Northern Fund Projects 2008/09

The following is a descriptive list of the projects that are being funded by the Northern Boundary Restoration and Enhancement Fund Committee in 2008.

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ENHANCEMENT

SOCKEYE SALMON

Project Title: **Trapper Lake Sockeye Access Improvement. Year 5.**
Project Lead: Brian Mercer, Mercer and Associates, Whitehorse, YT
Project Cost: $66,500 CAN/US

Improving the access for returning sockeye to Trapper Lake could result in a sustained increase in production from the Taku River system conservatively estimated to be between 10,000 to 40,000 adult sockeye. The potential benefits to the Trapper Lake system that would be incurred by the establishment of a sustained anadromous sockeye run include increased biodiversity and trophic levels in the system, and increased productive capacity of the lake from marine derived energy and nutrients. In 2004 preliminary engineering work was initiated to examine the feasibility of improving access. Additional limnological and baseline biological assessments of Trapper Lake were also performed. In 2005 the Transboundary Panel recommended continuation of the baseline limnological work as well as additional engineering assessments. Another of the 2005 project activities included transplanting eggs and/or fry into the Trapper

Lake system in order to assess the potential impacts of anadromous sockeye fry in the system. An application for the trial transplantation of eggs/fry to the B.C.Fish Transplant Committee was neither approved nor rejected for 2005. It was understood that since the transplant application would also include the potential modification of the barrier and therefore a "range extension" of anadromous sockeye additional factors had to be considered. In 2006 and 2007 ongoing limnological field work was conducted at Trapper Lake from June through October. This field work consisted of adding to the baseline limnological data that has been collected on the lake to date. In both 2006 and 2007 two separate approvals were granted by the FTC for transplanting 1 million hatchery incubated fry into Trapper Lake in June of 2007 and 2008. The donor stock for the fertilized sockeye eggs was to be from the Little Trapper Lake sockeye. In addition, approval was granted in 2007 for the deposition of 100,000 fertilized sockeye eggs into Tunjony Creek.

2008 objectives are:

- Outplanting of Little Trapper Lake origin sockeye fry into Trapper Lake in June 2008
- Monitoring of outplanted sockeye fry to assess the growth, survival, habitat utilization, diet of the fry as well as niche overlap/competition with resident species. In addition quantitative and qualitative assessment of the incubation and emergence of the eggs transplanted into Tunjony Creek will be conducted.
- Continued collection of baseline biological data.
- Continuation of the program in 2008 and 2009 would be dependent on another approval of a the fish transplant application. Application will be made for egg collection and fish transplant in spring 2008.
- Pending positive developments from the approval process an egg take will be performed at Little Trapper Lake in 2008 to collect eggs from broodstock supplied by Little Trapper Lake origin sockeye.

Project Title: Trapper Lake Barrier Modification
Project Lead: Brian Mercer, Mercer and Associates, Whitehorse, YT
Project Cost: $178,725 CAN/US

Between 2004 and 2007 feasibility studies have been conducted to investigate the establishment of a self sustained anadromous sockeye run stock originating at Trapper Lake. The intent of the Trapper Lake sockeye enhancement project is to establish an anadromous sockeye population in Trapper Lake with un-restricted access to returning adults. Outplanted fry in 2007 and 2008 will return to Trapper Lake as early as 2010. The mandate of the Transboundary Technical Committee, as directed by the Transboundary Panel, is to modify the present barrier at the outlet of Trapper Lake to allow un-restricted access to the lake for the returning adult sockeye.

The field work to modify the barrier may take more than a single year. Therefore it is proposed to initiate work to modify the barrier in the late fall of 2008 when water levels could be low enough to allow work on the project. It is proposed to conduct further engineering assessments of the barrier at Trapper Lake (as recommended by the Transboundary Panel) in the summer of 2008, and begin construction and blasting work in the late fall of 2008.

It should be noted that the initiation of this project is dependent on approvals and feasibility studies that are ongoing and in progress. It is possible the project could be deferred/cancelled if approvals and studies conducted in 2007/2008 do not allow the project to proceed as planned.

Project Title: **Lakelse Lake Sockeye Rehabilitation Program: Fry Outplant Project. Year 3.**
Project Lead: Lana Miller, Resource Restoration Biologist – North Coast, DFO Prince Rupert, BC
Project Cost: $75,000 CAN/US

The Lakelse watershed has very high fisheries values and is a major producer of sockeye, coho and pink salmon as well as supporting chum, chinook and steelhead populations. The Lakelse system supports about 35% of the total Skeena River commercial fishery catch for all species. Skeena River sockeye are recognized as being a stock produced in Canadian waters that are subject to interception by American fisheries. As such, sockeye produced in tributaries of Lakelse Lake are part of a stock which is a high priority for conservation by the PST. However, sockeye stocks in Lakelse Lake have been declining at an alarming rate, due to physical changes and habitat impacts caused by logging, linear development and beaver activity. Sockeye escapements to Lakelse Lake have been depressed relative to historic levels, due to degraded or limited tributary spawning habitat which is believed to be restricting spawner access and spawning success in terms of fry recruitment. As an integral part of the Lakelse Lake Sockeye Salmon Recovery Plan, we propose to once again use Snootli Creek Hatchery to incubate and read ~300,000 Lakelse sockeye fry. Enhancement will be coupled with continued habitat restoration, protection and other assessment and monitoring in the overall plan while also building capacity in the Lakelse area.

Project Title: **Tuya River Harvest Study. Year 4**
Project Lead: Pete Etherton, Senior Stock Assessment Technician, DFO Whitehorse, Yukon.
Project Cost: $240,000 CAN/US

The Tuya River system, specifically Tuya Lake, has long been recognized as a potential producer of Stikine sockeye salmon. Because of this potential, the Tuya River is key to the Canada / US joint enhancement agreement, which has the objective of increasing the adult production of Stikine River sockeye by 100,000 fish. Sockeye production originating from releases to Tuya Lake has resulted in a substantial increase in Stikine adult production, but has left in its wake problems associated with terminal harvest and the subsequent downstream straying of sockeye. Discussion within the Transboundary Technical Committee and with the Tahltan First Nation have resulted in the pursuit of funding from the Northern Fund to address the issue of terminal harvest (as well as straying). The Northern Fund granted funding commencing in 2004 based on a submission outlining an approach to addressing the problems. This application is for fifth year funding.

Between 2004 and 2007, monies from the Northern Fund of the PST have been directed at developing a terminal harvest system. A trap harvest system was deployed in 2005, with very marginal success, but with some promise contingent on trap redesign. In early July 2006 a rock slide occurred adjacent to the fish trapping site used in 2005. The rock slide rendered the fishing site and fish trap unusable due to a constriction of river flow and alerted managers to the instability of rock slopes there and inherent dangers to the fishing crew operating the fish trap. The best option for a harvest site, and new harvest system, now appears to be located approximately 800 metres above the recent barrier, contingent upon the provision of fish passage through the new barrier. Fish passage work, via strategic blasting, is scheduled to commence in March 2008. This proposal may not be implemented if fish passage is not achieved.

This proposal is for funding to complete the final design of a new Tuya River fish harvest structure based on the conceptual design developed by members of the Tuya River Steering committee in 2007. The final design shall also include the routing and estimated cost of an access tote road to the harvest structure site, a summary of permit requirements including permit scheduling, and a recommended process design to adequately consult and accommodate First Nations and the general public.

Project Title: **Sockeye Outplanting to Hanging Lakes: Initial Sockeye Outplanting**
Project Lead: Chris Picard, Gitga'at Development Corporation, Prince Rupert, BC.
Project Cost: $189,295 CAN/US

This project initiates large-scale sockeye fry outplanting and associated monitoring following 3 years of successful background feasibility and regulatory work. The economic benefits accrued from the established Alaskan outplanting program clearly demonstrate how similar dedication in BC could produce comparable benefits (Levy 2005; ENRI 2001). Smolt production and adult return estimates developed by Shortreed and Hume (2007) for the three hanging lakes assessed to date (i.e., Red Bluff, Batchellor and Whalen lakes) provide initial insight into the anticipated benefits of such a program. Shortreed and Hume (2007) estimated that the three lakes in aggregate could produce between 0.7 and 1.0 million smolts. Assuming 5% marine survival, they further estimated adult returns between 35,000 and 50,000. Potential returns to Whalen Lake may be even greater since they are currently based on a preliminary and conservative productivity estimate.

We have chosen to initiate outplanting to one of these three lakes; Batchellor Lake. This decision was made despite Batchellor having the lowest productivity of the assessed lakes. However, since kokanee are not present in Batchellor Lake, we expect to successfully acquire a transplant permit to outplant to this lake. Estimated range of smolt production and adult returns from a fry outplanting into Batchellor Lake are 100,000 to 150,000 and 5000 to 7500, respectively, and are based on photosynthetic-rate modeling (Shortreed and Hume 2007).

Project Title: **Tatsamenie Lake Extended Rearing**
Project Lead: Brian Mercer, Mercer and Associates, Whitehorse, YT
Project Cost: $120,000 CAN/US

This proposal is to utilize extended netpen rearing of sockeye salmon at Tatsamenie Lake with the expectation of significantly improving survival rates. We hope to see 30% survival from green-egg to smolt, a roughly five-fold increase from what has been observed in the average survival of enhanced fry over the past five years at Tatsamenie Lake. The intention is to test this technique with the expectation that it could be used at Tatsamenie or other lakes to rebuild stocks and/or enhance sockeye production; however, we want to note that this is a test of this technique, with no prejudice to what might happen in the future. (Potentially this test project would produce 15,000 adults for each brood year). We will collect approximately 500,000 eggs from sockeye returning to Tatsamenie Lake in each of the summers, 2008 and 2009. The eggs will be incubated in an "isolation module" at Snettisham Hatchery. All eggs/fry will be uniquely thermally marked. Emergent fry will be reared at Snettisham to a size of 0.35 grams. This initial growth is critical so that fry can be transferred to 1/8" mesh net pens (smaller mesh creates lots of problems with fouling). Fry will be transported to Tatsamenie Lake on about June 1. The objective will be to release 400,000 pre-smolts from the net pens into Tatsamenie Lake on August 1 at a size of from 3 to 5 grams each.

Project Title: **Transboundary Enhancement Feasibility Study**
Project Lead: Richard Erhardt, Taku River Tlingit and Tahltan First Nations, Whitehorse, YT
Project Cost: $135,651 CAN/US

It has been approximately 20 years since the original Transboundary enhancement feasibility work was conducted and since that time much experience and knowledge has been gained regarding enhancement methods. Some initial feasibility work has been started at Big Trapper Lake and upon extensive review, alternative enhancement methods are being considered for Tatsamenie Lake. However, examination of

other potential sites has not been thoroughly explored in recent years and it seems prudent that options for alternative sockeye enhancement projects (particularly on the Taku) be investigated further.

Top candidate enhancement sites are:

1. King Salmon L. (good initial feasibility / joint interest / recent weak returns)
2. Hackett River (best candidate site for access maintenance work / of CAN interest)
3. Kuthai Lake (good initial feasibility / joint interest / recent weak returns)
4. South Fork L. (lower initial feasibility / interest to the CAN Panel / small part of overall study)

Project objectives are:

- To investigate the main factors which may limit production
- To consider and describe prospective enhancement methods, risks and benefits
- To evaluate (or re-evaluate) potential productive capacity

CHINOOK SALMON

Project Title: **Snootli Hatchery Chinook Augmentation. Year 2.**
Project Lead: Russ Hilland, Snootli Hatchery Manager, Bella Coola, BC
Project Cost: $67,237 CAN/US

This proposal is to take 300,000 more Lower Atnarko Chinook eggs, and rear them to yearling smolts prior to release at the Atnarko rearing channels. Based on previous experiments (where a 3% survival rate was achieved) this increased enhancement would be expected to produce 10,000 returning adults. Potential broodstock would be randomly selected from the wild spawning population. Broodstock for this project will be captured and eggs taken in Sept 2008. Eggs and milt would be transported to Snootli Hatchery for fertilization and planting. Snootli hatchery uses modified matrix spawning, which when combined with random broodstock collection protects natural stock genetic diversity. Resultant fry will be ponded in Feb 2009 and reared until Oct 2009 at Snootli Hatchery, at which time they will be transported to the Atnarko channel for over winter rearing. The yearling smolts will be released in June 2010 at an average size of 20 -25 grams. (Note: June is the migration window for wild smolts).
In summary, the objectives are to:

- Increase the enhanced chinook production from Snootli hatchery by taking an additional 500,000 eggs and rearing to release as yearling smolts.
- Provide increased Snootli chinook harvests in Canadian and Alaskan fisheries.
- Increase production from a northerly migrating chinook stock contributing to Canadian and Alaskan PST chinook abundance indices.
- Evaluate the survival and harvest distribution of this enhanced release by applying cwt's.

Project Title: **Feasibility Study for Enhancing Nass River Chinook Salmon and Development of a Concept Proposal for a Low-Technology Enhancement Facility at Tseax River**
Project Lead: Cheryl Stephens, Nisgaa Fisheries Program Manager, New Aiyansh, BC
Project Cost: $103,877 CAN/US

This proposal is for a feasibility study of enhancing Nass River Chinook salmon with a focus on Tseax River Chinook. The project will provide for collection of critical information to support conceptual design, engineering, and ultimately operation of a pilot, low-technology, low-cost hatchery in the fall of 2009. A number of potential sites have been identified with the following operational advantages: 1) Safe,

reliable water source (i.e., lava bed acts as a giant filter controlling water quality [reducing TSS, heavy metals] and seasonal buffering of water temperatures), 2) Low operational/maintenance costs (i.e., gravity fed incubation water sources), and 3) Low capital costs (floating net pen facility) which will result in producing high quality smolts using very cost effective methods, and assuring a sufficient number of marked fry/pre-smolts are released to assess the success of the enhancement program. This proposal involves the development of a low technology enhancement project specific to the Tseax watershed but with the capability in the long term to support other enhancement objectives. Based on previous Chinook and coho enhancement programs at Tseax River (Fisheries and Oceans Canada and Nisga'a Fisheries 1986-1993), we are confident in securing a safe, reliable water supply and operating a cost-effective hatchery over the long term. These previous enhancement programs were small scale and did not have secure funding. With the Nisga'a Final Agreement and Lisims Trust, opportunities for securing long term funding are promising. The proposal also addresses the collecting of life history information for Chinook and other species of salmon in the Tseax River and identifying limiting factors to production. The feasibility study will provide key life history information, identify potential Chinook production limitations, determine low cost technology enhancement methods specific to the Tseax watershed, and develop an enhancement plan that is consistent with the Pacific Salmon Treaty, the Nisga'a Final Agreement, the Nass Joint Fisheries Management Committee, and Canada's Wild Salmon Policy. The end product of Year 1 will be a conceptual design for the development of a low-technology enhancement facility at Tseax River. Nisga'a Fisheries will be seeking a second year of funding from the PSC for the engineering and construction.

CHUM SALMON

Project Title: **Marx Creek Rehabilitation. Year 3.**
Project Lead: Todd Tisler, Fish & Wildlife Staff Officer, Ketchikan-Misty Fiords, AK.
Project Cost: $300,000 US

This project will improve and expand upon the existing Marx Creek chum salmon spawning channel in the Salmon River drainage at the head of Portland Canal. Portland Canal chum salmon stocks were specifically identified in the Pacific Salmon Treaty as having conservation concerns. Marx Creek and nearby Fish Creek are tributaries of the Salmon River, located near Hyder, Alaska. In 1985, a spawning channel (Marx Creek) was constructed by excavating into the ground water in the area between Fish Creek and the Salmon River in a protected area between dikes. This channel was 4,000 feet long and entered the Salmon River approximately one mile upstream from the Fish Creek confluence. In 1989 Marx Creek channel was extended upstream 1,600 feet. The extension was constructed directly in contact with the Salmon River dike, but, silty glacial water leaks through the dike and enters Marx Creek and, fish avoid this extended part of the channel. The severity of the leak depends on the proximity of the Salmon River to the constructed dike. The quality of the spawning gravel throughout Marx Creek is also deteriorating because of the deposition of silt. The purpose of this project is to prevent Marx Creek from further water quality deterioration and expand the channel by constructing an additional 1,500-2,000 feet of high quality, groundwater-fed spawning habitat. The new channel will connect to the existing channel 3500 feet from the confluence with the Salmon River.

Project Title: **Marx Creek Monitoring**
Project Lead: Ellen Martinson, Fishery Biologist, NOAA-NMFS-AFSC, Auke Bay Lab, Juneau, AK.
Project Cost: $39,023 US

In southeast Alaska and northern British Columbia, Portland Canal chum salmon are a commercial resource shared by U.S. and Canada mentioned in the Treaty as having conservation issues. Chum salmon

en route to spawn in Fish Creek and Marx Creek, at the head of Portland Canal in the U.S., are caught in the U.S. and Canadian fisheries. Approximately 50% are captured in Alaska Areas 101 and 104 and 50% in Canadian Area 3. Marx Creek is a man-made spawning channel for chum salmon that is protected by a dike from the glacial Salmon River. Chum salmon seek silt-free, ground water for spawning. However, Marx Creek has experienced excessive influx of silt and glacial water seeping through the dike from the Salmon River. To reduce the deterioration of prime chum salmon spawning habitat there is an interagency effort to repair the leak in the dike or move the spawning channel away from the Salmon River. In addition a new channel extension will be built and consist of 1,500 to 2,000 feet of high-quality, groundwater fed spawning habitat. Our proposed project will monitor the use of Marx Creek spawning channel, especially the new channel by chum salmon during the post-construction phase. In addition, we will compare past enumerations, size, age of chum salmon sampled in Marx and Fish Creek. The project assists in monitoring the success of the Marx Creek Rehabilitation Project (Todd Tisler-Project Lead) funded by the Northern Fund. As a result of the construction of the new channel, we expect Marx Creek to have enhanced chum salmon egg survival in freshwater and increased overall production of salmon available in the marine environment.

Project Title: **Determining the Trend of Chum Population Dynamics in Fisheries Statistical Area 5 and Measuring the Success of Small Hatcheries for Stock Assistance. Year 3.**
Project Lead: Janet Lemon, Oona River Resources Association, Oona River, BC.
Project Cost: $41,483 CAN/US

The goal of this project is to evaluate the effectiveness of a small hatchery such as the Oona River hatchery as a means of increasing chum salmon populations in systems such as the Kumeleon River that have historically had much larger chum populations (maximum reported spawners 1500). The proposed project for 2008 would be the third year of acquiring chum eggs from the Kumeleon river, incubating the eggs and feeding the fry to the 1.0 gram weight at the Oona River hatchery before the fry are released back into the Kumeleon river. Before their release, the left ventral fin would be clipped in order to distinguish between the returning wild adult salmon and enhanced salmon so that we can quantify the success of this project by a numerical count of the enhanced fish in relation to the wild fish.

In the 2006 field season there was an estimated 80 chum returning to the system and we managed to only take 10,000 eggs but we returned 7,500 clipped fry back to the system in the spring of 2007. We have just completed the 2007 field season and we have taken 25,000 eggs and have them presently in heath trays at the Oona River hatchery.

We are requesting some extra funding for 2008 to investigate the out-migration of wild chum salmon based on John Jensen's Incub Win developmental model which uses the inputs of our temperature data recorder for predicting different developmental stages such as time to the eyed stage and swim up stage. We found that the model accurately predicted the swim up stage for the chum fry at the Oona River hatchery around December 15th 2006 but when we ran the data through the Incub Win model it predicted the swim up stage for Kumeleon around November 28th 2006. In the field season of 2007 we placed both a temperature logger in the same place as 2006 for recording the ambient flow in Kumeleon and also a logger in the cobble near a redd to record any differences in the temperature for forecasting the Accumlated Thermal Units (ATU's). We would like to use the outputs of the model for traveling to Kumeleon to confirm if the model is accurate in forecasting the timing of the wild juvenile chum out migration in this system.

Project Title: **McLoughlin Hatchery – One Million Chum Production Increase**
Project Lead: Sandie MacLaurin, Community Advisor, DFO Central Coast, Hagensborg, BC.
Project Cost: $45,119 CAN/US

The purpose of the project is to double production of chum salmon from an established facility (McLoughlin Hatchery) on B.C's Central Coast. The project will allow facility upgrades to accommodate for an additional 1 million 1gm smolts to be released and estimated 20,000 additional adults for harvest in return years. Funds will be used to purchase additional incubators, plumbing and netpen capacity. Current operations will be modified/extended to allow for additional eggtakes and increased work associated with the higher production. Enhanced chum from McLoughlin creek have consistently been harvested in a terminal net and IFF fishery for 25 years. The fishery is easily managed and provides opportunity after area 8 pink and chum fisheries are closed for the season. Many local FN commercial fishers take advantage of the opportunity as there is little travel involved and has a high potential for delivery of the product to a Native Band owned processing facility. Heiltsuk FN band members also access McLoughlin River chum for food as the river is close to the community and safe to capture adults in.

MULTI-SPECIES

Project Title: **Snootli Hatchery Infrastructure Upgrade**
Project Lead: Russ Hilland, Snootli Hatchery Manager, Bella Coola, BC
Project Cost: $163,000 CAN/US

A new well will provide 800 lpm for incubation and rearing at the Snootli Creek Hatchery. Water from the new well can be distributed from the existing aeration tower. This will enhance the rearing environment for Wannock River chinook (400,000 smolt production funded by Rivers Inlet North Coast Salmon Enhancement Association), 2,000,000 Atnarko "90 day" chinook smolts (funded by DFO- SEP Operations) and 300-500,000 Atnarko yearling chinook smolts (2007 brood funded by the Northern Fund). By having this water available production well #10 can be solely dedicated to the culture of Lakelse Lake Sockeye (2006 and 2007 broods Northern Fund funded), Atnarko River and Lonesome Lake sockeye (funded by Nuxalk First Nation) and Curtis and Michado Lake sockeye (2007 brood pilot funded by the Northern Fund).

HABITAT RESTORATION

SOCKEYE SALMON

Project Title: **Kitwanga Sockeye Salmon Spawning Habitat Improvement Assessment. Year 3.**
Project Lead: Mark Cleveland, Head Biologist, Gitanyow Fisheries Authority, Kitwanga, BC.
Project Cost: $25,000 CAN/US

Kitwanga sockeye salmon stocks are extremely depressed and presently at risk of extirpation. Studies on this genetically unique stock have been on going since 1999 and declines in stock abundance have been linked to over exploitation in mixed stock fisheries in Alaska and Canada, and the deterioration of spawning grounds located along the lakeshore of Gitanyow Lake. Over the last few years' exploitation rates on the stock have been slightly reduced, but adult recruitment is still low (e.g. 2007 escapement of 240 adults). Therefore, the Gitanyow Fisheries Authority (GFA) in partnership with Fisheries and Oceans Canada (DFO) and the Pacific Salmon Commission (PSC) initiated a habitat restoration project in 2006 and again in 2007 to restore Kitwanga sockeye spawning areas in an attempt to increase egg to fry survival and boost production of the stock.

In 2006/07 and 2007/08 funding was acquired through the PSC to complete spawning ground restoration works. GFA focused on small-scale gravel cleaning operations (fine sediment extraction using hydraulic wands and high pressure pumps) and the addition of superior spawning gravels along lakeshore sites. Through both initiatives a total of 400 m^2 of spawning area was improved, which could potentially accommodate 800 adult sockeye with superior spawning sites.

Sockeye usage of restoration sites and the assessment of egg to fry survival in enhanced versus unenhanced sites was completed in 2006/07. Preliminary assessment results from egg tube survival studies showed that both enhanced sites and non-enhanced sites yielded good egg to fry survival rates (60-80%) and no statistical difference between enhanced and non-enhanced sites could be detected. Although these results are preliminary (small sample size, only one year of data), GFA has decided to suspend any further restoration works until better assessment information can be collected on the value of lakeshore restoration works. In 2007/08 GFA attempted to reproduce the assessment techniques employed in 2006/07 to determine spawner use of the area and to assess egg to fry survival. However, as of October 30, 2007 no spawners and or redds had been observed on known spawning areas and it looks doughtful that the egg to fry survival studies would go ahead for 2007/08, do to the lack of broodstock available for the study.

Therefore, for 2008/09 GFA is requesting funds to continue to study Kitwanga sockeye lakeshore spawning sites to improve our knowledge of the enhanced and non-enhanced sites. It is GFA's belief that by implementing another year of spawning ground assessments it will help determine if the restoration of spawning sites is necessary, and to see if the techniques presently being employed are adequate to achieve the intended goals of increasing egg to fry survival in designated spawning sites.

Project Title: **Lakelse Lake Sockeye Rehabilitation Program: Spawning Channel/ Improved Spawning Habitat Project. Year 2.**
Project Lead: Lana Miller, Resource Restoration Biologist – North Coast, DFO Prince Rupert, BC
Project Cost: $60,980 CAN/US

In recent years, sockeye recruitment in the Lakelse system has fallen dramatically, apparently due (in part) to reduced and degraded spawning habitat in the major spawning tributaries to Lakelse Lake (DFO, 2006). A recent sedimentation study of Williams Creek (the main sockeye spawning tributary) suggests that the causes of reduced spawning habitat are a combination of ongoing flood scouring each fall and continued sedimentation/siltation of historic spawning grounds from combined human (logging) and geological activity. Other tributaries are affected by flow diversions and beaver activity. The Lakelse Sockeye Recovery Team believes that spawning habitat enhancement may one of the most suitable options to increase fry recruitment to the lake. This project will endeavor to systematically increase spawning habitat and productive capacity of the Lakelse watershed over several years with the long term goal of providing quality spawning habitat to support 4-7 thousand adults in Scully and 20-30 thousand adults in Williams Creek.

Year 1
A feasibility study was conducted in 2007 in order to identify and prioritize opportunities for improving sockeye spawning habitat in tributary streams to Lakelse Lake that currently or historically supported sockeye populations.

Year 2
Scully Mainstem – Hotsprings Channels: Pilot spawning platforms will be developed and monitored for incubation success and physical stability.

Scully South: Beaver dams will continue to be breached during the spawning season by DFO staff and volunteers during enumeration walks to ensure access to existing spawning habitat. The feasibility of diverting a portion of the surface water from the fan apex of Scully Mainstem to Scully South will be examined.

Williams Creek Off-channel: test pits will be monitored for temperature, water level and dissolved oxygen to fine-tune the appropriate design requirements for the channel. Location for a channel intake will be determined and designed. The feasibility of developing an in-stream incubation box and/or a small fish production facility at this site will be examined.

CHINOOK

Project Title: **Big Boulder Creek Restoration and Monitoring Project**
Project Lead: Emily Seward, Development Director, Takshanuk Watershed Council, Haines, AK
Project Cost: $66,287 US

Big Boulder Creek is a tributary to the Klehini River in Southeast Alaska. This steep mountain stream has a watershed area of 30 square miles and flows south from headwaters in British Columbia. The creek supplies important spawning and rearing habitats for Chinook salmon in the area. The system accounts for 5 to 10% of the total Chilkat Watershed population of Chinook salmon. Historic runs were reported to be considerably larger than those seen in recent decades. There is thus concern over the current quality of habitat. The existing channel is relatively straight and entrenched with little access to a floodplain. It is hypothesized that the high energy and velocities produced by the constrained channel limits the amount of suitable salmon habitat. Earlier studies suggest that the existing channel has occupied its current alignment since at least 1948 and that the normal dynamics associated with alluvial fans have been significantly altered by placement of the upstream highway bridge. It has been suggested that diverting flows into a pre-1948 channel to the east will reduce energy and velocity resulting in increased quantity of quality habitat. With this as a starting point, the objectives of the project are: first, to protect the existing spawning habitat, secondly, to install restoration features to enhance the habitat for Chinook salmon and, finally, to monitor the project's success.

A recently excavated gravel pit located immediately west of the current creek poses an imminent and substantial threat to habitat and highway infrastructure. A breach into the pit would create a very powerful headcut that could quickly erode the channel upstream. This would dramatically lower the channel bed elevation and threaten the highway bridge abutments. Proposed modifications to the stream channel have been carefully designed and installed to minimize lateral erosion to the west.

COHO

Project Title: **Exchamsiks Backchannel Rehabilitation**
Project Lead: Allen Gottesfeld, Head Scientist, Skeena Fisheries Commission, Hazelton, BC.
Project Cost: $403,260 CAN/US

The Skeena River is the second most important salmon producer in B.C. The Exchamsiks Backchannel is composed of two relatively large meandering backchannels located on the Skeena River floodplain east of Exchamsiks River. The Skeena River downstream of Terrace is characterized by an extensive network of sidechannels and wetlands that range from channels many kilometers in length to intermittent channels a few hundred meters in length. Highway #16 and the CN Rail grade have cut off several productive

backchannels from the Skeena River. The backchannels are watered remnants resulting from past positions of the Skeena River as it meandered across the floodplain. They are fed by groundwater and surface flows and feature a complex of channel and pond habitats that this project will capitalize on.

The project goal is to provide fish access
and rehabilitate 4.8 km of quality juvenile rearing habitat and create enhanced coho spawning conditions in order to increase wild stock productivity. The four main project objectives are to:

1. Restore access to Exchamsiks Backchannel;
2. Establish rearing opportunities and high water refuge for juvenile coho;
3. Create and rehabilitate coho spawning habitat and;
4. Restore self-sustaining habitats by allowing high water river flows to flood through the coarse material that comprises the CN Rail and Highway 16 subgrades.

This project originated with the 2005-06 Northern Fund project Lower Skeena Fish Passage Assessment on Highway #16, #37S, and CN Rail and follows 18 months of feasibility, surveys, and planning studies.

Project Title: **Bulkley/Kispiox River Agricultural Stream Restoration Seed Funding**
Project Lead: Bob France, General Manager, BC Cattlemen's Association, Kamloops, BC.
Project Cost: $25,000 CAN/US

Fish habitat degradation on agricultural land, often the result of riparian losses, is well documented in the Kispiox and Bulkley drainages (Agra 1998, BC Conservation Foundation 1997 and 1998, Mackay 1997, Remington et al 2002, Tamblyn et al 2000, Triton 1998). The BC Cattlemen's Association's Environmental Farm Plan program has conducted a large number of riparian assessments in the BC Northwest and concluded that there is a large amount of work to be done to return riparian areas on private lands to proper functioning condition. Every important fish bearing stream from Terrace to Burns Lake has sections of riparian area on private lands that are unstable (D. Russell, pers. comm).

This project will focus on a multi-faceted approach to these issues. Environmental Farm Plans for several farms will be developed prescriptions for protecting riparian corridors and restoring damaged fish habitat will be completed. These will include (but not be limited to) riparian fencing and planting, limiting cattle access through construction of proper crossings) and stream bank stabilization work. Projects will be implemented with partnership funds and in-kind support from multiple sources. These projects will primarily target juvenile coho rearing habitat, however, they will also provide refuge habitat for other species and will protect existing spawning and rearing habitat by restoring riparian function.

This project will support 10 projects on agricultural properties in the Bulkley Valley and Kispiox Watersheds in 2008. Additional sites may be added as new sites become identified.

MULTI-SPECIES

Project Title: **Atnarko Spawning Channel Flow**
Project Lead: Neil Oborne, Consultant, Hagensborg, BC
Project Cost: $140,354 US

The Atnarko Spawning Channel was built in 1986 to provide a "buffer" against the effects of high water events on Pink, Chinook and Coho in the Atnarko River. A log jam slightly downstream of the channel intake ensured adequate intake flow. A high water event removed the log jam, lowering the intake level and intake volume. The channel was designed for an operating flow of 50-70cfs, but since the intake

began to fail, flows have dropped to less than 20 cfs for most of the year. Fish production has declined to less than 20% of capacity as a result. The project objective is restoration of the designed operating flow to the channel by redirecting water from the Atnarko River into the spawning channel intake. Restoration of design flow will result in an immediate potential for a sustainable increase in fry and smolt production. Historic maximums were 2,660,000 Pink, 4,101,084 Coho, 590,948 Chinook. But the 2006 production was 27,000 pink, 0 Coho, 0 Chinook.

IMPROVED INFORMATION

SOCKEYE SALMON

Project Title: **McDonald Lake Sockeye Escapement Estimate. Year 2. WITHDRAWN**
Project Lead: Steve Heinl, Alaska Department of Fish and Game, Division of Commercial Fisheries, Ketchican, AK.
Project Cost: $102,491 US

Project Title: **Kitwanga River Sockeye Salmon Enumeration. Year 5**
Project Lead: Mark Cleveland, Head Biologist, Gitanyow Fisheries Authority, Kitwanga, BC.
Project Cost: $25,000 CAN/ US

Kitwanga sockeye originate from Gitanyow Lake, one of the ten important wild Skeena River sockeye producing lakes. They are genetically unique and spatially separated from other Skeena River sockeye populations (no gene flow). Historically, sockeye escapement to Kitwancool numbered in the 10's of thousands per year. However, today only a fraction of these historical sockeye escapement numbers persist. Stock assessment patterns for Kitwanga sockeye over the last 50 years show extremely low but stable escapement trends, and presently the stock produces less than 5% of its potential. Reasons for the Kitwanga sockeye decline are believed to be linked to 100 years of over harvest in the commercial fishery at the coast and a 40-year legacy of poor forest harvesting techniques in the Kitwanga Watershed that has changed the ecology of the system. Some of the adverse effects to Gitanyow Lake and subsequently Kitwanga sockeye include changed drainage patterns, increased sediment input and increased macrophyte growth.

The specific objectives that will be achieved through the implementation of this project in 2008 include the accurate determination of Kitwanga sockeye salmon population health through the collection of escapement data and improved fisheries management through accurate in-season run timing for Kitwanga sockeye. A secondary objective includes the data collection of chinook, pink, chum and coho salmon escapement to the Kitwanga River for 2008. The data collected will not only provide indications of Kitwanga salmon health but will also give insight into the health of all middle Skeena salmon stocks with similar run timing. Furthermore, employment opportunities for up to 8 individuals on a full-time seasonal basis will be provided to locals living in the communities surrounding the Kitwanga River.

Project Title: **Kitwanga River Smolt Fence Completion Project - 2008**
Project Lead: Mark Cleveland, Head Biologist, Gitanyow Fisheries Authority, Kitwanga, BC.
Project Cost: $30,000 CAN/US

Since 1999, the Gitanyow Fisheries Authority (GFA) has been studying the limiting factors affecting sockeye salmon production in the Kitwanga watershed. One of the key factors used in determining the relative health and abundance of the Kitwanga sockeye stock is to enumerate the yearly emigration of

sockeye smolts. Over the last seven years GFA in conjunction with DFO stock assessment biologists have experimented with several different smolt fence designs in an effort to accurately enumerate sockeye smolt production. For the most part the smolt fence designs that were tested were rendered unusable during high water when most of the smolts move out of the lake and migrate downstream. In an effort to increase the accuracy of the yearly smolt estimates the GFA with the help of DFO engineers designed a permanent smolt fence at the outlet of Gitanyow Lake. In 2007 the GFA were successful in acquiring partial funding from the Ministry of Forests and Fisheries and Oceans Canada to complete Phase I of the construction of a fence. Phase I consisted of establishing a concrete sill in the Kitwanga River from which aluminum transoms could be erected to support fence panels for smolt enumeration.

This project will complete Phase II of the Kitwanga Smolt Fence, and will include the fabrication and construction of the aluminum fence components to make the fence operational. Reliable fry and smolt estimates leaving Gitanyow Lake will help measure the effectiveness of pilot programs such as fry out planting into the lake and sockeye lakeshore spawning ground restoration works.

Project Title: **Northern Boundary Area Sockeye Genetic Stock Identification. Year 3**
Project Lead: Richard Wilmot, Supervisory Research Geneticist, NOAA-NMFS-AFSC, Auke Bay Laboratory, Juneau, AK.
Project Cost: $175,600 US

Provisions of the 1999 Pacific Salmon Treaty (Chapter 2) specify harvest sharing arrangements of Nass and Skeena River sockeye salmon returns for the U.S. and Canada. The United States is allowed to harvest a fixed percentage of the annual allowable harvest (AAH) of Nass and Skeena sockeye stocks in Alaska's District 101 gillnet and District 104 purse seine fisheries. Accurate estimates of the stock-specific catch in commercial fisheries of each nation are required to estimate the total return of these stocks, and the percentage of each stock caught in treaty-limited fisheries. Annual catches over or under the agreed percentage are made up for in subsequent years.

The Alaska Department of Fish and Game has used scale pattern analysis (SPA) successfully for over two decades to estimate contributions of Nass, Skeena and Southeast Alaska sockeye stocks to fisheries in southern Southeast Alaska. Recently the Canadian Department of Fisheries and Oceans has applied genetic stock identification techniques (DNA analysis) to estimate sockeye stock compositions in selected Canadian Boundary area fisheries. Additionally, the two agencies have compared SPA and DNA analyses in limited sample sets from Alaska's District 101 gillnet fishery. Results of these tests show that, although the two methods provide similar estimates on matched samples from mixed stock fisheries, DNA analysis is slightly more accurate and is able to discriminate stocks at a finer scale than SPA. Using the additional 15 SNP loci developed by ADF&G has the potential for greatly increasing the precision and accuracy of stock composition estimates in the Area 101 and 104 fisheries. Simulation results obtained by ADF&G on the Bristol Bay sockeye salmon baseline using the extended SNP markers showed greater than 90% accuracy by stock. New baseline samples of British Columbia and southeast Alaska sockeye salmon stocks were obtained in the fall of 2006, and a 39 SNP marker baseline should be available by the summer of 2007. (Pers. Comm., Chris Habicht, ADF&G) An additional advantage of the DNA technique is that it is capable of providing results on an in-season basis for use by fishery managers because, unlike SPA, it does not require annual sampling to establish an annual 'escapement baseline'.

In Alaska this project would provide funding for stock identification of weekly samples from commercial catches in the District 101 gillnet fishery and District 104 seine fishery using the 44 SNP baseline developed by ADF&G. Approximately 500 samples per week will be collected from the 2008 District 101 gillnet fishery and the District 104 seine fishery will be analyzed in 2008 and 2009 (Approximately 6,000 samples total). In addition, the 6,000 fishery samples collected in 2006 will be analyzed for 44

SNP markers rather than the 25 SNP markers originally proposed. The specific objective is to determine the proportion of Nass, Skeena and southeast Alaska origin sockeye salmon harvested in the District 101 gillnet fishery and the District 104 seine fishery with acceptable levels of accuracy.

Project Title: Northern and Transboundary Sockeye Matched Scale-Tissue Sampling. Year 2
Project Lead: Anne Berg, Fisheries Biologist, Alaska Department of Fish and Game, Douglas, AK.
Project Cost: $202,808 US

Provisions of the 1999 Pacific Salmon Treaty specify abundance-based harvest sharing arrangements of Nass, Skeena, Stikine and Taku River sockeye salmon returns for the U.S. and Canada. The United States is allowed to harvest a fixed percentage of the annual allowable harvest (AAH) of Nass and Skeena sockeye stocks in Alaska's District 101 gillnet and District 104 purse seine fisheries. The U.S. is allowed a fixed percentage of the annual total allowable catch (TAC) of Stikine River sockeye in the District 106 and 108 gillnet fisheries and of Taku River sockeye in the District 111 gillnet fishery. Alaskan McDonald Lake sockeye are the largest stock in southern Southeast Alaska and have been below escapement goals recently; time and area specific catch information is required for conservation efforts. Accurate estimates of the stock-specific catch in commercial fisheries of each nation are required to estimate the total return of these stocks, and the percentage of each stock caught in treaty-limited fisheries. Significant numbers of enhanced sockeye are caught in the District 106, 108 and 111 fisheries and the relative strength of the wild and enhanced returns need to be assessed by inspecting otoliths for thermal marks inseason to avoid over-harvest of wild stocks. DNA based analysis is a powerful emerging technology. Matched samples will allow side-by-side comparison of DNA and scale pattern based stock identification estimates which will be useful in indexing new DNA estimates to the scale pattern estimates which go back to 1982 and which were used in calculating the current sharing agreements. DNA analyses provide much finer definition of individual stocks than is possible with scale analysis. As DNA stock identification techniques are developed this powerful tool may supersede much of the current scale pattern based stock identification work.

Project Title: BC North Coast Sockeye Lakes Hydroacoustic Surveys. Year 3.
Project Lead: Allen Gottesfeld, Head Scientist, Skeena Fisheries Commission, Hazelton, BC.
Project Cost: $47,853 CAN/US

We propose to quantify the number of sockeye fry rearing in five Skeena and Nass watershed lakes through the use of a scientific echosounder and concurrent trawl and gillnets sampling. Sockeye fry sampling will be used with the geo-referenced echosounding data to produce sockeye fry population estimates and rearing densities as well as estimates for competitor limnetic species for each surveyed lake.

Bear Lake is estimated to have the 3rd largest lake rearing capacity and the 3rd largest surface area in the Skeena watershed. Bear Lake was surveyed successfully using the hydroacoustic method in 2003; it has not been surveyed since. A hydroacoustic survey of Bear Lake sockeye juveniles is appropriate since there has not been a complete escapement estimate for this stock since 1989 and Bear Lake sockeye are known to have lakeshore spawners which means visual estimates of adult spawners may be underestimating the true size of the stock. The Bear Lake sockeye stock has been depressed since the 1950's. A good lake rearing capacity estimate, based on the PR (photosynthetic rate) model, has been developed for Bear Lake.

Azuklotz Lake is a small lake (2.2 km2) in the Skeena watershed and is estimated to have the 13th largest lake rearing capacity. Azuklotz Lake is relatively shallow with a mean depth of only 3.7 m which makes it marginally suitable for the hydroacoustic survey methodology; however, it is separated by a low

gradient stream channel of only a few hundred meters making it accessible by boat from Bear Lake. This makes it economical to survey the lake concurrently with the larger Bear Lake which requires air transportation. The last hydroacoustic survey of Azuklotz Lake was in 2003 and a PR model estimate of lake rearing capacity has been developed for this lake.

Damdochax Lake is the 2nd most productive lake for sockeye in the Nass watershed based on trophic status. Prior to this year's survey, the last hydroacoustic survey of the lake occurred over a decade ago. Total sockeye fry population and density estimates from this year's study are not yet available. Escapements to Damdochax have steadily declined from an average of 12,500 in the 1950's to an average of 3,470 in the 1990's. A lake rearing capacity estimate has not been developed for this lake based on the photosynthetic rate (PR) model.

Wiminasik Lake is located just over 2 km upstream of Damdochax Lake in the Damdochax watershed. A concurrent survey of Wiminasik Lake with Damdochax Lake would provide information on the relative importance of each lake for sockeye rearing within the Damdochax watershed. There are also some charter float plane flight cost savings by surveying both lakes at the same time. A hydroacoustic survey was completed for the first time ever on Wiminasik Lake this year which confirmed the presence of sockeye fry and initial results suggest that the lake is quite suitable for the hydroacoustic survey methodology. There is no rearing capacity estimate available for this lake.

Lakelse Lake is estimated to have the 8th largest lake rearing capacity in the Skeena watershed. A hydroacoustic survey of this lake is planned for later this year (2007). In the absence of a sockeye smolt program, annual hydroacoustic fry estimates are the primary way to assess the performance of the habitat restoration and enhancement projects currently being performed and funded by the Northern Fund.

Project Title: **Genetic Changes Associated with In-basin Supplementation of a Population of Sockeye Salmon; Feasibility**
Project Lead: William Smoker, University of Alaska Fairbanks, Fairbanks, AK
Project Cost: $131,000 US

We propose a feasibility study of an evaluation of the genetic effect of sockeye wildstock supplementation in a model system in which part of a wild spawning population is spawned artificially, cultured in a hatchery, reared in captivity, and released into the lake as fry. We would ultimately evaluate reproductive success of fish produced artificially for wildstock supplementation through parentage analysis; this will require repeated intense genotype surveys of the naturally spawning wild population which will allow us to detect the presence of salmon produced by wildstock supplementation and of their offspring. This feasibility study will include a thorough genetic analysis of an entire population of spawners in a single brood year of Auke Lake sockeye; it will demonstrate how parentage analysis can be carried out. This feasibility study will also demonstrate how supplementation fish culture could be modelled in Auke Lake: in particular how adult salmon can be cultured to maturity at the research station. Wildstock supplementation has been used to increase the productivity of depressed populations and is proposed for use in others, e.g. Hugh Smith Lake sockeye, McDonald Lake sockeye. The effect of wildstock supplementation on reproductive isolation between local subpopulations, on naturally adapted variation within and between them, and on their fitness and productivity, is unknown and a matter of concern. This concern inhibits the use of artificial wildstock supplementation which otherwise might be a useful tool for improving the productivity of depressed stocks and therefore improving the harvest available to the PST parties. The effectiveness of wildstock supplementation (and the related practice of fishery enhancement—releasing cultured fish for the purpose of augmenting the overall harvest) is an important consideration in implementation of the PST. This research will ultimately evaluate in detail the effect of wildstock supplementation in a model system, providing insight to guide managers of sockeye

resources; feasibility research is required before supplementation is undertaken The operating hypothesis of the research is that wildstock supplementation will cause genetic changes in Auke Lake sockeye either by the domestication of artificially cultured salmon and the introgression of their genotypes into Auke Lake sockeye or through processes like the Raiman-Laikre effect.

Project Title: **Analysis of Alsek River Sockeye Salmon Radiotelemetry Data Collected from 2001 to 2003**
Project Lead: Jason Smith, Fisheries Biologist, LGL Ltd, Sidney, BC.
Project Cost: $44,500 CAN/US

In conjunction with a five-year mark-recapture program (2000-2004), the Alaska Department of Fish and Game (ADF&G), Canadian Department of Fisheries and Oceans (DFO), and Champagne and Aishihik First Nation cooperatively implemented a three-year radiotelemetry study (2001-2003) of sockeye salmon in the Alsek River drainage. The original objectives of the radiotelemetry study were to: 1) estimate the stock-specific contribution to the total escapement; 2) estimate the stock-specific run timing and composition of Alsek River sockeye salmon through the inriver U.S. commercial fishery located in Dry Bay, Alaska; 3) identify the primary spawning locations for sockeye salmon within the Alsek River drainage; and 4) determine the stock-specific migration rates for sockeye salmon within the Alsek River drainage. To date, a detailed technical analysis of the 2000-2003 radiotelemetry data has yet to take place. The intent of this proposal is to provide funding to support such an analysis and to document the results in a technical report. Results of this analysis will help to improve abundance-based management for this transboundary stock of sockeye salmon.

Project Title: **Assessing the Ability of Palaeolimnological Records to Further our Understanding of Declining Productivity in BC Sockeye Populations in Relation to Harvest, Climate, Trophic Status and Productivity of Nursery Lakes: A Workshop of Leading and Active NA Researchers**
Project Lead: Misty MacDuffee, Biologist, Wild Salmon Program, Raincoast Conservation Foundation, Sidney, BC
Project Cost: $15,250 CAN/US

We intend to host a two-day workshop of leading scientists and researchers to assess the utility of using palaeolimnological records to inform scientists and managers about long-term changes in sockeye productivity and the natural and anthropogenic factors that may be contributing to depressed sockeye populations in BC.

Paleolimnological techniques used to reconstruct historic changes in sockeye abundance and productivity of sockeye nursery lakes have been successfully undertaken in Alaska. These studies have shown lake productivity to be regulated by climate and salmon derived nutrients, and that d15N can be used as a proxy for spawner density, thus providing long-term escapement records. However the application of these techniques to sockeye lakes in BC is yielding less consistent and clear results (specifics below). This has lead to skepticism about the utility of paleolimnological studies to provide insights into the cause of changes in sockeye productivity and the importance of spawner densities in assisting depressed sockeye populations to recover. This workshop will explore the reasons for the discrepancies and inconsistencies in results, identify considerations in interpreting and understanding palaeolimnological records, and make recommendations on their continued application to sockeye management in BC and Alaska.

Limnological and some palaeolimnological information is now available for a variety of sockeye lake types (clear, dystrophic, glacially turbid, high and low flushing) and in a range of geographic regions and basin characteristics with low and high spawner densities in BC and Alaska. Using both published and unpublished data, this group will discuss the current understanding of the complex relationship between climate, harvest, lake trophic status and sockeye production and how this information is documented and interpreted in sedimentary records.

CHINOOK SALMON

Project Title: **Live capture and Tagging of Skeena Chinook Feasibility Study**
Project Lead: Allen Gottesfeld, Head Scientist, Skeena Fisheries Commission, Hazelton, BC
Karl English, President, LGL Ltd, Sidney, BC
Project Cost: $150,000 CAN/US

The primary purpose of this project is to determine if sufficient numbers of adult Chinook can be caught at sites along the lower, middle and upper Skeena River to provide the fish needed for a full-scale biotelemetry study to assess the distribution, abundance and migratory behavior of Skeena Chinook in 2009. Results from a full-scale telemetry study will improve our understanding of Skeena Chinook stocks and have implications for future management, such as: revised estimate of the productive capacity and spawning goals for the major stocks and a new understanding of the absolute numbers associated with the Tyee test fishery index.

Given recent escapement estimates of Chinook to the Skeena River watershed (40,000-60,000), plus the number of Chinook salmon stocks within the Skeena drainage, and experience from previous telemetry studies on the Nass, Skeena, Fraser and Columbia rivers, we estimate that 500-700 radio-tags will have to be applied to adult Chinook salmon to determine the proportional contribution and abundance for the major stocks within the Skeena River watershed. In 2008, we propose to identify sites in the lower, middle and upper Skeena where tangle netting and angling techniques could be used throughout the run to capture and tag 500-700 adult Chinook. Chinook caught in 2008 will be sampled for DNA, measured and tagged with external tags

The primary objectives for the proposed project are: 1) to determine if sufficient numbers of Chinook can be captured at sites along the Skeena River to permit a full scale biotelemetry study to be conducted in 2009; 2) to obtain DNA samples, scale and fish size data that could be used to assess the stock origin, age and size distribution of the fish captured during the various test fishing periods in 2008; and 3) use the data collected in 2008 to design a full-scale biotelemetry study for 2009.

Project Title: **Chickamin River Chinook Salmon Escapement Sampling. Year 3**
Project Lead: Todd Johnson, Alaska Department of Fish and Game, Ketchikan, AK.
Project Cost: $105,100 US

The Chickamin River drainage contributes Chinook salmon to the sport fisheries in the Ketchikan area and to commercial troll, gillnet and seine fisheries throughout much of Southeast Alaska and northern British Columbia. This proposal would extend by one year a project that was funded by the Northern Fund in 2006 and 2007. The Chickamin River is one of 11 Chinook escapement stocks in Southeast Alaska (SEAK) used by ADF&G and the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) to assess escapement abundance trends and to judge performance per Chapter 3 of the 1999 U.S./Canada Pacific Salmon Treaty (PST). Mark-recapture studies were conducted in 1995 and 1996 and 2001-2005 to estimate the escapement of Chinook salmon and the percentage of fish seen in

aerial surveys. In an associated project, juvenile Chinook salmon were tagged from 2001 to 2007 with coded-wire tags (CWT) to provide estimates of smolt production and harvest.

Providing high-quality escapement enumeration data for index stocks of Chinook salmon and ensuring these data meet minimum US CTC standards is important to abundance-based management of PSC Chinook fisheries for two reasons. First, the CTC uses the CTC Chinook model to evaluate potential coast-wide fishery management options being considered or planned by the PSC and/or other fishery management agencies as well as to assist in evaluating fishery management decisions already made. Abundance indices in the CTC model are based, in part, upon escapement data. Data quality has limited the CTC and PSC in the past and as the PSC and coast-wide fishery management agencies shift to abundance-based management regimes, higher quality stock abundance data will be needed to ensure that both conservation and allocation fishery management objectives are realized.

A second reason this work is important is for stock specific, rather than coast-wide, implementation of abundance-based management regimes. Existing commercial and sport fisheries in SEAK could be used to fine-tune management of Behm Canal Chinook salmon. Surplus production could be harvested in these terminal or near terminal fisheries if data limitations concerning stock status were adequately addressed and if accurate pre-season forecasts were developed for use in pre-season and in-season management. Improved data bases coupled with accurate forecasts will lead to improved management of Behm Canal Chinook stocks. With the data gaps addressed, an abundance-based approach for specifically managing Behm Canal stocks of Chinook can be developed.

Project Title: **Chilkat River Chinook Salmon Coded Wire Tagging. Year 3**
Project Lead: Rich Chapell, Assistant Area Management Biologist, ADF&G – Sport Fish Division, Haines, AK.
Project Cost: $114,749 US

The Chilkat River produces the third or fourth largest population of Chinook salmon in Southeast Alaska. Chinook salmon escapement to the Chilkat River has been estimated annually since 1991 by on-going mark-recapture programs with escapements ranging from 2,035 to 8,100 large (3- to 5-ocean-age) fish and an average precision (CV) of 15%. A biological escapement goal of 1,750 to 3,500 large Chinook salmon was adopted for the Chilkat River in 2003. The CTC uses a Chinook Model for various analyses. One important output from this model is estimation of an annual Abundance Index (AI) that is used to specify annual harvest limits in aggregate abundance-based management regimes (AABM) (see June 1999 PST, Chapter 3, Paragraphs 2, 5 and 6). Southeast Alaska (SEAK) sport, net and troll fisheries are to be managed under an AABM approach (PST, Chapter 3, Paragraphs 2, 6(b), and Table 1). The stepped catches in Table 1 (PST) are based on the annual AI generated from the CTC Chinook Model. At present, the CTC Chinook Model includes one SEAK "model stock" in the annual AI. Inclusion of a single SEAK stock has limitations because: 1) the escapements of the five largest Chinook salmon stocks in SEAK are not included and 2) differences in distribution and exploitation of the six stocks that are included warrant further separation. For that reason, ADFG has developed data for five separate model stocks that utilize escapement data for SEAK/Trans-boundary River (TBR) stocks and proposes to include them in the CTC modeling process when capabilities and agreement exist to include more stocks in the Chinook Model. Of interest in this proposal is the SEAK Northern Inside model stock, which would be weighted heavily toward the Chilkat River data because of its stock size in relation to that of the King Salmon River stock.

Estimates will be generated for the number of Chinook salmon fry rearing in the Chilkat River drainage during the fall of 2008 as well as the marine harvest of Chilkat River Chinook salmon from the 2007 brood year. The marine harvest estimate will be derived from recovery of CWTs in Southeast Alaska salmon fisheries and in the Chilkat River from 2010 through 2014.

Project Title: **Recreational Chinook Creel Survey**
Project Lead: Mark Reagan, Resource Manager, DFO, Prince Rupert, BC.
Project Cost: $115,000 CAN/US

Areas 3, 4 and 5 roughly represent the terminal areas of the Nass River and Skeena River respectively. Chinook salmon escapements to each of these river systems and their respective tributaries make up escapement indicator stocks defined by the CTC for the purposes of Chinook salmon management. The Kitsumkalum tributary of the Skeena River is the exploitation rate indicator for North and Central British Columbia Chinook stocks. The Kitsumkalum indicator stock is one of 36 coded wire tagged (cwt) stocks used in the Chinook model and one of only 7 cwt stocks used in the model from Canada. It is the only Canadian stock used for exploitation rate analysis and model calibration procedures with age 1 smolts (others are age 0). The only other model stock with age 1 smolts and the only model stock north of Kitsumkalum are Alaska springs.

The Kitsumkalum River is the natal stream for a population of summer run Chinook salmon that have been coded wire tagged (cwt) annually since 1984. The tagging and recovery programs were formalized in response to the objectives set out in the Pacific Salmon Treaty between Canada and the United States in 1984. This project will provide age and stock specific data for Chinook catches in the sport fishery and general stock composition data for weak stock considerations and support of treaty accounting. DNA data may also be compared with coded wire tag estimates of stock contributions to this fishery. Catch and stock composition data are delivered annually to the fishing community and the public during the post season review process.

Project Title: **Morice Chinook CWT Group. Year 2**
Project Lead: Mike O'Neill, Manager, Toboggan Creek Salmon and Steelhead Enhancement Society, Smithers, BC.
Project Cost: $63,000 CAN/US

There is presently no CWT marked group of chinook representing the largest component of the Skeena run, these being the mid-timed (June 15th to July 15th) portion of the population in the upper Skeena watershed. Mid-timed stocks are the Morice, Kispiox and Sustut stocks, with the Morice stock historically having the highest escapements of the three. A CWT mark group representing these mid-timed upriver stocks would provide in-season abundance estimates and provide for better-informed management decisions. There also exists the possibility for an accurate estimate of catch, escapement and exploitation in future years.

Initially, the first year of the program involved reconnaissance, broodstock collection, egg takes and over-winter incubation and monitoring. Subsequent years, up to a full 5-year cycle will involve annual rearing, marking and release. A tag group of Morice chinook should provide the same type of valuable information now available from the Toboggan Creek coho CWT group raised at this hatchery for the past 23 years.

The objective of this project is the increased scientifically-based knowledge of Morice River, and other mid-timed Skeena stocks, as a result of coded-wire tags sampled in the various Alaskan and Canadian ocean fisheries and in the freshwater areas of the Skeena watershed as well.

Project Title: **Habitat-Based Chinook Escapement Goal Calibration: Clear Rivers in Northern BC. Year 4.**
Project Lead: Ivan Winther, Fisheries Biologist, DFO, Prince Rupert, BC.
Project Cost: $48,100 CAN/US

The Pacific Salmon Treaty outlines tasks for the Chinook Technical Committee (CTC), which includes establishing MSY or other biologically-based escapement goals. Chinook escapement goals are used in the management of ISBM fisheries (Appendix to Annex IV, Chapter 3, para. 4, p. 35), as well as triggers for additional management actions for both ISBM and AABM fisheries (para. 9, p. 39). Typically MSY escapement goals are calculated from stock-recruitment analyses of several years of spawner escapements and subsequent production. The approach can take many years (15-20) to acquire sufficient data and often requires considerable resources. For these and other reasons, many stocks do not have sufficient spawner and production data to estimate optimal spawning escapements. Consequently, habitat-based methods have been developed as low-cost, quick alternatives.

The habitat-based approach will be used to estimate the optimal spawning escapements based on the size of the watershed used by the stock. The model was developed from stock-recruitment estimates of optimal spawning escapements for stocks ranging from coastal Oregon to the Yukon drainage in Alaska. The model has been verified with independent estimates of optimal spawner escapements and was used to establish escapement goals for data limited stocks in Alaska.

In Northern BC, abundance indices for chinook salmon are chiefly generated from visual surveys during the peak of spawning activity. Little information exists from this area to convert spawner indices to total escapement estimates. Since rivers can be grouped by common visual counting conditions that influence the accuracy of counts (e.g. river size and water clarity), we propose several studies on rivers with similar counting conditions to calculate stream-specific expansion factors and average-stream expansion factors. With this information, we will assess the expected bias from applying an average-stream expansion factor with respect to data standard guidelines being developed by the CTC.

This proposal is for continuation of a project funded by the Northern Endowment Fund since 2005. We will generate expansion factors for visual escapement indices at two sites, a coastal stream and a tributary of the Skeena River. On the Kateen River, a mark-recapture program will provide an escapement estimate with a reasonable level of accuracy (within CTC guidelines) to allow for the development of an expansion factor relative to the visual index of escapement. On the Kitwanga River the project is the inverse; we will generate visual indices of Chinook salmon escapement for a system where a true estimate of escapement is derived from a counting fence. The habitat model predicts the total number of optimal spawners needed, but most data limited stocks only have indices of abundance and additional information is required to convert the indices to total spawners. This calibration study will generate expansion factors to convert the spawner indices into estimates of total escapement such that the habitat model may be applied to these data limited systems.

Project Title: **Estimating the Chinook Salmon Stock Composition of Southeast Alaska Fisheries, 2009. Year 3**
Project Lead: William Templin, Fisheries Geneticist and Lisa Seeb, Fisheries Scientist**,** Gene Conservation Laboratory Alaska Department of Fish and Game – Commercial Fisheries Division, Anchorage, AK.
Project Cost: $280,264 US

Since 1999, the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) has explored the inclusion of genetic stock identification estimates of the Alaska commercial harvest as part

of the decision-making process. Between 1999 and 2003, the State of Alaska Department of Fish and Game (ADFG) used genetic stock identification based on a coastwide allozyme database (Teel et al. 1999) to estimate the composition of the commercial troll fishery harvest (Crane et al. 2000; Templin et al. in revision). At the same time, samples were collected from sublegal-sized Chinook salmon encountered in the summer troll fishery, providing important information for evaluating assumptions of stock-specific survival rates. Initial estimates demonstrated that the stock composition of the sublegal encounters was substantially different than assumptions used for management purposes (Bloomquist and Carlile 2002).

Advances in genetic methods and technologies using DNA-based markers have increased the potential utility of genetic stock identification for estimating harvest composition over the previous set of allozyme markers. Through a process that began in 2002, a standardized baseline of genetic markers was developed through collaboration between 10 laboratories and it was made available for use during the summer of 2005 (Moran et al. 2005; Seeb et al. 2007). This baseline has continued to be improved through the addition of more genetic markers and more populations. Beginning in 2005, the CTC funded the expansion of the database to include single nucleotide polymorphisms (SNPs; Smith et al. 2005a, b). Version 2.1 of the CTC baseline contains allele frequencies from 166 populations contributing to PSC fisheries, ranging from the Situk River in Alaska to the Central Valley of California. Expansion of the baseline continues and the next version will include additional populations provided by both ADFG and the Department of Fisheries and Oceans Canada. Initial results indicate that 44 regional groups can be identified in mixtures with acceptable accuracy and precision (Moran et al. 2005; Seeb et al. 2007). Results from this and other genetic stock identification analyses could be integrated into a coordinated coast-wide management system. This was the subject of recent workshops held by the PSC; recommendations from this workshop are expected in 2008.

Beginning in 2003 genetic stock identification was extended to cover the troll, seine, drift gillnet, and sport fishery harvests of Chinook salmon in Southeast Alaska waters for a period of two years with the intent to use the baseline of DNA-markers. In 2006, coverage of the Chinook salmon harvest was reduced to just the troll and sport fisheries and the directed gillnet fisheries in districts 108 and 111. Funding for stock identification of these harvests will end September 2008. This project will extend genetic stock identification of Chinook salmon harvested or encountered in the commercial troll and sport fisheries in Southeast Alaska until the close of the summer fisheries in September 2009. Stock composition estimates will also be provided for the directed drift gillnet harvests in the District 108 and 111 directed fisheries in 2009.

Project Title: **Expand and Refine the GAPS Chinook Database to Support Genetic Stock Identification Studies Relevant to the Pacific Salmon Treaty**
Project Lead: Paul Moran, NOAA, Research Geneticist at NW Fisheries Science Center, Seattle, WA.
Project Cost: $45,770 US

The GAPS consortium has recently built a powerful World Wide Web application and prototype database to host and serve standardized genetic data to the research and management communities. The coast-wide GAPS database is growing rapidly and the GAPS database and web application provides an essential service to interagency collaboration. In this proposal, we seek to expand the utility of the existing Chinook database by adding new data that are already available, including new microsatellite data for additional populations and single nucleotide polymorphism (SNP) data. We also propose significant improvements that will increase information content and data quality, and overall utility of the GAPS coast-wide Chinook genetic data. We argue that NWFSC is ideally suited to this task unless and until arrangements are made for a smooth transition of the database to a third party. In anticipation of that

possibility, we remain committed to portability and reliance on open source (other than Oracle) throughout this project.

Project Title: **Increase Southern BC Indicator Stock Coded-Wire Tagging to Improve the Quality of Chinook Indicator Stock Analyses**
Project Lead: Chuck Parken, DFO, Research Biologist, Nanaimo, BC.
Project Cost: $76,055 CAN/ US

We propose to increase coded-wire tagging (CWT) for 3 Chinook indicator stocks in southern B.C. that contribute mostly to Northern Boundary Area fisheries (small contributions in Southern Boundary Area). This proposal will fund incremental tagging beyond the base level provided by CDFO in order to meet standards under development by the PSC CWT work group to account for survival rate, fishery sampling rate, exploitation rate, and an 80% probability of attaining a minimum standard of observed CWT recoveries. CWT targets developed in the late 1980s were based on much higher survival rates than recently experienced. The proposed tagging will not replace the base tagging funded by CDFO – it is incremental to the DFO program. PSC NEF funding would be interim until internal CDFO funding can be secured following the signing of a new agreement, and this proposal is intended to improve data quality as soon as possible.

CWT data has been collected from these stocks for many years, but when the study designs were developed originally survival and exploitation rates were higher than they are currently. CWT data continue to be collected, but the estimates of exploitation rates are of lower quality because there are far fewer tag recoveries due to reduced exploitation rates in the commercial fisheries and declines in survival rates.

Since priorities vary, this proposal has 2 tagging components: (A) 370,000 Chinook ($73K) to meet standards for AFC-CWT indicator stocks, and (B) 16,000 Chinook ($3K) for the Robertson indicator to better represent WCVI natural Chinook in the NCBC sport fisheries with low sampling rates (~11% in QCI from 2000 to 2006). Currently, the WCVI natural stock limits Canadian fisheries.

This proposal is for stocks providing the majority of benefits, based on total fishing mortality distribution, to Northern Boundary fisheries and another proposal was submitted to the Southern Fund for stocks benefiting southern fisheries.

“The coded wire tag (CWT) was introduced in the 1960s and has provided unparalleled information about ocean distribution patterns and fishery impacts for Pacific salmon along the Pacific coast. For the last 30 years, CWT data has provided the fundamental basis for assessment and management of Chinook and coho salmon. Prior to the advent of the CWT, large-scale troll and sport fisheries had developed in marine areas along the Pacific coast. Catches were sustained by large but unknown mixtures of hatchery and wild populations, the composition of which varied from year to year and area to area. Fishing mortality rates were unknown but the cumulative effect of fishery and other impacts were resulting in declining trends in spawning escapements for many natural populations. Fishery harvest rates (the proportion of fish available to a fishery that are killed by that fishery) could not be estimated or monitored, except for some fisheries in terminal areas. Competitive over-fishing and extensive debate amongst users and agencies was fueled by limited data and assessments. The ability to unambiguously identify specific groups of fish using CWTs provided the first opportunity to monitor and assess the harvest patterns and survival rates and a quantitative basis for development of management actions.” PSC CWT Work Group Report (in prep).

The United States and Canada have recognized the importance of developing and maintaining a CWT program to estimate exploitation rates and better define time-area distributions to develop management options at least since the August 13, 1985 Memorandum of Understanding (PSC 2004: March 2004 Annexes, P. 96). With the 1999 Agreement, CWTs became one of the key methods to assess harvest rate reduction compliance. For Chinook, CWT-based ISBM indices monitor relative exploitation rate reductions from the base period (para. 4(d), 5(b&c)). CWT data and analyses are also important for developing stock abundance forecasts used in the CTC Coastwide model calibration. In 2005, the PSC convened an Expert Panel to review the utility of the CWT system for future PST implementation. They reported (Hankin et al. 2005) that the CWT program must be relied upon as the primary fishery and stock assessment tool for at least the next 5-10 years. No alternative technology currently exists that is capable of providing the data necessary for the implementation of the PST. In 2006, the PSC convened a CWT Work Group to review and recommend a plan to implement the recommendations of the PSC Expert Panel. The CWT Work Group reports (unpublished, in prep.) that the principal factors influencing the uncertainty surrounding CWT-based estimates of exploitation rates are those affecting precision and those causing bias. The major factors affecting precision are the number of CWTs released and sample rates for fisheries and escapements. As increased tagging is the most cost effective way to increase precision of CWT-based statistics for the southern BC indicator stocks, we propose increasing tagging beyond base tagging levels funded by DFO to the release group size standards based on expected marine survivals.

This proposal supports Goal 1 of the Northern Fund and will improve our ability to better manage the stocks and fisheries in the region. Increased CWT releases will provide more precise resource management information to better describe the locations and timing of stocks contributing to fisheries. CWT data are used to forecast pre-fishery ocean stock abundances used in the CTC Coastwide model calibration which estimates the abundance index for future Chinook salmon AABM fisheries. Fishery-specific exploitation rates and harvest rate indices are estimated from CWT data and they are also used to estimate and monitor trends in the marine survival. The project will benefit and contribute to PST implementation, the management of stocks for optimal production, improved stock status assessments, and improved management of the runs to fulfill the terms of the negotiated regimes.

When these stocks are healthy and abundant they can be large contributors to SEAK and NCBC fisheries. Robertson represents the WCVI natural and hatchery stock groups which may have had adult production of about 500,000 fish before the natural stock became depressed. Currently, WCVI hatchery and natural fish represent about 1-10% of fish in the 2007 June-July 13 NBC troll fishery samples. They also contribute to SEAK fisheries. Lower Shuswap is the indicator for the Fraser Summer Run 0.3 in the South Thompson basin. Adult production is at or near record high abundance based on limited spawning ground and NBC troll fishery sampling data. Spawning escapements were around 20,000 fish during the 1979-1982 PST base period, and now the stock has increased to spawning escapements of 150,000 in 2006. Even at the recent high spawning escapements, the stock is increasing in size while making large contributions to NBC and SEAK fisheries. Currently, Fraser Summer 0.3 group (South Thompson) represents about 35-45% of fish in the 2007 June-July 13 NBC troll fishery samples. Quinsam represents the upper Georgia Strait stock group which contributes mainly to SEAK fisheries and NCBC sport fisheries.

Project Title: Development of Thermal Mark Data Sharing Methods
Project Lead: Kristopher Hein, DFO, Nanaimo, BC.
Project Cost: $70,000 CAN/ US

Otolith thermal marking has become an important tool for assessment of salmon stocks in the north Pacific. As an example, thermal marking of Chinook has been used to estimate exploitation rates, migratory behavior of salmon, and in-stream contribution of hatchery production in escapement

indicators. Also, by making the historic data more accessible, we will be able to estimate biases in the use of CWT.

To move forward with these initiatives, DFO and ADFG propose to work collaboratively to make thermal mark data more readily accessible. This project proposes to develop a system for the exchange of thermal mark data between DFO and ADFG. The data would include release details for thermal marked fish, sampling information, and recovery information. This would be somewhat analogous to data exchange for CWT data but at simpler level.

This proposal would build on previous collaboration, when ADFG and DFO informally agreed to standardize data and the database to that developed by ADFG. The agreement set in place the capacity for sharing data back and forth in a consistent manner. Canada was provided a copy of the ADFG Oracle database for use on the DFO network. Work completed to date includes making the necessary adjustments to the database and to data capture methods in southern British Columbia. Outstanding issues include: getting the Trans-boundary thermal mark sampling into this system, documentation and understanding of any changes, quality control protocols, and the need to develop an application that will pass data from one system to the other electronically and save duplication of effort.

This project would complete the outstanding issues. DFO would contract a programmer (or work may be done internally) to develop a web based application using Visual studio Dot Net. Both agencies would oversee the design and development of the application. DFO would transfer the technology to the Yukon staff. Protocols for timely sharing of data would be developed.

This project is simply to facilitate the joint Canada/US use of a common database. ADFG are already using this. There is no issue for feasibility as the two databases are working independently. The objective is to get the sharing happening, to ensure understanding and agreement on changes, opportunities for learning and quality control need to be incorporated.

Project Title: **CWT, Genetic, and Spawner Escapement Information Combined to Improve Spawning Abundance Estimation for the Fraser Summer-run Age 0.3 and WCVI Natural and Hatchery Aggregates**
Project Lead: Michael Chamberlain, Stock Assessment Biologist, DFO, Kamloops, BC.
Project Cost: $24,400 CAN/ US

The Fraser River Summer Age 0.3 and WCVI natural and hatchery aggregates are major contributors to SEAK and NCBC fisheries when they are abundant and healthy. For example, the Fraser Summer-run Age 0.3 aggregate has represented upwards of 30-40% of the NBC troll fishery catches since 2002 (Winther and Beach 2006). Good quality spawning ground estimates are valuable for these stock groups to develop accurate forecasts of the NBC and SEAK AABM abundance indices. However, the current visual survey methods are thought to underestimate spawner numbers because of poor counting conditions experienced during helicopter surveys in the South and lower Thompson rivers and experienced during swim surveys on the WCVI. Results from the Lower Shuswap escapement survey calibration program indicate escapements can be underestimated by 20-65% in the Fraser Summer-run Age 0.3 aggregate. We propose to investigate how spawner estimates can be improved by using two approaches.

The first approach will estimate ratios of the indicator stocks to the total aggregate abundance in the NBC troll fishery, by age and aggregate from 2002 to 2006, and apply these ratios to the spawning escapement estimates of the indicator stock CWTs. Exploitation rate indicator stock CWTs and aggregate catches estimated by genetic analysis will be used to estimate the ratios in the NBC troll fishery. In the second

approach, the spawner abundances from the first approach will be combined with spawner estimates from the visual surveys on the spawning grounds using Bayesian methods. We will compare estimates developed from the 3 methods (i.e. current visual survey methods, approach 1, and approach 2) and evaluate how the quality of spawner estimates for the aggregate can be improved by incorporating information from multiple fishery and spawning ground sources. Since estimates of spawners, fishery CWTs, escapement CWTs, and troll catches for genetic stock aggregates have been developed by other CDFO and PSC projects, this concept is to analyze and report on the existing information collected from 2002 to 2006.

Improved management of PST fisheries will result from improving the accuracy and precision of Chinook salmon abundance estimates. In 2005, the Fraser Early model stock represented about 5% and 3% of the CTC model catch in the SEAK all gear and NBC troll and sport fisheries, whereas the WCVI hatchery and natural model stocks represented about 20% and 6% of the CTC model catches in the respective fisheries (PSC 2007). However, genetic analysis of fishery samples from the NBC troll fisheries suggests the CTC model estimates of catches may not correspond well for the Fraser Early model stock. This stock group makes about a 10 fold larger contribution to the NBC troll fishery catches than recently estimated by the CTC coastwide model. This is not surprising given its poor representation in fisheries during the 1979-1982 base period, since very few CWTs were recovered then. Also, spawning escapements during the base period average about 20,000 and have increased substantially to about 150,000 in 2006. Among the Fraser Early CTC model stock, the Fraser Summer Run Age 0.3 aggregate represented a substantial amount, about 50% (range: 39%-75%), of the total model stock escapement since 1999.

The objective of this project is to create a procedure to improve the quality of the spawning abundance estimation for two stock groups (WCVI and Fraser Summer run 0.3) so that their contribution to marine fisheries in both Canada and the United States is better represented in the coast wide Chinook model and fisheries planning. Increased accuracy and precision of the abundance estimates of these two stocks will improve the advice to fisheries managers in both countries.

COHO SALMON

Project Title: **Taku River Coho Salmon Escapement and Smolt Tagging Augmentation. Year 3 for Fisheries and Oceans Canada.**

Project Lead: Ian Boyce, Stock Assessment Biologist, DFO, Whitehorse, YT
Ed Jones, Fisheries Biologist, Alaska Department of Fish and Game, Douglas, AK

Project Cost: $119,000 CAN/US

The stock assessment program for coho salmon originating from the Taku River is a cooperative effort between the Alaska Department of Fish and Game (ADF&G), Fisheries and Oceans Canada (DFO), and the Taku River Tlingit First Nation (TRTFN). Each spring since 1991, coho salmon smolts have been tagged with coded wire tags as they emigrate from the Taku River. Then in the following year, returning adults are sampled for these tags using fishwheels and set gillnets operated near Canyon Island in the lower Taku River. At the same time, adults are tagged as part of a two-event mark-recapture study to estimate in-river abundance and sampled for age, sex, and length composition data. A short distance upriver, in Canada, adults are inspected in the commercial gillnet fishery. Typically the commercial fishery ceases in late August and it is necessary to obtain tag ratio information by contract. Data gathered from these efforts has provided estimates of in-river abundance and escapement since 1987, estimates of harvest, exploitation, survival, smolt abundance, and total run since 1992, and run forecasts since 1996. These combined efforts in-river along with adult sampling programs in the various marine fisheries allow detailed stock assessment analyses. Because of the many fisheries that utilize the Taku River stock of

coho salmon and the need for a biological escapement goal on adult coho salmon and newly implemented directed chinook salmon fisheries, the researchers propose that the Northern Fund augment the existing budget to: (1) allow the addition of another smolt trapline in order to boost chinook and coho smolt tagging numbers and the associated coded wire tag marked fractions, (2) allow the operation of the coho adult tagging project through the first week of October to encompass the majority of the adult run, and (3) run the coho recapture effort through the duration of the tagging project. Coho salmon returning to the Taku River pass through an offshore troll fishery before entering inside waters where they encounter seine, drift gillnet, and recreational fisheries. After entering the river, the remaining coho salmon are exposed to a drift/set gillnet fishery in Canada. Such a resource is worthy of a stock assessment program that directly estimates production parameters such as harvest, escapement, exploitation rate, smolt production, survival rates and brood year production. This project will provide annual estimates of escapement necessary to refine escapement goals and forecast runs. Improved escapement goals and run forecasts along with in-season abundance estimates allow for the implementation of abundance-based management.

Project Title: **Analysis of Stikine River Coho Salmon Coded Wire Tag (CWT) Application and Recovery Data, 2000-2007**
Project Lead: Jason Smith, Fisheries Biologist, LGL Ltd, Sidney, BC.
Project Cost: $33,071 CAN/US

From 2000 to 2007, coho salmon smolts were coded-wire tagged in the lower Stikine River, and a portion of these tagged fish were subsequently recovered as adults in marine and freshwater fisheries in Canada and the U.S. The purpose of this proposal is to provide funding to prepare a technical report that summarizes the tag and recovery data for this coded-wire-tag (CWT) project. This report will document the relative abundance, timing, and size distribution of emigrating juvenile coho salmon, the distribution of harvest in marine fisheries and migratory timing of adult tagged fish by fishery and gear type, and the migration pathways of tagged fish as they transit marine fisheries. The Northern Boundary and Transboundary Rivers Restoration and Enhancement Fund 2008 document includes the following guiding principle: “Improve our ability to better manage the stocks and fisheries in the region (e.g., develop methods to accurately estimate in-season run sizes).” Under Goal 1 of that document, the committee encourages projects involving: “c) Baseline data necessary to forecast returns and determine fishery stock composition for stocks originating in rivers in the geographic area and harvested in the fisheries of both nations,” and “e) Projects that improve understanding of production potential, rearing and early ocean survival and limiting factors especially for stocks of interest.” A detailed technical analysis of the 2000-2007 coded-wire-tag program data meets these criteria. Specifically, this project addresses one of the recommended priorities for 2008 Northern Fund proposals under the Improved Information category; namely, “full and detailed analyses of existing data and reporting of results,” which includes Stikine River coded-wire-tag studies.

Project Title: **Deena Coho Indicator Stock Equipment Upgrade**
Project Lead: Peter Katinic, Haida Fisheries Program, Queen Charlotte Islands, BC.
Project Cost: $13,500 CAN/US

Deena Creek Coho are used as a stock indicator for northern B.C. coho populations. The Haida Fisheries Program (HFP) has been enumerating and applying coded wire tags (CWT) to emigrating coho smolts, and enumerating adult escapement since 1994. This data along with CWT recoveries from marine fisheries has been used to monitor marine survival and exploitation of Deena Coho in Alaskan and Canadian fisheries.

Deena coho smolts are captured using 2 rotary screw traps as they emigrate from Deena Creek to the ocean. An upstream trap is used to capture smolts for application of CWTs, while a downstream trap is used to enumerate the total migrating smolt population using mark recapture methodology. In previous years, HFP technicians were required to manually sort marked and unmarked fish. This was labour and time intensive and therefore limited the number of marked fish released upstream of the trap to approximately 10% of all CWT marked fish. During the 2007 season, HFP successfully tested a T4 CWT detector developed by Northwest Marine Technologies, to detect and sort CWT marked smolts from unmarked smolts at Deena Creek. This resulted in a significant increase in sorting efficiency and mark detection and therefore all CWT marked fish were released upstream of the mark recapture trap. Larger mark groups and improved CWT detection therefore improved the Peterson estimate of the migrating coho smolt population.

We propose to improve the estimates of migrating coho smolts from Deena Creek coho through an equipment upgrade. Objectives of the project are as follows:

1. Purchase and receive a T4 CWT detector from Northwest Marine Technologies prior to May 2008;
2. Release all CWT marked fish upstream of the mark recapture trap location and use the T4 to sort and enumerate marked and unmarked coho smolts during May and June of 2008;
3. Estimate the migrating coho smolt population from Deena Creek using mark recapture data collected by the T4 CWT detector.

Deena Creek Coho are one of the few remaining coho populations on the B.C. north coast has a long term data set and is presently being used as a coho indicator stock. Using a T4 CWT detector will increase the precision and accuracy of the emigrating population of Deena Creek coho smolt estimate. This data is used as a secondary method to estimate marine survival and validate estimates generated from CWT marked fish.

This project addresses Goal 1 of the Northern Fund: 'projects that involve data collection, stock assessment, and research concerning fisheries and stocks in the Northern Fund's geographic area.' It will improve existing data from one of the few remaining coho indicator stock on B.C.'s north coast and therefore aid in fisheries management of coho stocks in the Northern Panel area.

Project Title: **Rivers Inlet Coho Enhancement**
Project Lead: Sandie MacLaurin, Community Advisor, DFO, Hagensborg, BC.
Project Cost: $40,000 CAN/US

The main objective is to evaluate the harvest distribution for Rivers Inlet coho as there has never been a cwt application for this area. Secondary benefits will be improved knowledge base about coho adult run timing and distribution, having the information needed to consider a wild juvenile marking program and increased production from the enhanced stock.

The Project concept has been modified for Stage II based on feedback from the Northern Fund CTTE and to include preliminary work being initiated by private donors this fall. Should an eggtake occur there could be opportunity for and additional brood year of CWT marking (2007 brood). The proposal now consists of two components, the first component would involve the use of enhancement to enable CWT marking and release of one stock of coho and the second component would focus on a reconnaissance and preliminary field work to establish feasibility of a wild juvenile capture and marking program that would be developed into a project submission in 2008 for funding and implementation in 2009 (so could mark the same brood as the enhanced group - 2008 brood).

Component One

This project involves egg takes from Johnston Creek or either of Kilbella or Chuckwalla River in Rivers Inlet, incubation and rearing to smolt and cwt marking at Snootli hatchery in Bella Coola, with final rearing and release in Rivers Inlet. The initial egg target would be 30,000 eggs to insure a 25,000 smolt group (for CWT marking and tracking of recoveries through marine fisheries). Johnston Creek has been included in the eggtake proposal as there is significant interest in work on this system by sport lodge owners in the area and they have initiated/funded preliminary field work to occur in November of 2008.

The approach would be to monitor these stocks of coho so spawn timing and location could be determined more exactly, then when appropriate, get field crews out to the best candidate site immediately to collect gametes and transport them to a hatchery facility (Snootli Hatchery in Bella Coola) for fertilization, incubation, ponding and rearing/marking.

The coho would be reared, marked and kept to a pre-smolt (10-15gms) average size before being transported back to Rivers Inlet to netpens in the estuaries of the rivers of origin for final rearing and release.

The project would also provide more information about stock size, spawning distribution and timing, disease profile, baseline DNA and length/wt. data.

Component Two – Wild Juvenile Marking Feasibility Study

During the fall of 2008 a field crew will visit candidate coho systems that have been pre-screened as to size of escapement, ease of access and potential for establishing a field camp. A variety of juvenile capture techniques in high quality coho habitat will be tested to establish whether there is a probability of capturing sufficient numbers of target size fish for a wild marked group. The field program will also allow crews to ground truth appropriate locations for field camps.

Project Title: **Middle Nass Mark-Rate Sampling Program for Coho Salmon: Seaskinnish Weir Program - Year 2**
Project Lead: Cheryl Stephens, Nisgaa Fisheries Program Manager, New Aiyansh, BC.
Project Cost: $74,782 CAN/ US

The uncertainty in mark-recapture rates for Middle and Upper Nass coho salmon reduces the reliability of the annual escapement estimates generated each year especially if Meziadin River is used as the only mark-recapture site (i.e., estimates may be severely under-estimating the Middle/Upper Nass coho population). Accurate adult escapement and mark rate information at systems other than Meziadin River, would allow managers to estimate more precisely the system-wide coho salmon escapement and harvest rates for Middle and Upper Nass coho stocks. These estimates are critical for the abundance-based management of Nass coho stocks and treaty implementation (i.e., US - Canada and Nisga'a - Canada Treaties).

This project represents the second year of an anticipated three year effort that focuses on addressing uncertainties in determining mark-recapture rates in Middle/Upper Nass coho salmon stocks that are caught at the Gitwinksihlkw test fishery (fishwheels 1 and 2) and increasing the reliability of the annual escapement estimates calculated each year by the Nass Joint Technical Committee (NJTC).

Results from past PSC funded Nass coho research studies on the Kwinageese River in 2002 (Miller et al. 2005), 2005 (Alexander et al. 2006) and 2007 (Alexander and Jessop 2007) have indicated that the use of

only one mark-recapture tag recovery system (i.e., Meziadin River) is not recommended in generating system-wide population estimates for Middle and Upper Nass coho salmon stocks. Net escapement estimates calculated from data collected in those studies were found to be under-estimated by 16% (26,000 fish), 10% (9,000 fish) and 7.5% (4,000 fish) in 2002, 2005 and 2006, respectively, when using only one mark-recapture recovery site. As a result of the past two year's of studies, which were funded by the Northern Fund, the NJTC recommended to the Nass Joint Fisheries Management Committee that for 2005 and 2006 that blended mark-recapture data be used for generating Middle/Upper Nass coho escapement in those years and that more than one Middle/Upper Nass indicator system be used where possible for generating Middle/Upper Nass coho salmon escapement each year. Further investigation was recommended to evaluate differences in stock proportions at the tagging site when generating the aggregate population estimates. The consistently lower mark rate of coho salmon observed at the Kwinageese River raised concerns that the proportion of marked coho migrating to spawning grounds is decreasing with distance from the tagging platform at Gitwinksihlkw through potential delayed mortality, tag loss, or removals of tagged fish in fisheries above the tagging site. Furthermore, it was also evident that at least since 2002, mark rates at Meziadin are consistently lower than mark rates at the Grease Harbour fishwheels, located 24 km upstream of the Gitwinksihlkw wheels.

In 2007, the PSC approved funding to further examine this hypothesis of decreasing mark rates with distance from the tagging site and to evaluate variability in coho mark rates among tributary systems by establishing a new, temporary mark recovery site closer to the Gitwinksihlkw fishwheels. Seaskinnish Creek, a Middle Nass tributary above the fishwheels, was selected as a unique and cost-effective opportunity for such a project. Results from the PSC-funded coho telemetry study conducted on the Nass River in 2005 suggested that Seaskinnish Creek represented approximately 4% (~4,000 spawners) of the Middle/Upper Nass coho salmon escapement (Alexander et al. 2006). This size of population was estimated to result in a significant (> 30) number of marked coho entering the creek each year, enabling reliable determination of mark rates in 2007 and beyond. Preliminary results from October 2007 indicate that this video-weir is performing exceptionally well as a multi-species salmon enumeration facility. At the time of this proposal submission, 1,030 adult coho salmon have been counted past the Seaskinnish weir. Of those fish, 40 or 3.9% were tagged. This mark rate is currently 67% higher than the mark rate for adult coho counted through the Meziadin fishway in 2007.

A second year of study at Seaskinnish Creek is important to understanding the annual variability in tributary specific mark-rates. In addition, the information collected from this study, combined with results from past coho research studies will assist in determining whether using only one mark-recapture system (i.e., at Meziadin Fishway) is consistently under-estimating annual escapement estimates each year for Middle and Upper Nass coho stocks.

The proposed study for a second consecutive year of operation at Seaskinnish has five objectives in 2008: 1) install and operate an adult weir at Seaskinnish Creek using materials from the 2007 weir program, 2) enumerate coho salmon (and any other salmon species entering the system) using underwater video, 3) collect mark-rate data for Nass coho, 4) generate a reliable post-season estimate of Middle/Upper Nass coho escapement for 2008, and 5) improve our understanding and methodologies for generating escapement estimates and pre-season/in-season forecasting for Upper Nass coho stocks.

Project Title: **Thermal Mark Recovery Validation**
Project Lead: Kray Van Kirk, Fisheries Biologist, ADF&G, Thermal Mark Lab, Juneau, AK
Project Cost: $61,396 US

We propose to rear three groups of coho salmon (Oncorhynchus kisutch) to assess the role of thermal mark placement relative to the hatch event in mark detectability and recovery. To achieve this goal, one

group (A) will be thermally marked prior to the hatch event, and another group (B) will be thermally marked after the hatch event. A control group (Z) will be raised without thermal marking to provide baseline data on otolith growth patterns and serve as a surrogate for unmarked (wild) individuals. Otoliths will be taken from all three groups and read by four independent readers. Reader results will be compared to the known values of each otolith and analyzed with a logistic regression to identify and measure the impact of mark placement and reader variability on mark detection rates.

Over one billion hatchery fish in the Alaska were marked with otolith thermal marks in 2005. Mark detection and recovery play a critical role in fisheries management and protection of wild stocks within Trans-Boundary waters, and provides data for the implementation of the Pacific Salmon Treaty. It is of fundamental importance that these data be accurate and precise if such data are to be used to manage these stocks effectively.

Anecdotal evidence and a small pilot experiment from the ADF&G Thermal Mark Lab, however, suggest that mark detection rates are not constant and vary significantly between marks placed prior to the hatch event and those placed after the hatch event. Pre-hatch marks are heavier and more distinct, while post-hatch marks are not only finer and lighter, but are also at risk for being removed accidentally during the sample preparation process which involves grinding the otolith so that it is thin enough to view its internal growth structure. This has the potential to skew run composition assessment and produce inaccurate mark recovery data. If a thermal mark is missed by a reader, the number of wild salmon within a given sample will be overestimated.

Comparisons of release and return numbers of fish carrying pre- and post-hatch marks within Trans-Boundary river systems also support the idea that mark placement affects detection rate. Within the Tuya Lake system, the average recovery rate for fish released with a pre-hatch mark between 1996 and 1999 was 60% higher than for those released within the same time period with a post-hatch mark. Similarly, within the Tahltan Lake system, the average recovery rate for fish released with a pre-hatch mark between 1995 and 2000 was 76% greater than for those released with a post-hatch mark. Even allowing for differing marine mortality rates, these are troubling discrepancies.

The primary objective of this project is to produce a statistically robust analysis of the manner in which mark placement relative to the hatch event influence thermal mark detectability. Statistical power is made possible due to the large number of samples that will be produced within a strictly controlled lab environment, thermal marks that are mirror-images of each other with the exception of placement, and sample otoliths whose true values are known. Analyses built upon samples taken from commercial fisheries are unable to meet these criteria and are therefore statistically less reliable.

Once quantified, the differential between pre- and post-hatch mark detection rates can be addressed by limiting the scope of applied post-hatch marks, constructing lab protocols specifically designed to improve mark detection by readers, and possibly developing an algorithm to modify assessment of run composition for runs carrying post-hatch marks.

CHUM

Project Title: **Nekite River Adult Chum Enumeration Program**
Project Lead: David Stevenson, Rivers and Smith Salmon Ecosystem Planning Society, Comox, BC.
Project Cost: $30,000 CAN/US

The Nekite River is situated at the head of Smith Inlet on the Central Coast of B.C. and lies within the traditional territory of the Gwa'sala-Nakwaxda'xw Nation. This river system is recognized for its high

fisheries values, especially for chum salmon (Oncorhynchus keta). In 1985, DFO constructed a spawning channel approximately 10km upstream of the estuary on the Nekite River with the goal of improving chum production. It was hoped that this channel would improve production levels sufficiently to support a commercial fishery. The channel was maintained for several years before being abandoned due to a lack of funding. Although the channel is no longer maintained it continues to support between 500-5000 spawners annually.

In recent years, the Gwa'sala-'Nakwaxda'xw Nation has performed many of the monitoring activities within the Nekite River; assessing escapements into the spawning channel since 1996 and into the Nekite River as a whole since 2001. Prior to 2002, DFO has estimated chum escapement by conducting several stream walks using charter patrolmen. These estimates yielded an index of escapement over time which is highly variable and uncertain. DFO derived estimates of escapement beyond 2002 were derived based on opportunistic overflights.

In an effort to derive absolute escapement estimates for determining potential commercial chum harvest opportunities the Gwa'sala-Nakwaxda'xw Nation initiated an intensive mark-recapture / deadpitch program on the Nekite River in 2002. This program was funded through AFS and has continued annually with successful mark-application efforts as well as carcass recoveries in an extensive deadpitch program. While sincere efforts have been made to arrive at a reliable escapement estimate for management purposes, huge confidence intervals have rendered this data unreliable.

The purpose of the proposal presented here is to improve the population estimate derived from the mark-recapture program. This improvement will result from increasing the total number of fish tagged and re-capturing a larger proportion of the tagged fish, thereby improving confidence limits. Estuary captures using seine boats will allow for an improved tagging effort. In order to recover more tags the deadpitch effort will continue, but improvements will be made handling fish that are typically unreachable (ie. at the bottom of large pools). This will occur through snorkeling efforts and the strategic placement of stop-nets. Observations that influence fish mortality (i.e. bear kills) will also be conducted on a more regular basis. The improved program design was developed by DFO and GN biologists through meetings held this fall.

The proposed study is relevant to both the Pacific Salmon Treaty in general, and the strategic objectives of the Northern Fund. Significant portions of Central Coast chum populations are harvested in Southeast Alaska and Northern BC, as well as in the Central Coast (PFRCC, 2001).

With the recent commercial closures within the Rivers and Smith Inlet region, current data on exploitation is limited. The commercial fishery, however, prior to its complete closure in the mid 1990's, did exploit the Nekite stock in past seasons Furthermore, harvesting of the Nekite chum for food, social and ceremonial purposes by the First Nations people has occurred for thousands of years. A grizzly bear tour company relies on healthy stocks of Nekite chum for assessable bear viewing.

This project will focus on salmon that utilize the areas within the northern fund boundaries and should provide valuable, accurate information on the current size of this population. Furthermore, it is hoped that development of a reliable program to accurately enumerate chum will lead to the use of the Nekite stock as an indicator for Area 10 chum.

PINK

Project Title: **Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Catches and Associated Environmental Parameters**

Project Lead: Alex Wertheimer, Fishery Research Biologist, NOAA-NMFS-AFSC, Ted Stevens Marine Research Institute, Juneau, AK.

Project Cost: $77,960 US

The Southeast Coastal Monitoring project (SECM) is a component of the Auke Bay Laboratories salmon research program which has sampled juvenile salmon and associated biophysical parameters in northern Southeast Alaska (SEAK) since 1997. Sampling juveniles as they migrate to the Gulf of Alaska, after high-mortality periods of freshwater incubation and early marine residency, provides information on year-class strength that can be used with associated environmental data to forecast abundance. Data from these annual surveys have been used to develop models that predicted SEAK pink salmon harvests within 10% of actual harvests in 2004 and 2005. In 2006, the pink salmon return was well below both the juvenile salmon forecast and the ADF&G forecast based on the harvest time series, but the juvenile forecast did indicate the decline in year-class strength. ADF&G is now incorporating the juvenile data into their harvest time series forecast. In 2007, predictions from both the SECM forecast model and the ADF&G model adjusted with SECM juvenile catch data were within 10% of the actual harvest.

In 2005, the Northern Fund supported expanding the (SECM) to southern SEAK for 2005-2007. This proposal to the Northern Fund will continue the sampling efforts in both areas for an additional year. The information will be used to develop models that incorporate the southern SEAK juvenile data for comparison with the current models that use Northern SEAK data only. The project will also determine a calibration factor between the NOAA vessel John N. Cobb that has been used for the sampling from 1997 through 2007, and the ADFG research vessel Medeia. This calibration effort will ensure continuity of the long-term data series after 2008 when the Cobb is scheduled to be decommissioned from the NOAA fleet. For the calibration, catch rates, juvenile salmon sizes, area swept, and acoustic net measurements will be compared between the two vessels. A feasibility project using the Medeia was carried out in 2007. The paired sampling was successful, and 28 pairs of trawls were accomplished with the two vessels. However, catch rates were at a historical low in 2007, necessitating additional comparisons for statistical validation of differences observed between the two vessels and determination of the consistency of the calibration factor across a broader range of abundance of juvenile pink salmon.

This project addresses the persistent problem of developing reliable forecast methodologies for pink salmon fisheries. It specifically addresses the Fund Committee call for projects GOAL 1.d, “Development and/or implementation of techniques to improve …forecasting”. The project will provide annual pre-season forecasts of pink salmon abundance in SEAK. The forecasts will be based on relative abundance and size of juvenile salmon and associated environmental variables in the sampling area. The information will also be used to modify the current ADFG forecasts projected from smoothed time series of prior years’ catches. The project also addresses the Fund Committee call for projects GOAL 1.f, “Projects that improve understanding of … early ocean survival and limiting factors…” The project will explicitly evaluate relationships between biophysical conditions encountered by juvenile salmon in the sampling area and regional and Gulf of Alaska environmental data sets, with growth and abundance of juvenile salmon and harvests and escapements of SEAK pink salmon. These analyses will provide insight into factors affecting year-class variability and carrying capacity.

The proposed project is located in SEAK, within the geographic area for the Northern Fund. The most direct and tangible benefits apply to pink salmon management within SEAK. Implementation of the project will also provide information on forecasting approaches and factors affecting salmon production

and carrying capacity that may have utility throughout the entire geographic scope of the Pacific Salmon Treaty and the Northern Fund.

STEELHEAD

Project Title: **Skeena River Steelhead Genetics**
Project Lead: Mark Beere, Senior Fisheries Biologist, Province of BC, Ministry of Enironment, Smithers, BC
Project Cost: $22,000 CAN/US

A baseline of the nuclear DNA of summer steelhead from Skeena River tributary streams (n=1143) has been analyzed at 13 microsatellite loci and compared to samples taken from the summer steelhead aggregate, captured in 1998 (n=1617) and 2003 (n=437) at the Skeena River estuary in the Tyee Test Fishery (Beecham 2004). Beachum analyzed these tissue samples to determine stock composition of the Skeena River summer steelhead aggregate and tributary specific run timing information.

1501 steelhead tissue samples obtained at the test fishery in 2001 (n=312), 2004 (n=245), 2005 (n=313), 2006 (n=519) and 2007 (n=206), along with 519 additional samples of baseline (tributary) streams from the Lakelse (n=76), Kitsumkalum (n=149), Kitsequecla (n=246), Kluatantan (n=155) upper Skeena (n=46) rivers, which will yield more comprehensive results, have yet to be analyzed. Steelhead cpue data from the test fishery is available to correct stock compositions for weekly abundance. Funds are being sought to cover the laboratory costs of analyzing the outstanding 2020 samples.

The analysis will provide information on the stock specific timing and relative abundance of Skeena summer steelhead. In addition to the direct value of the information, the analysis will provide the data required to evaluate the accuracy of the information obtained from the current sampling program and the utility of the current data to evaluate the abundance and timing of the less abundant stocks. Further resolution of stock composition and run timing data will improve accounting accuracy when using the Skeena Management Model to estimate the impacts to steelhead in the commercial fisheries of the Skeena River approach waters. Balancing sockeye and pink salmon harvesting, with the interest of minimizing steelhead impacts from the commercial salmon fisheries is a long standing management challenge of increasing profile. This information could influence important decisions on selective fishing measures, and fishery closure dates.

The specific objective of this project is to further resolve/describe Skeena summer steelhead timing, stock composition and abundance. 2020 steelhead tissue samples will be analyzed and the results will be described in a report, similar to that accomplished by Beachum previously (Beachum 2004). The information summarized in this report will update the current state of knowledge of steelhead in the Skeena at this critical juncture when fisheries reform is proceeding and managers most need technical information pertaining to steelhead biology and abundance. Again, further resolution of stock composition and run timing data will improve accounting accuracy when using the Skeena Management Model to estimate the impacts to steelhead in the commercial fisheries of the Skeena River approach waters. This may contribute to a better balancing of salmon harvesting with the interest in minimizing steelhead impacts which may influence important decisions on selective fishing measures, and fishery closure dates as a result.

In addition to the formulation of partnerships and facilitating data sharing, the results of this investigation may lead to new approaches to assist fisheries managers. Future works will be priorized and knowledge will be disseminated.

MULTI-SPECIES

Project Title: **Alsek Sockeye & Chinook Salmon Genetic Stock Identification Analysis (U.S. Commercial Tissue Samples) and Population Estimate 2007/2008**
Project Lead: Bill Waugh, Senior Fisheries Technician, DFO Whitehorse, Yukon.
Project Cost: $10,000 CAN/US

Prior to 2000, the Alsek River sockeye salmon escapement was unknown because stock assessment projects to determine system-wide escapements had not yet been developed. Escapements were known for the Klukshu River, which has a salmon counting weir run by DFO in co-operation with the Champagne-Aishihik First Nation (CAFN). An escapement goal was developed for the Klukshu River in 2000 but very little else was known about the magnitude of run sizes and system wide production capacity. In 2000, a pilot project (mark-recapture) was initiated to determine the feasibility of assessing the drainage wide escapement for sockeye salmon. After encouraging results from the 2000 study, the program was continued from 2001 through to 2004. In 2006 and 2007, funding was provided by the PSC to estimate the total Alsek sockeye run size using genetic stock identification (GSI) with tissue samples provided by the U.S.(as prescribed in the PST (Annex IV, Chapter 1, 3(c))) from the Dry Bay commercial fishery for years 2005 and 2006. Results were encouraging and it is proposed that similar work be conducted for the 2007 and 2008 sockeye run.

Prior to 1997, the Alsek River Chinook salmon escapement was unknown because stock assessment projects to determine system-wide escapements had not yet been developed. Escapements were known for the Klukshu River, which has a salmon counting weir run by DFO in co-operation with the Champagne-Aishihik First Nation (CAFN). An escapement goal was developed for the Klukshu River in 1998 but very little else was known about the magnitude of run sizes and system wide production capacity. In 1997, a pilot project (mark-recapture) was initiated to determine the feasibility of assessing the drainage wide escapement for Chinook salmon. After achieving the objectives of the 1997 study, the program was continued from 1998 through to 2004. In-order to assess the productive capacity of the Alsek, returns from past mark-recapture estimates need to be assessed. It is proposed that through this type of project a low cost means of determining run size can be achieved.

Project Title: **Stikine River Field Camp Facilities**
Project Lead: Pete Etherton, Senior Stock Assessment Technician, DFO Whitehorse, Yukon.
Project Cost: $60,000 CAN/US

This proposal request funding to purchase, transport, and build a four person sleeping quarters at the lower Stikine field camp. The approximate proposed footprint measures 9m*7m. The quarters will accommodate staff participating in a host of fisheries research projects staged out of this field camp. Presently, DFO rents cabin space from one of the commercial fishers. The cabin space rented, although comfortable for staff, is located a distance from the main camp and the rented facilities may not meet DFO health and safety requirements in their entirety.

Project Title: **Stikine, Taku, and Alsek River Sockeye and Chinook Salmon Baseline DNA Profiles. Year 3**
Project Lead: Sandy Johnston, DFO, Whitehorse, on behalf of the Transboundary Technical Committee.
Project Cost: $86,472 CAN/US

The primary objective of this project is to continue to develop the DNA baseline for Transboundary Chinook and sockeye salmon. Once baselines are established/refined, they will be used in the analyses of mixed stock fisheries located in Canada and the U.S. to determine run timing and catches of specific transboundary river Chinook and sockeye stocks, and eventually provide managers with reliable inseason stock specific catch numbers and run reconstructions where required to improve management regimes. They will also be used to monitor the relative abundance of specific spawning stocks and improve stock assessment databases to enable development of biologically based escapement goals.

This is a continuation of sample collections that occurred in 2007 under Northern Fund Project. Problems with extreme high water conditions and low numbers of Chinook and sockeye on the spawning grounds in 2007 resulted in fewer than expected populations being sampled and sample sizes being below the 200 samples per population target established by the Transboundary Technical Committee. Sample sizes and protocols were previously developed by the TTC (see PSC report: TCTR 07-02: Summary of the Transboundary Genetic Stock ID Workshop: January 18-19, 2007.) As mentioned in the 2007 project description, completion of the collection of baseline samples is expected to require a few years of sampling effort.

The plan for 2008 is to return to many of the sites sampled in 2007 to address sample shortfalls, and to sample additional populations as identified in the aforementioned report: TCTR 07-02.

Project Title: **Developing Baselines for Chinook and Sockeye Salmon Genetic Stock Identification**
Project Lead: William Templin, Fisheries Geneticist and Lisa Seeb, Fisheries Scientist, Gene Conservation Laboratory Alaska Department of Fish and Game – Commercial Fisheries Division, Anchorage, AK.
Project Cost: $300,000 US

Stock identification for salmon caught in fisheries of Southeast Alaska (SEAK) and northern British Columbia (BC) is needed to fulfill harvest sharing arrangements specified in the 1999 Pacific Salmon Treaty (PST). Over the past 25 years, stock identification has primarily been accomplished through recovery of coded-wire tags and/or scale pattern analysis, sometimes complemented with brain parasite, egg size, and otolith information. More recent work with DNA-based genetic methods has provided the potential for improved and more-detailed estimates of stock composition. The Northern Fund has supported the development of standardized genetic baselines for both Chinook and sockeye salmon to provide information for the management of Transboundary River (TBR) and Boundary Area salmon stocks. However, a recent TBR Genetic Stock Identification Workshop highlighted the need for a more collaborative approach between laboratories to avoid duplication and unnecessary competition for funding, and to promote the development of a common plan to guide the development of stock identification to benefit both Canada and the U.S.

In response to this need, the Department of Fisheries and Oceans Canada (DFO) and the Alaska Department of Fish and Game (ADFG) propose to cooperatively assay genetic markers from sockeye and Chinook salmon sampled over spawning grounds from populations that contribute to fisheries covered under the PST Annex provisions. Emphasis will be placed on samples collected as part of Northern Fund projects currently collecting samples in this region, including those spawning in the Transboundary rivers

and in coastal areas in SEAK and in both inland and coastal areas of BC. Populations were identified through the Transboundary Technical Committee in cooperation between ADFG and DFO agency staff (Tables 1, 2). For sockeye salmon, approximately 9,000 individuals will be assayed for genotypes at 45 single nucleotide polymorphisms (SNPs) and data will be compatible with the interagency baseline developed by ADFG and National Marine Fisheries Service Auke Bay Laboratory (NMFS). For Chinook salmon, approximately 840 individuals will be assayed for genotypes at the 13 standardized microsatellite loci and 2,400 individuals at 53 SNP loci, and data will be compatible with both the Chinook Technical Committee (CTC) database (166 populations) and the ADFG coastwide SNP database. The current database contains SNP information from more than 180 populations from throughout the species range (Russia to California), and of these, 97 overlap with the populations in the CTC microsatellite database.

DFO and ADFG participation in development of SNP markers and in conducting surveys of SNP variation in Chinook and sockeye salmon populations will enable development, evaluation, and application of SNPs to estimation of stock composition of Chinook and sockeye salmon in mixed-stock fisheries. The main project benefits will be: 1) increased coverage of both the microsatellite and SNP baselines for Chinook salmon, 2) increased coverage for the SNP baseline for sockeye salmon, and 3) coordination between Canada and the U.S. such that standardized baselines will be used for stock composition estimation.

Project Title: Stock Composition of Stikine and Taku Chinook and Sockeye In-River Fisheries
Project Lead: Sandy Johnston, DFO, Whitehorse, on behalf of the Transboundary Technical Committee.
Project Cost: $44,297 CAN/US

Improved inseason stock specific management of Transboundary River salmonids is required to meet stock specific spawning goals and harvest shares. Inseason catch estimates based on historical stock compositions (from scale pattern analysis i.e. SPA) are often unreliable and tend to differ significantly from post season estimates. There is also a need to verify the present stock identification techniques used in the inseason management some transboundary sockeye salmon. The techniques presently used include SPA, egg diameter measurement, and brain parasite prevalence, each of which has significant drawbacks; the techniques available for Chinook are even more limited. Transboundary Chinook arrangements established in 2005 require the development of the capability by 2008. While this project will focus on collection of samples for post-season estimates of weekly stock compositions, the long term goal is to have inseason capability. Improved stock composition estimates will permit the compilation of stock recruitment data which will be used to establish biologically based escapement goals for particular stocks of interest (e.g. Tatsamenie sockeye). This project will involve the collection of tissue samples from Chinook and sockeye in order to determine weekly stock compositions in 2008 lower Stikine and Taku inriver commercial fisheries such that the estimated proportion of a given stock is accurate within 12.5%, 95% of the time.

Project Title: Installation of Slamgeesh Smolt Trap
Project Lead: Allen Gottesfeld, Head Scientist, Gitksan Watersheds Authority, Hazelton, BC.
Project Cost: $32,763 CAN/US

The Slamgeesh Lake field station was set up in 2000 with the goal of becoming a long-term sockeye and coho full index site for the upper Skeena Watershed. It is a small salmon producing system with simple hydrology enabling fairly simple technology to be used for stock assessment. Slamgeesh (Golangiist) has important cultural significance to the Gitxsan people having been an important fishing site and winter village. It has been unoccupied since about 1950. The Gitksan Watershed Authorities (GWA) has made

this fly-in only system a focus of wild salmon biology studies for the past eight years. These studies have included in-season coho and sockeye smolt population estimates, coded-wire tagging of coho smolts, adult escapement counts through a weir, foot surveys of spawning streams and biophysical measurements including lake temperature and oxygen profiles, lake bathymetry, stream stage, air temperature, etc.

Sockeye and coho adults have been enumerated by the GWA annually since 2000. From 2000 through 2006 a temporary weir on Damshilgwet Creek downstream of Slamgeesh Lake built of logs and thin-wall tubing was used. In the summer of 2007 the weir was improved and replaced with a concrete and aluminum structure with the help of a PSC Northern Fund grant. From 2000 to 2005 we trapped emigrating sockeye and coho smolts at the outlet of Slamgeesh Lake. We used a fyke trap and an inclined plane trap (IPT) to collect juveniles. We succeeded in trapping between 9% and 26% of the migrating smolts but the traps had quite variable efficiencies during the season. This was made up to some extent by the complementary behavior of the two traps, i.e. the fyke trap worked best at high flows and the IPT at low flows. Channel change in 2006 and 2007 has eliminated the possibility of fishing an IPT. We therefore would like to move to a weir system to trap and count smolts.

In 2007 we reconstructed the counting weir at Slamgeesh to create a long-lasting concrete and aluminum structure. The fence was intended primarily to count returning adult salmon in the summer and fall, but was designed for alternative use as a smolt trap in the spring. The current design includes a set of perforated panels for blocking smolt movement. We acquired a set of used fan traps from the Fulton River facility that were used on the pilot scale spawning channel A in the 1970s and 1980s. We propose modifying these traps and building a set of collection devices and holding bins for smolts. To facilitate seasonal installation of the traps we would like to also construct a cable system for moving the heavy traps into place in the spring. We would do this construction work in April and early May of 2008 in time for the 2008 smolt run.

Effective trapping of juvenile coho will enable us to resume coded wire tagging so as to derive marine survival and exploitation rates for this upriver population. We tagged coho from 2001 to 2005 and obtained survival data. With a more effective trap we will be able to mark 10,000 smolts which is an appropriate number to get sufficient returns from the marine fisheries to estimate the exploitation rate.

Project Title: **Stikine River Coded Wire Tagging Augmentation. Year 3.**
Project Lead: Pete Etherton, Senior Stock Assessment Technician, DFO Whitehorse, Yukon.
Project Cost: $70,000 CAN/US

This project is directly linked to the requirement in Annex IV, Chapter 1, paragraph 3(a)(2&3) of the PST to develop and implement abundance-based management regimes for Stikine chinook and coho salmon. In addition, the chinook component will help refine the management regime of the new ‘directed chinook salmon fisheries’ which were agreed to by the Transboundary Panel, commencing 2005. The data derived from this project will be used to determine the distribution, run timing and magnitude of marine catches of adult Stikine chinook and coho salmon. In addition, the project provides the means to estimate chinook salmon smolt abundance (which then can be used to monitor marine survival and refine escapement goals).

Since 2000 Canada and the US have been conducting coded wire tagging (CWT) projects on Stikine River chinook and coho. Since its inception, the CWT tagging goals of 25,000 chinook and 25,000 coho smolts have not been achieved consistently. Through funding provided by the Northern Fund for this project in 2006, additional staff and support resources were provided which resulted in a record catch of 48,000 chinook smolts and 32,000 coho smolts. This proposal requests funding to continue with the

required augmentation to the existing CWT project and further requests a multi-year agreement through to June 2009.

By again increasing field staff and the requisite equipment and supplies, it is anticipated that the annual tagging goals of 40,000 chinook and 25-30,000 coho will be met. Further, it is anticipated that a renewed interest in the in-river commercial harvest of coho salmon will occur due to the increase in coho prices in 2005 and 2006. It is also anticipated that the annual coho test fishery will be funded by DFO in 2007 which will provide a rough measure of run size and a relatively precise picture of run timing. Returning CWT-marked coho will be collected from both fisheries.

Project Title: **A Feasibility Study to Determine the Potential to Develop a Stock Assessment Tool on the Cranberry River**
Project Lead: Mark Cleveland, Head Biologist, Gitanyow Fisheries Authority, Kitwanga, BC.
Project Cost: $15,000 CAN/US

The Nass River is the third largest in BC providing a multitude of fishing opportunities for Aboriginal, commercial and sport fishermen in both salt and freshwater in Alaska and Canada. The Cranberry River is a major tributary to the Nass and it produces a good portion of the overall salmon returns in Area 3 on a yearly basis. Presently, the management of Nass River salmon is conducted through a mark-recapture program implemented by the Nisga'a Government Fishwheel Program. Overall this type of management ensures the sustainable use of the aggregate salmon returning to the Nass River in any given year. However, the strength of any mark-recapture program relies on the ability to recapture tagged fish in individual streams. Presently there are reliable recapture locations for sockeye and to some extent chinook salmon. Re-capturing marked coho and steelhead in the Nass Watershed has proven problematic because these stocks usually enter the rivers when waters are higher and more turbid.

Therefore, in an attempt to complement the Nisga'a Fishwheel mark-recapture program the Gitanyow Fisheries Authority (GFA) are proposing to conduct a feasibility study on the Cranberry River to attempt to find suitable locations for the establishment of a long-term stock assessment tool, which could efficiently enumerate coho, steelhead and possibly chinook in the Cranberry River system. If a stock assessment tool could logistically and economically be established and operated on the Cranberry River on an annual basis, information such as recapture rates from fishwheel tagged salmon could compliment the Nisga'a Fisheries Program. This information will allow for better management of salmon stocks in the Nass as a whole. In 2006 the Gitanyow Fisheries Authority partnered with the Nisga'a Government to jointly collect salmon mark recapture rates in the Upper Nass through Gitanyow Food fishery and escapement walks. To date the partnership has been deemed a huge success. The Gitanyow would like to expand this partnership in the future to provide better population size data for Cranberry River salmon, which will benefit both Nations, Canada and Alaska through improve fisheries management.

Project Title: **Transboundary Rivers Salmon Plan and Gap Analysis**
Project Lead: Jan Caulfield, Sheinberg Associates, Juneau, AK
Project Cost: $67,504 US

This project will result in the implementation of a bilateral planning process for transboundary rivers that will provide a venue and opportunity for Transboundary Panel and TTC members from Canada and the United States to share perspectives, expertise, and current data/information regarding salmon stocks, salmon management, and restoration and enhancement needs on these rivers. It will see the preparation of a Transboundary Rivers Salmon Plan and Gap Analysis that will develop goals and objectives relevant to salmon stock assessment, habitat restoration, and enhancement in the Alsek, Stikine and Taku River

basins; assess and identify priority information needs/gaps relevant to achieving the plan's goals and objectives; assign the Panel's assessment of the relative importance of these needs; and identify strategies to address high priority needs/gaps. A resulting benefit of the planning process will be the strengthening of professional relationships and understanding among participants, which will have a long-term benefit to achieving the goals of the Bilateral Transboundary Panel and the Pacific Salmon Treaty.

Project Title: Electronic Data Collection Equipment
Project Lead: Ron Josephson, Fishery Biologist, ADF&G, Tag and Age Laboratory, Juneau, AK
Project Cost: $26,105 US

ADFG routinely collects salmon fishery samples and data from approximately 10,000 interviews per year in Southeast Alaska. Data for these studies was typically recorded in the field on paper forms, a technique that is inherently inefficient and prone to human error. In the past ADFG has received NF funding support for a handheld/facilitated data acquisition project; this request is part of the ongoing implementation effort following those earlier projects. More equipment is needed to equip all ports and samplers. This proposal is for funding to purchase ~10 more data collectors and to equip one field office with wireless internet to support data transfer.

Coded Wire Tag Data is one of the most important data sets for implementation of the Treaty. The collection, timely transfer, and reliability of this data are fundamental to stock management and assessment for chinook and coho. Equipment which provides better and more reliable data should be supported. This project will involve the purchase and use of the data collectors