between the 2010 commercial sockeye harvest attributed to Karluk, Frazer, and Spiridon lakes and their 20 year average contribution to the sockeye harvest from 1989-2008 was 900,000 fish. The estimated lost ex- vessel value of those 900,000 fish at 2010 prices is \$6.25 million. Assuming a first-wholesale value 3.5 times that of the ex-vessel value, an additional \$21.9 million is estimated to have been lost. That's a huge loss of wages and taxes.**
- **Depressed sockeye production of these three key systems is projected to continue, because availability of freshwater nutrients is limited. The lost potential harvest and revenue experienced in recent years thus threatens to become a chronic problem.**
- **KRAA proposes a program of lake fertilization be implemented to provide the essential nutrients required to improve the freshwater habitat for juvenile sockeye salmon and restore subsequent adult returns from depressed to historic levels.**
- The analysis of the depressed systems, identification of these systems as ideal candidates for lake fertilization, and model for the proposed fertilization program were prepared by world-renowned limnologist Dr. Dana Schmidt.
- ADF&G successfully implemented lake fertilization programs in Karluk and Frazer lakes in the late 1980s and early 1990s, contributing to the stable salmon fishing opportunity experienced on Kodiak's west side and south end through the 1990s. KRAA seeks to duplicate that success.
- **The proposed project plan calls for a fertilization project to be sustained for not less than a five year period. If all three candidate lakes are permitted, funded and fertilized, first year costs are estimated to fall in the range of \$645,000 to \$749,000.**
- Preliminary estimated project costs, broken out by lake:
  - Start-up and common costs: \$192,000 to \$222,000
  - Karluk Lake specific costs: \$198,000 to \$230,000
  - Frazer Lake specific costs: \$150,000 to \$183,000
  - Spiridon Lake specific costs: \$105,000 to \$114,000
  - Total first year cost estimate: \$645,000 to \$749,000

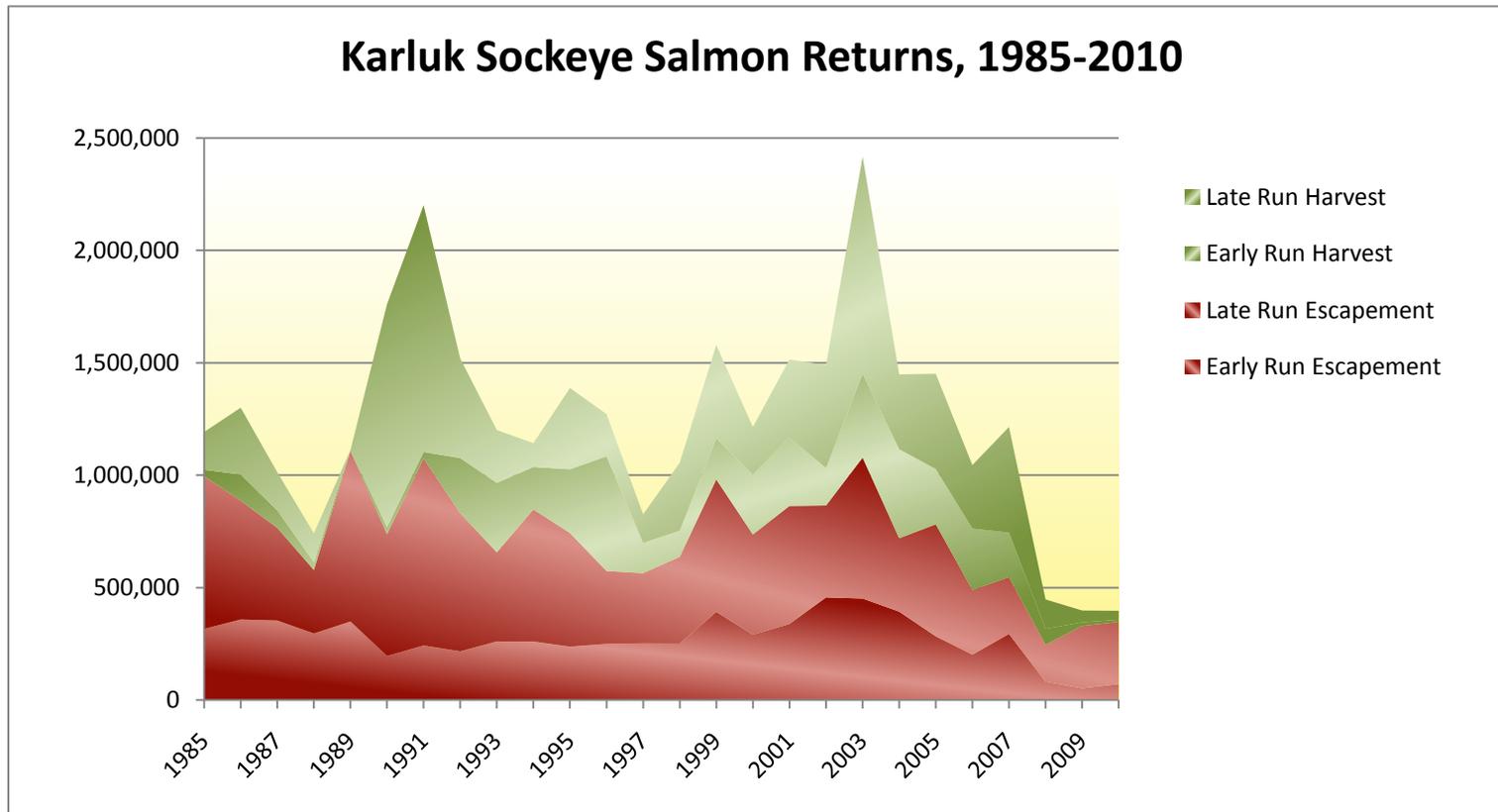
- **Dr. Schmidt projects a summary cost-benefit ratio of 10:1 or better, assuming fertilization of all three lakes. Ex-vessel value is the identified benefit.**
- **KRAA identifies this project as scientifically sound and of critical importance to the fishery and our community, and thus seeks support and funding to assure its implementation.**

## Combined Karluk, Frazer & Spiridon Sockeye Salmon Harvest, 1985-2010

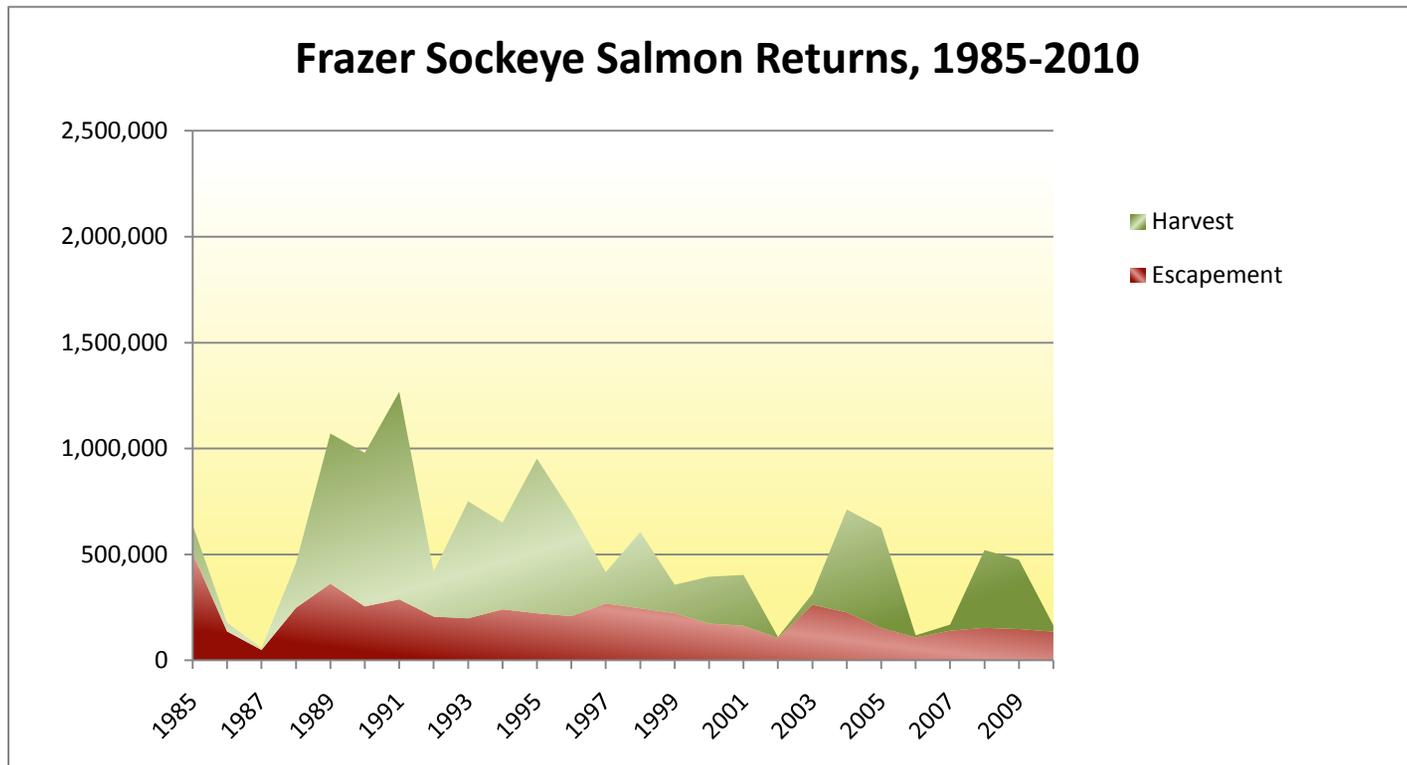


This chart illustrates the combined commercial harvest of sockeye returning to the Karluk, Spiridon, and Frazer systems. The static red line across the chart represents the 20-year average of that harvest, approximately 1.2 million fish. The 2010 sockeye harvest illustrated here totaled just a quarter of a million. To do the math: The gap between those two figures is over 900,000 harvested sockeye. At 4.5 to 5.5 lbs/fish, that would be 4.5 million pounds. At 2010 prices, that 900,000 fish gap between 2010 fish and the 20-year average adds up to approximately \$6.25 million in lost ex-vessel value. There's a reason the peaks on the chart are green: it's money. \$6.25 million is unarguably a huge negative impact upon a localized fishery. The community further suffers the loss of revenue realized as the fish is processed, resold, and shipped out of Kodiak. A commonly used index of this value is the first-wholesale value of the processed fish, which varies substantially, but might in a community such as Kodiak average 3.5 times the ex-vessel value of the fish (from a McDowell Group study of salmon enhancement contribution to coastal economies): that would be another \$21.9 million. Added together, we are talking about approximately \$28 million lost from this depressed fishery, in 2010 alone. \$28 million lost in 2010, and that figure should be larger, because it is STILL NOT INCLUDING fishing time on other salmon stocks lost to Karluk management fishery closures. I think it is fair to say that our current situation is one of economic crisis for the participants in these fisheries, and of concern to the entire community.

## Karluk Sockeye Salmon Returns, 1985-2010

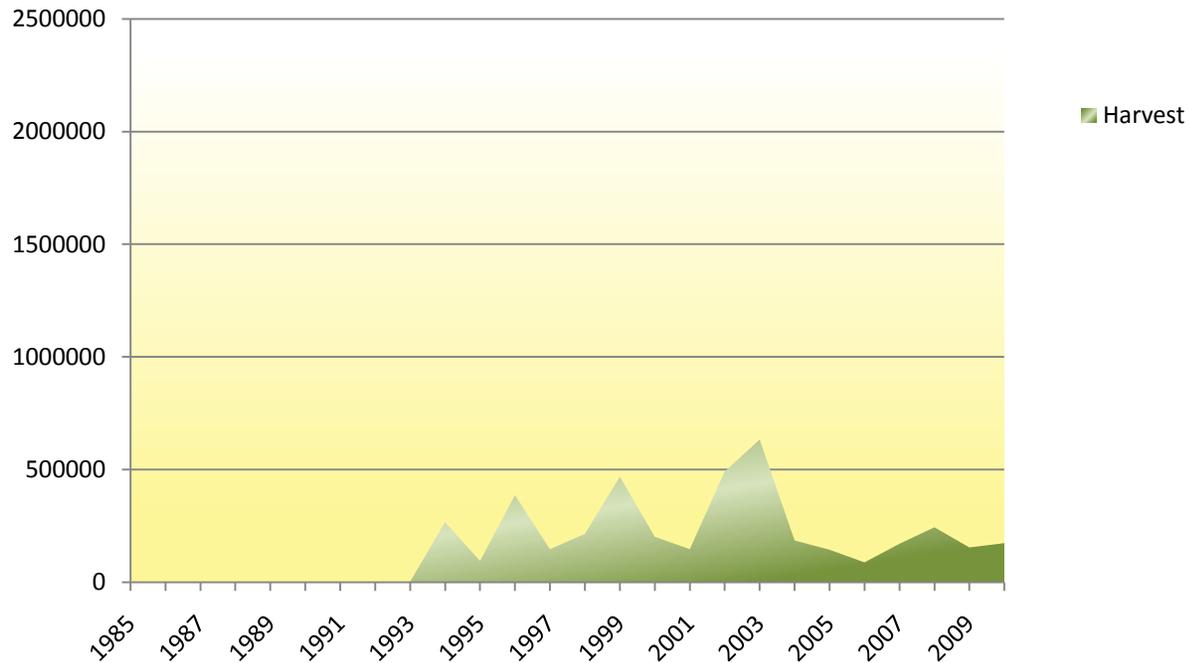


Karluk Lake. Of the three systems we are examining, Karluk is the most troubling. The Karluk system has a bimodal sockeye return, meaning the lake's return has two distinct components, an early run (the majority of which are counted through an in-stream weir by mid-July) and a late run (the majority of which return later than mid-July). The red areas in the chart illustrate escapement into the lake, and green represents harvest. The three year period from 2008-2010 registered the three lowest returns since at least 1985 for BOTH the Karluk early run and late run sockeye. Historically, the Karluk sockeye return has been the largest on the archipelago, and the Kodiak west side salmon fishery is managed to meet Karluk sockeye escapement goals. Limits on fishing time are based upon performance of the Karluk River sockeye return. Thus, and I'd like to emphasize this point, when Karluk returns are weak, the lost salmon harvest is not limited to the Karluk's underproduction; it is compounded



Frazer Lake. The red area of this chart depicts adult escapement into the lake, the green is harvest. Frazer production is down significantly relative to the returns experienced during the 1990s. The average annual return for the ten year period ending in 2010 (361,000 sockeye) is about half that of the average return during the 1990s.

## Spiridon Sockeye Salmon Returns, 1994-2010



Spiridon Lake. Spiridon has a barrier waterfall which precludes entry of adult salmon into the lake. Thus, it has no natural sockeye salmon run, but returns are sustained through an enhancement project in which Pillar Creek Hatchery stocks juvenile sockeye salmon into the lake. Depicted here are returns since the project's inception. Through the first ten years of full production, the project generated average annual returns of approximately 302,000 adult sockeye, all for harvest since escapement is of no consequence to the system's future production. Over the last five years, the average return has been roughly half of that – 167,000 fish – and the projected 2011 return is 83,000 fish, which, should it materialize, will be the lowest return on record.

# KODIAK REGIONAL AQUACULTURE ASSOCIATION

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February 16, 2011

Rick Gifford  
Borough Manager  
Kodiak Island Borough  
710 Mill Bay Road  
Kodiak, AK 99615

Dear Rick:

The Kodiak Regional Aquaculture Association would like to address the Kodiak Island Borough Assembly regarding the depressed state of sockeye salmon production from some of the largest historical contributors to the Kodiak Management Area fishery. Recent low sockeye salmon returns have had a devastating effect on Kodiak commercial salmon fishing and, and upon the Kodiak economy. Three systems which have historically contributed significantly to the annual sockeye harvest are of particular concern:

1. Spiridon Lake. Spiridon is a system which has no natural sockeye run, but sockeye returns are sustained through an enhancement project in which Pillar Creek Hatchery stocks juvenile sockeye salmon into the lake. Through the first ten years of full production, the project generated average returns of 302,000 adult sockeye. Over the last five years, the average return has been 167,000 fish, and the projected 2011 return is 83,000, which would be the lowest on record.
2. Frazer Lake. Frazer production is also down relative to the returns experienced during the 1990s. The average annual return for the ten year period ending in 2010 (361,000 sockeye) is about half that of the average return over the 1990s.
3. Karluk Lake. Of the three systems we are examining, Karluk is the most troubling. Karluk has a bimodal sockeye return, meaning the lake's return has two distinct components, an early run (the majority of which are counted through an in-stream weir by mid-July) and a late run (the majority of which return later than mid-July). The three year period from 2008-2010 registered the three lowest returns since at least 1985 for BOTH the early run and late run fish. Historically, the Karluk sockeye return has been the largest on the archipelago, and the Kodiak west side salmon fishery is managed to meet Karluk sockeye escapement goals. Limits on fishing time are based upon performance of the Karluk River sockeye return. Thus, when Karluk returns are weak, the lost salmon harvest is not limited to the Karluk's underproduction; it is compounded because the opportunity to harvest salmon bound for other natal streams is also lost.

Although each freshwater system is unique, and different factors have contributed to their depressed sockeye returns, each lake could benefit from the controlled application of the essential nutrients nitrogen and phosphorus, a program commonly known as lake enrichment or lake fertilization. In fact, this method of improving freshwater forage for juvenile sockeye salmon was used by the ADF&G in both Karluk and Frazer lakes in the 1980s in order to improve the freshwater habitat for juvenile sockeye salmon and restore subsequent adult returns from depressed to historic levels. In each case, the project was deemed a success, and likely contributed to the stable salmon fishing opportunity experienced on Kodiak's west side through the 1990s.

KRAA contracted Dr. Dana Schmidt, the former ADF&G Principal Limnologist and an expert on both Karluk Lake and lake fertilization, to analyze data collected over two decades in order to assess the potential benefit of lake fertilization under current conditions. Dr. Schmidt's analysis is rigorous, and arrives at the conclusion that a lake enrichment program would significantly increase and stabilize sockeye production in each of these systems. Based on this report, KRAA has resolved to institute such a program for each system, with a target date for first application of May 2011, and is currently in the process of drafting a detailed project plan for each lake, assessing the Kodiak National Wildlife Refuge permitting requirements, and seeking project funding.

The project plan calls for a fertilization project to be sustained for not less than a five year period, a typical one generation life-cycle for sockeye salmon. Although specific project plans and budgets are still in draft, it is estimated that, should we obtain permits to enrich all three lakes, first year program costs would fall in the range of \$620,000 to \$720,000. Dr. Schmidt's estimates indicate a potential summary cost-benefit ratio of 10:1 or better for these projects. The majority, if not all, of this projected benefit, however, would be realized in common property ex-vessel value. This, of course, is the point of the program, but does little to defray the cost to KRAA. As mentioned above, in the past, the ADF&G took responsibility for restoration projects of this nature, but simply said, times have changed.

Truth be told, Kodiak's west side salmon fishery is already in a state of crisis, and the measures we propose are already late. Even if implemented this year, the resulting benefit of increased sockeye salmon returns is still five or more years out. Unfortunately, although KRAA began investigating the potential for lake fertilization two years ago, we've been unable to rush what has been to this point a long and arduous process. We finally feel now that we are on the verge of implementing this critical restoration program. The hurdles that remain before us are securing permits, and funding the project.

KRAA also hopes to secure Borough support for this effort. The community's understanding and endorsement of the project will be a critical factor taken into account by the State legislature as that body considers the merits of our proposed project and potential funding. To that end, KRAA requests that the Borough pass a resolution in support of the proposed project and its funding, recognizing the critical importance of salmon fisheries to our community and actively participating in our efforts to sustain them.

Sincerely,

Gary Byrne  
KRAA Production/Operations Manager