



The Fraser River Action Plan

Mid-Term Report 1991-1994



Environment
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Fisheries
and Oceans

Pêches
et Océans

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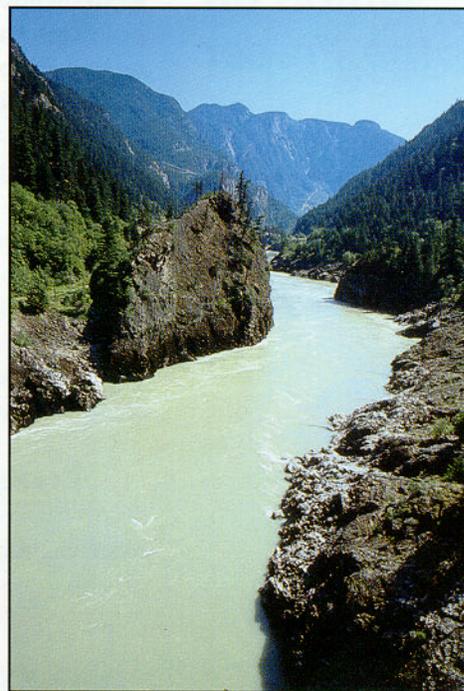


Towards a Sustainable Future

A report on the Fraser River Action Plan is more than a list of objectives, accomplishments, research findings and proposed future directions. It is also about the environmental health of the Fraser, about our children's future and the actions that are being taken now to ensure that both are sustained.

**A basin
full of
riches**

From its headwaters high in the Rocky Mountains, the Fraser River flows 1,375 km to its massive delta on the Strait of Georgia. A vast network of lakes and tributaries feeds the Fraser along its route. Together they drain a richly varied basin the size of Great Britain.



The Fraser Basin is one of the richest and most productive in the world...

The Fraser Basin represents just about every type of climatic zone and ecosystem in British Columbia. It is home to an abundant diversity of fish, birds and wildlife, and nearly two million people—over 60% of B.C.'s population. Its rivers, streams and estuary are among the most productive in the world and its rich soils nurture more than 44% of the province's farmland. Millions of waterfowl use the estuary as feeding and staging grounds on their annual migrations. The Fraser is the backbone of B.C.'s economically and socially valuable fisheries, contributing 66% of the province's total sockeye salmon catch and 60% of its total pink salmon catch. The basin is the heartland of British Columbia, its natural resources and industries accounting for 80% of the province's economic production.

**Ecosystem
under stress**

All this abundance is under threat. Our urban areas and industries pump millions of tons of pollutants into the river; overfishing and habitat destruction have reduced some Pacific salmon stocks; critical wetlands and other ecosystems have been destroyed or polluted; groundwater and lakes have been contaminated; and high demands for water have led to local shortages. The basin's ecosystem is showing signs of stress. A burgeoning population, expected to grow 50% in the next 20 years, urban sprawl and expanding resource development threaten the environmental balance of the basin. What's to be done?



...but its ecosystems are under threat.

Taking action on the Fraser

In 1990, Canadians from across the country participated in public meetings on the environment. The result was Canada's Green Plan. The Fraser River basin, with its tremendous environmental and economic importance, featured high on the list of priorities. Known as the Fraser River Action Plan, FRAP aims to clean up pollution, restore the productivity of the natural environment, and put in place a management program to ensure the basin's sustainability. Working toward these goals, in partnership with all those who live, work and play in the basin, is crucial if FRAP is to leave a legacy of long-term environmental health.

This ambitious plan, announced June 1, 1991, by the federal ministers of Environment and Fisheries and Oceans, is jointly run and funded by their two departments. Each department brings its own expertise and emphasis to the plan: the Department of Fisheries and Oceans (DFO) is primarily concerned with rebuilding salmon stocks and restoring and protecting fish habitat; Environment Canada (DOE) focuses on wildlife habitat, cleaning up the ecosystem and environmental quality.

FRAP is now at the half-way point of its six-year mandate. Much has been accomplished. Much is still left to do. This report provides a perspective on the first three years of the Fraser River Action Plan, and a look at what lies ahead.

The Salmon River: a test case

The Salmon River near Salmon Arm is the focus of much activity these days. One of several FRAP demonstration watersheds and projects, it is a testing ground for new ways of managing human and environmental needs. The project began with a strong local push to restore the watershed to its former abundance and environmental quality. A decline in salmon runs and deterioration in water quality through impacts from ranching, farming and logging practices, together with water-use conflicts, are environmental concerns. FRAP became involved in 1993, in partnership with BC Environment and the Salmon River Watershed Roundtable.



Trees anchored to stream banks provide fish habitat and reduce erosion.

A microcosm of the Fraser Basin

Drawing together people from all parts of the watershed and from all points of view, the project seeks both to restore the watershed and to maintain it on a sustainable basis. As such, it is a microcosm of FRAP's task for the Fraser Basin as a whole.

Encouraging public participation

The involvement of all stakeholders—concerned citizens, landowners, First Nations, industry, municipal and regional officials and federal and provincial agencies—in land and water-use decisions is key to the success of the initiative. Toward this end, FRAP helped fund the hiring of a project coordinator and the

establishment of a watershed resource centre. It also sponsored an educational video about the Salmon River project called *Voices of the River*.

Setting ecosystem objectives

The goal of sustainability requires finding a balance between social, economic and environmental needs

by involving all stakeholders in setting ecosystem objectives. The stakeholders group reviews the stresses between these various interests, the causes of these stresses and possible remedies. The group sets goals and objectives for the basin and FRAP monitors efforts to meet them. After several years, the stakeholders group will review the results.



Salmon Arm citizens working together planting trees.

Repairing damage

To help restore the watershed, FRAP supports habitat improvement projects, in partnership with local groups, in several areas suffering from bank erosion and habitat damage. The work has stabilized river banks and planted vegetation to provide shade and a food source for fish, built refuge areas for fish and erected fences to protect the streams from cattle.

Environmentally friendly ranching

The Salmon River project is also working with ranchers to encourage management practices such as cattle fencing and controlled grazing that reduce damage to sensitive river habitat. This improves and protects fish and wildlife habitat and benefits ranchers by reducing loss of grazing land through bank erosion.

In the future

Future work will focus on public education, water and land-use planning and improvements needed in administrative and legal procedures. FRAP will also sponsor a conference in which partners and interested parties from existing and potential watersheds can exchange information and ideas.



Cattle allowed free access to streams pollute the water and damage fish habitat.

Pilot projects such as the Salmon River are designed to show sustainability in action. They are efficient ways to hone new approaches which, together with the lessons learned and results gained, can be applied to other areas of the basin or to the Fraser as a whole.

Restoring Productivity...

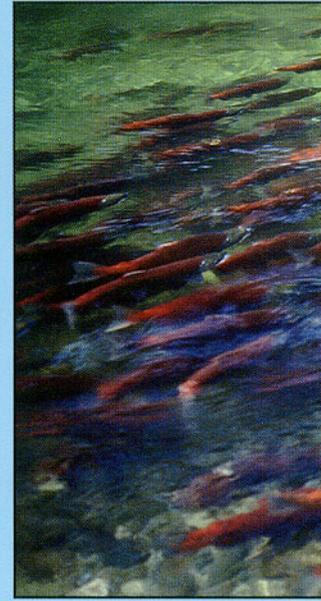
GOAL: *To restore and enhance the environmental quality and natural productive capacity of the Fraser River ecosystems and to return salmon populations to historic levels of abundance.*

A key objective of FRAP, restoring productivity, recognizes that action must be taken now to protect the Fraser Basin's valuable fish, bird and wildlife populations from environmental threats and human activities. The focus is on three main tasks: enhancing fish and wildlife habitat, rebuilding fish stocks and managing the natural environment.

Enhancing fish and wildlife habitat

Productivity cannot be restored without improving and protecting the precious habitat on which fish and wildlife depend. To this end, the plan is working to:

- Enhance conditions for rearing and spawning fish by improving water flows, removing barriers to migration, reducing siltation of the water, planting vegetation on stream banks and building areas in streams where fry can hide from predators.
- Encourage stewardship and environmentally friendly practices by community groups, farmers and landowners to protect wetlands and streams.
- Prevent habitat loss and degradation caused by erosion, loss of vegetation and by cattle trampling stream banks.
- Increase the amount of available habitat—from planting winter crops for birds to expanding spawning gravel for fish.
- Protect critical wetland habitat by purchase, where necessary.



FRAP aims to increase valuable salmon stocks.



Volunteers clear wood debris from valuable estuary marsh habitat.

... an Overview



Birds and waterfowl depend on the Fraser's wetlands.

Rebuilding salmon stocks

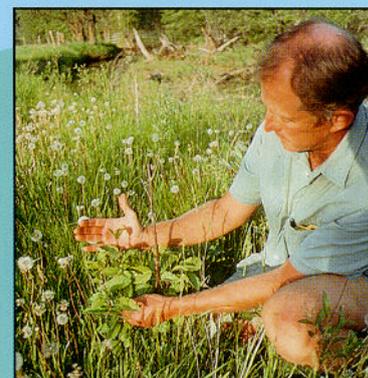
The Fraser River supports six species of salmon. Each species is made up of hundreds of different stocks, which have unique characteristics such as where they spawn and the timing of their migrations. FRAP aims to increase the basin's salmon populations, while maintaining the diversity of stocks. To do this requires effective management of the resource, through limits on catch sizes and targets for escapements (the number of fish that must reach spawning grounds to ensure strong runs for the future.) It also calls for:

- A comprehensive management plan for all Fraser River salmon species, which considers the needs of all fishing groups and economic and biological factors, to guide salmon rebuilding over the next decade or more.
- Analysis of the strength of species and stocks and the impact of the fisheries on them.
- Scientific information about fish behaviour, key habitats and environmental impacts on survival and production on which to base sound management decisions.

Managing the natural environment

Protecting the streams, wetlands, forests and the myriad ecosystems of the Fraser Basin requires:

- A management strategy for all areas of the basin that integrates the protection of fish stocks, habitat and land use.
- Mapping and collection of data on streams, wetlands and vegetation to help biologists plan how to protect and restore critical habitat.
- Improved land and water management practices for the benefit of ecosystems and the diversity of life they contain.



Planting trees on stream banks improves fish habitat.

Restoring the Fraser's Productivity

Millions of salmon—one of the biggest runs in the world—return to spawn every year in home streams of the Fraser River. Hundreds of thousands of wintering waterfowl—the largest population in Canada—flock to wetlands of the Fraser Estuary. Millions of migratory birds touch down to feed and rest on their journey south.

The Fraser River Action Plan is committed to protecting these valuable populations of fish and wildlife from environmental threats and human activities for the benefit of future generations. This is at a time when American Northwest rivers are in critical decline. Delaying action may only lead to the need for more drastic measures later, such as the recent fishing bans off the coast of Washington and Oregon. The objective of restoring productivity, including doubling the great river's salmon production within 20 years, translates into action on several fronts. FRAP is improving and protecting habitat, looking for better ways to manage these resources and collecting vital data on which to base key management decisions.



The Pacific Flyway. Millions of migrating birds visit the Fraser Estuary each year.

Habitat is the foundation of fish survival and production, as essential to the fisheries as topsoil is to farming. Improving and protecting the habitat on which Fraser River fish depend is a key component of FRAP. Habitat restoration protects existing salmon stocks and complements efforts to rebuild populations to historic levels of abundance.

Biologists and engineers are busy on the Fraser and its tributaries enhancing conditions for spawning and rearing fish. This means helping migrating fish by removing barriers created by bridges, culverts and landslides, and by improving water flows. The work includes planting trees on stream banks to reduce erosion and provide shade and cover for juvenile fish, as well as a food source (insects falling from branches). Other projects build areas for fry to hide from predators by installing refuge pits in the streams and by cutting ledges into stream banks. Sensitive urban streams also are protected from the pressures of development by fencing and tree planting. In the first three years of FRAP, 21 projects have been undertaken, from small community projects to large engineering works.

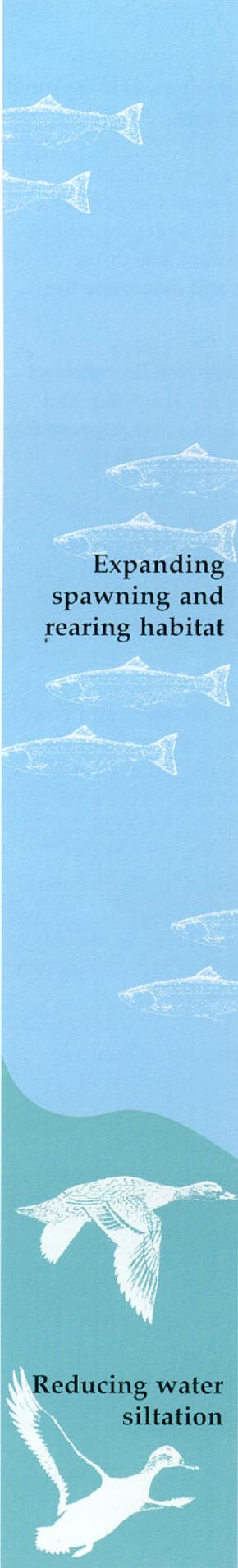
Estuary marshes are critical fish habitat, providing about one billion young salmon a year with



Transplanting marsh plugs in prepared areas of the Fraser Estuary.

Fish habitat enhancement

Protecting valuable estuary marshes



Expanding spawning and rearing habitat

a feeding ground and a place to rest and adapt to salt water before swimming out to sea. In the Fraser Estuary, many marshes have been destroyed by diking, wood debris and erosion. FRAP, in partnership with the City of Burnaby and the North Fraser Harbour Commission, has rebuilt marshes on a stretch of estuary foreshore and has stabilized adjacent banks to protect stream-side vegetation. The work improved 5,500 square metres of rearing habitat. Ongoing monitoring will assess the need for future restoration.

FRAP is funding a successful clean-up of intertidal marshes by volunteers and industry in the Fraser Estuary. The Fraser River Estuary Management Program, of which FRAP is a partner, coordinated the removal of wood waste choking marshes at Annacis Island, Deas Island, Woods Island, Tilbury Slough and the Fraser Foreshore Park. This allows marshes to regrow, improves food production and opens up areas for fry resting and feeding. Clean-up activities will expand to other areas.

Work on the Stave River below the Ruskin Dam has increased the amount of spawning habitat for chum salmon by excavating and grading several dry gravel channels. Partner BC Hydro is providing sufficient water from the dam for the restored habitat. The work has created 16,000 square metres of new habitat, which is expected to produce 30,000 adult chum salmon a year. Coho, pink and chinook salmon and trout will also benefit. Future work is planned.



Several projects, such as at Stave River, are restoring fish habitat below hydro dams.

The program is also building channels and ponds for spawning and rearing on the Coquitlam River downstream of the Coquitlam Dam. A flow agreement with partner BC Hydro ensures sufficient water from the dam, allowing fish to use habitat in a previously dry section of the river. The 11,000 square metres of additional habitat is critical to young coho salmon and will produce an estimated 5,200 coho smolts and 25,000 chum salmon fry a year. The project is continuing.

In partnership with BC Hydro and BC Environment, spawning platforms were built in the Bridge River below the dam to replace gravel lost during past flooding. Monitoring indicates the new gravel is being well used by spawning salmon. A fish-counting fence was built to collect data on migration timing and fish abundance, which will identify habitat improvements needed in the future.

Severe floods in 1989 and 1990 damaged the Chilliwack River's valuable salmon production. The floods exposed eroding clay banks which were silting the water and fish spawning grounds, hampering egg survival and fish rearing. In the past three years, siltation has been reduced by diverting three sections of the river away from the eroding banks and reinforcing the dikes. This has improved spawning for about 200,000 chum, 120,000 pink and 20,000 chinook salmon, while boosting fry

Water flows improved

Counteracting urban pressures

Boosting coho production

Involving the public

Managing a complex fishery



survival for their offspring. Future plans include developing side-channel rearing and spawning habitat in the protected floodplain at the Ranger Run area.

A small dam was constructed on the Bonaparte River to store water and improve water flows from Bonaparte Lake. It is designed to prevent freezing and drying of spawning beds and improve conditions for rearing and migrating fish. A fishway for chinook and steelhead salmon was installed in the dam and three monitoring stations built along the river. Ongoing monitoring will determine the need for future improvements to rearing habitat.

Langley's Salmon River is a productive urban stream, home to wild coho and steelhead salmon and cutthroat trout. In partnership with Langley Township and volunteer groups, trees are being planted to stabilize eroding banks and improve the quality of habitat. The construction of rock weirs is helping migrating fish by eliminating obstructions created by culverts and bridges.

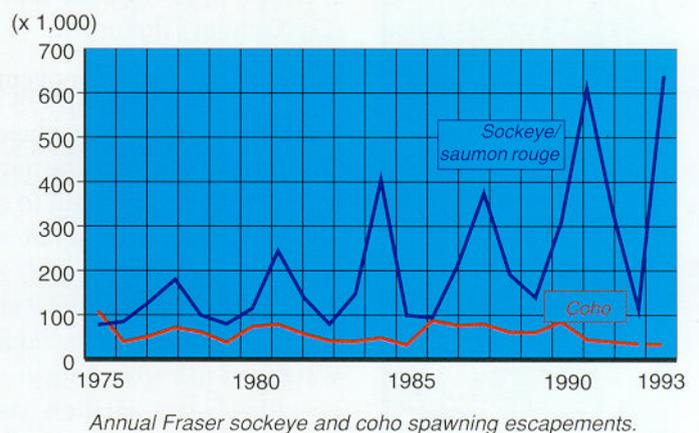
Several small urban streams in the Lower Mainland—such as the Nicomekl River—are under growing pressure from development. In an effort to improve the productivity of the habitat, banks are being stabilized and planted with vegetation. The project, involving municipalities and community groups, will tackle an increasing number of sites in future years.

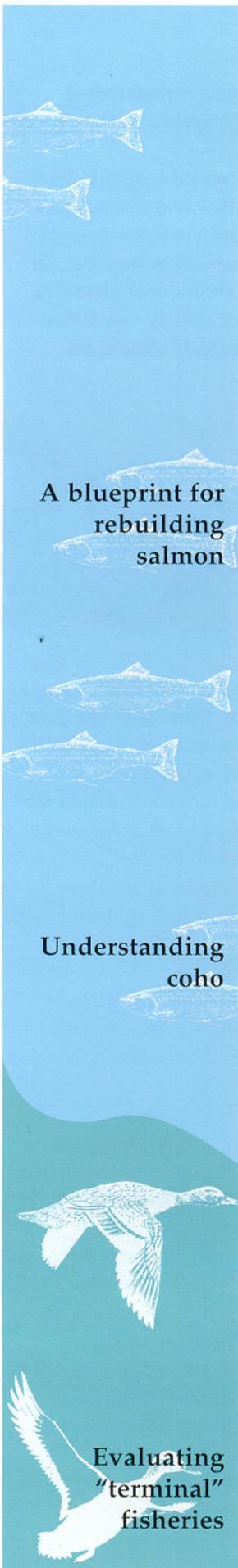
A project known as Fee Creek Ponds consists of a series of channels and ponds off the Birkenhead River to provide coho spawning and rearing habitat. It produces about 8,000 coho salmon smolts a year. Monitoring has shown that culverts built to improve adult migration to the channels are successful. A local salmon enhancement group, the Pemberton Sportsmen's Wildlife Association, is an active partner.

FRAP is funding a stream stewardship program, coordinated by the Salmonid Enhancement Program, that provides citizens with training and support to carry out environmental conservation and restoration in local watersheds. The program will also promote better public awareness of fish habitat protection. Six communities will test a training manual for volunteers.

The Fraser watershed supports six species of salmon, which are made up of hundreds of individual stocks. This complex and diverse resource demands effective management—especially if the goal is to increase salmon productivity.

Most Fraser River salmon stocks are relatively healthy although some are suffering from habitat loss and overfishing. Sockeye, the mainstay of commercial and Native fisheries, have been rebuilding rapidly since the mid-1980s, with the 1993 sockeye run—





A blueprint for rebuilding salmon

estimated at 24 million—the largest since 1913. Meanwhile, some wild coho and steelhead stocks are declining.

There is evidence that the Fraser watershed has the capacity to produce even larger runs of salmon. FRAP is developing a long-term management plan to rebuild salmon stocks to historic levels, while maintaining stock diversity.

A comprehensive, integrated management plan for all Fraser River salmon species is needed to serve as a blueprint for protecting and increasing productivity over the next decade or more. This blueprint will merge harvesting, habitat and enhancement into a single plan. It will consider the needs of all species and fishing groups as well as biological and economic issues. Draft recommendations are expected in the spring of 1995, and final conclusions by the end of FRAP in early 1997.

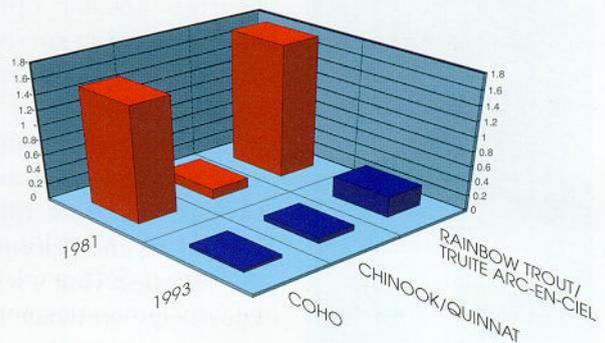
A task force of FRAP and BC Environment representatives is coordinating the plan's development and will seek input from stakeholders. To help these discussions, the task force is preparing reports on the status of each Fraser River salmon species. Meetings with DFO's commercial, Native and sports fishing advisory committees are planned for 1994-95. Also under way is an analysis of how commercial fishing affects salmon species, such as steelhead and coho, inadvertently caught in nets. And the project is exploring ways to evaluate new options for fisheries management.

A better understanding of the life history of coho salmon will help fisheries managers in the Fraser. Biologists are tracking the movements of wild juvenile coho in Lemieux and Louis creeks, two North Thompson River tributaries, and the upper Pitt River, a lower Fraser tributary. The young fish are wire-tagged so that they can be followed over their three-year life cycle, including freshwater movements, ocean survival, harvest and spawning migration. Data will be collected to the end of FRAP. Preliminary analysis shows the number of juveniles rearing in Louis Creek has dropped since the 1980s.

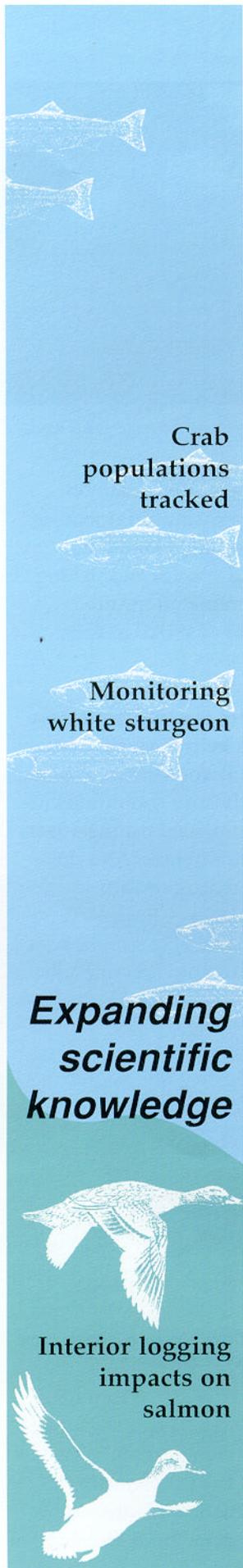
The economic feasibility of up-river fisheries close to spawning grounds has been evaluated. Such "terminal" harvests could solve some of the problems of managing mixed-stock fisheries. For instance, fisheries targeting abundant stocks sometimes inadvertently catch weaker stocks migrating at the same time. If fishing is



The Fraser hosts one of the biggest salmon runs in the world.



Results from one area of Louis Creek show a decline in some fish species since 1981. (Number of fish per m²)

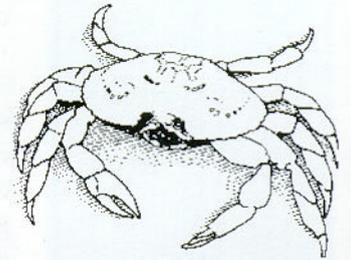


Crab populations tracked

adjusted to protect weaker stocks, the stronger stocks may exceed the spawning targets set by managers. These surplus fish could be allowed to spawn or they could be harvested in terminal fisheries.

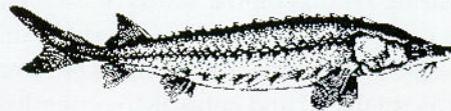
The study aimed to help resolve a long-standing debate over the quality and marketability of sockeye stocks caught up-river. By assessing the canned, smoked and roe products from two stocks, the study considered the feasibility, practicality and likely profitability of terminal fisheries. The quality of all products was found to be acceptable for commercial sale, but below that of comparable commercial products from ocean or river-mouth fisheries. The smoked products most closely resembled their commercial counterparts. The results suggest that further study should be undertaken on other stocks.

Scientists are observing the crab population in the Fraser delta to determine the effect of the commercial fishery on the resource and identify critical habitats for females and juveniles. The data will aid management of the fishery and indicate sensitive, priority areas needing protection in case of an environmental threat, such as an oil spill. Further field work is planned to establish annual variability in the crab population.



Monitoring white sturgeon

White sturgeon in the lower Fraser River are the focus of a project that seeks to identify their critical habitat and estimate their population size. Data from the past two years have found that juveniles, aged one to 15 years, favour slow-flowing backwater sloughs, while adults appear to move into the faster-flowing mainstem. More work is needed to explore adult sturgeon habitat and movements, population size and age composition. The work is carried out by Malaspina College, with funding from FRAP, BC Environment and the college.



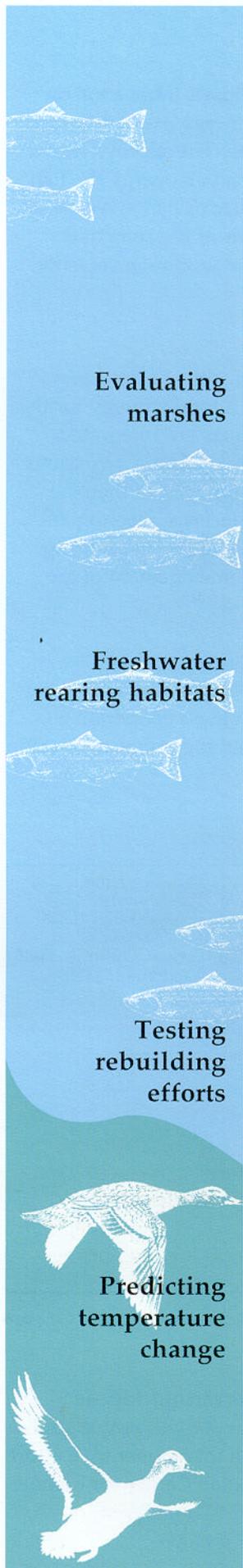
Expanding scientific knowledge

Good scientific information is crucial to effectively manage the Fraser River fisheries. Reliable, up-to-date data are needed on fish behaviour, environmental factors affecting survival and production, the potential of habitat to support fish and the effects of water quality.

This information helps fisheries managers set catch limits and targets for escapement—the number of fish that need to escape to spawning grounds to ensure strong runs for the future. It is also essential for determining strategies for stock rebuilding and priorities for habitat restoration—in short, to protect and strengthen the fisheries. That’s why FRAP is funding a variety of science projects to improve the knowledge on which these decisions are made.

Interior logging impacts on salmon

Scientists will observe the impact of interior logging practices on sockeye salmon stocks and habitat in four streams in the Stuart-Takla watershed. The results will help develop interior fish/forestry guidelines. These guidelines will serve as codes of practice for forestry operators to prevent adverse effects on fish and fish habitat. Changes in sediment, hydrology and temperature of streams will be documented to determine their impact on the ecosystem and egg survival. Over the last three years, data have been collected on fry migration, gravel quality, salmon



Evaluating marshes

egg distribution and water flow from unlogged areas. The results will be compared with those collected after various types of logging have occurred. Partners include the B.C. Ministry of Forests, BC Environment, Tl'Aztl'En Tribal Nation, B.C. universities and Canadian Forest Products.

An evaluation is under way of rebuilt marshes in the Fraser estuary that were planted to compensate for the destruction of natural habitat. The project observes fish abundance and fish food production and tracks chinook fry to determine their use of these areas. Results will help guide the design of future compensation projects. Critical factors identified so far are the elevation of the marsh in the intertidal zone, river currents, plant species and the source of donor plants. Restored marsh on the foreshore and in tidal sloughs will be evaluated next.



Scientists collect egg samples in the Stuart-Takla watershed.

Freshwater rearing habitats

Information on the freshwater biology of chinook salmon is needed to set goals for stock rebuilding and to develop habitat management plans. Scientists are investigating the life history of upper Fraser chinook, its habitat use and the factors that affect production. Sampling has been completed on the Fraser mainstem and Slim Creek, with more analysis planned.

The project is also developing a model to predict yields of coho smolts based on stream size. This will help determine optimal targets for coho escapements. Other work is assessing the effect of sudden flow reductions below hydro dams on the behaviour of chinook, coho and rainbow trout. Some of these results have already been incorporated into BC Hydro operating procedures in an attempt to reduce fish deaths due to "stranding" on gravel bars.

Testing rebuilding efforts

Remote sensing, aerial photography and a Geographic Information System are being used to test judgments made regarding sockeye rebuilding on the Fraser. This includes determining available habitat, how fish use habitat and the production that can be expected from that habitat. These visual mapping tools were used on Thompson River pink salmon and on Horsefly River sockeye to aid long-term management of fish and habitat. For the Horsefly River, they have provided maps showing habitat and spawning distribution and have mapped and classified Fraser salmon spawning streams.

Predicting temperature change

Global climate warming, if it occurs, could lead to higher water temperatures and pre-spawning deaths for the Fraser Basin. These concerns led to the design of a computer model that provides possible scenarios of water flow and temperature for the Fraser and Thompson rivers. An aid to fisheries management, the model aims to evaluate the effects on fish of proposed water diversions and predict the impact of climate change on fish migration.

Measuring energy use

The long, arduous journey upstream to the spawning grounds takes a toll on migrating salmon. To determine how water flow affects fish energy expenditure, scientists tracked sockeye salmon between Yale and Hells Gate. The sockeye were implanted with radio tags that transmit signals showing how much energy the fish use as they swim. The project, a partnership with the University of B.C.'s Westwater Research Centre, is designed to identify the most difficult areas of the river and recommend measures to make the journey easier for migrating salmon, increasing their chances of surviving to spawn.

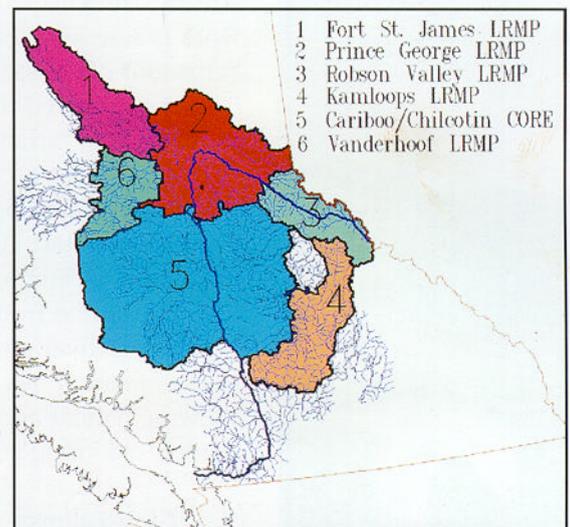
An integrated strategy

FRAP projects to restore habitat, improve fisheries management and expand scientific knowledge are pieces of a puzzle that together form a total strategy for the management of fisheries and habitat resources. The end products are Integrated Fisheries Resource Management Plans covering the entire Fraser Basin. Discussions are under way with provincial agencies and First Nations to incorporate their interests into these plans. The integrated plans will address concerns, recommend how to protect and restore habitat, identify sensitive habitats, suggest monitoring and enforcement measures, and act as a guide for sustainable management of the Fraser Basin beyond the end of FRAP.

FRAP is contributing to the province's regional planning process, the Commission on Resources and the Environment (CORE), and the sub-regional Land and Resource Management Plans. FRAP plays an active role in these cooperative consultations with other government agencies, stakeholders and the public to develop land and resource-use plans.

As part of the process, FRAP is documenting the status of salmon stocks and the spawning and rearing habitats that support them in all Fraser sub-basins. Selected land and water use information is also being collected. An assessment of resource uses has been completed for three Fraser sub-basins—the Quesnel, Stuart/Takla and North Thompson—which will be used in developing the integrated plans.

An advanced computer mapping technology—called Geographic Information System—is helping develop the integrated fish and habitat management plans. GIS electronically links complex databases on fish habitat, vegetation, land use and fish distribution with geographic maps. Biologists can quickly see relationships between the different elements, helping them plan how to protect and restore habitat in all areas of the Fraser Basin. Many partners in this cooperative effort include BC Environment, Canada Space Agency and the Canadian Centre for Remote Sensing. Completed projects include:

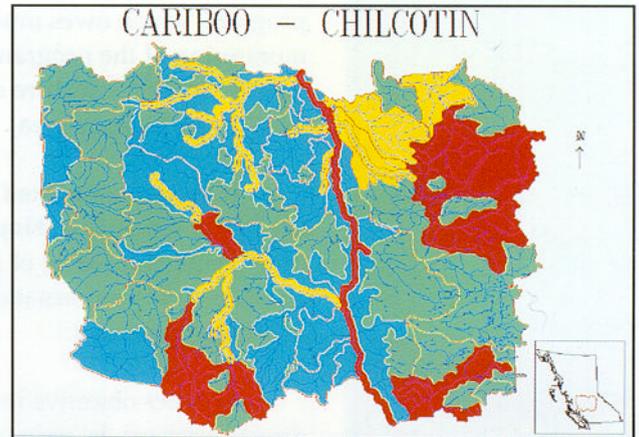


FRAP is involved in the provincial planning process in these areas of the basin.

Mapping habitat concerns



- acquiring geographic data that will be used with habitat data to produce maps;
- transferring spawning and habitat information in an existing stream inventory to GIS;
- producing integrated fisheries resource maps of the Cariboo-Chilcotin CORE region and Kamloops LRMP region; and,
- mapping stream-side vegetation and stream beds with an airborne multi-spectral imaging system.



Computerized GIS maps help biologists to protect and manage habitat.

Plans for the future include providing habitat managers throughout the basin with access to GIS data and continuing the huge task of building the GIS database.

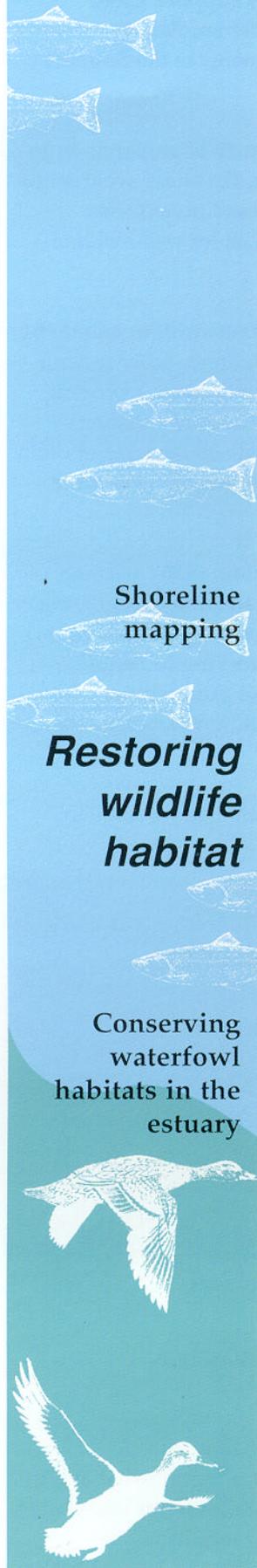
FRAP mapped shoreline habitat along the Fraser and Nechako rivers in Prince George in partnership with the city. The mapping will help design a riverfront park that protects fish habitat. The foreshores of Quesnel and Kamloops were also mapped to provide a detailed snapshot of river habitat and concerns.

The Fraser River basin is a mosaic of different ecosystems, geographic and climatic zones that provides habitats for a tremendous diversity of plant and animal species. Urban and rural development, industrialization, primary resource extraction and other human activities have destroyed, damaged or threatened delicate estuary ecosystems, inland wetlands and forest biodiversity. FRAP is focusing its efforts on these types of ecosystems in the Fraser Basin. Their overall goals are to protect and enhance biodiversity, conserve and restore threatened wildlife habitats, and make them more productive.

Each year, more than a million migratory shorebirds and many thousand waterfowl winter in the Fraser Estuary. Birds such as wigeon, swan and geese, rest and feed in delta farmland. The Greenfields project, run in conjunction with Ducks Unlimited, seeks to protect and enhance these bird habitats for the benefit of both wildlife and farmers. The project encourages farmers in Delta and Surrey to plant winter cover crops that improve the soil and provide food for wildfowl, which would otherwise damage more valuable crops. Some 1,200 hectares have been planted in the cost-sharing stewardship



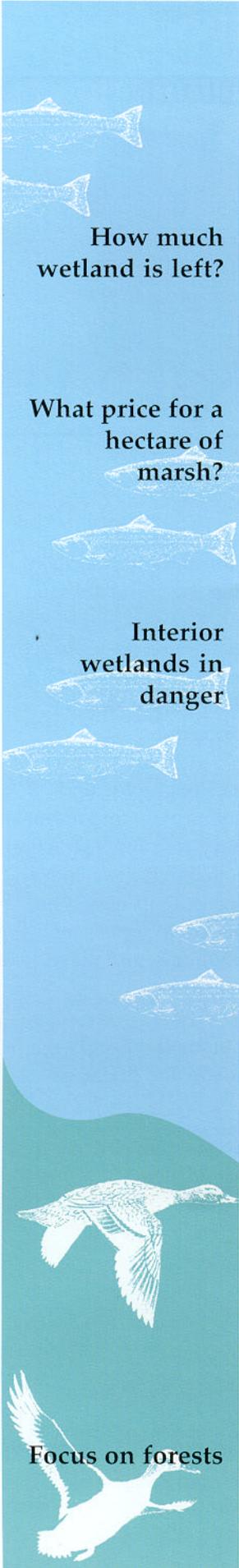
An agrologist measures winter cover crops planted in the Greenfields project.



Shoreline
mapping

Restoring
wildlife
habitat

Conserving
waterfowl
habitats in the
estuary



How much wetland is left?

What price for a hectare of marsh?

Interior wetlands in danger

Focus on forests

program, which owes much of its success to strong community support. Close monitoring of the program ensures its effectiveness, and broader studies are supplying a clear picture of waterfowl populations and movements in the Boundary Bay/Fraser Estuary area.

A project completed last year compiled a detailed inventory of wetlands from the Fraser's mouth to Hope. As well as mapping the wetlands, the study went on to chart ownership, level of protection or threat. This and other land inventories provide critical information for conservation agencies, as well as for regional and municipal planning.

Another objective in the Fraser Basin is to protect important wildlife habitat by direct purchase. In partnership with the B.C. provincial government, other federal agencies and various conservation organizations, FRAP has set in place a process with the Nature Trust of British Columbia to buy land under the Pacific Estuary Conservation Program. To date, the program has acquired some 40 hectares of delta wetlands, and it is exploring many opportunities to buy more over the next three years.

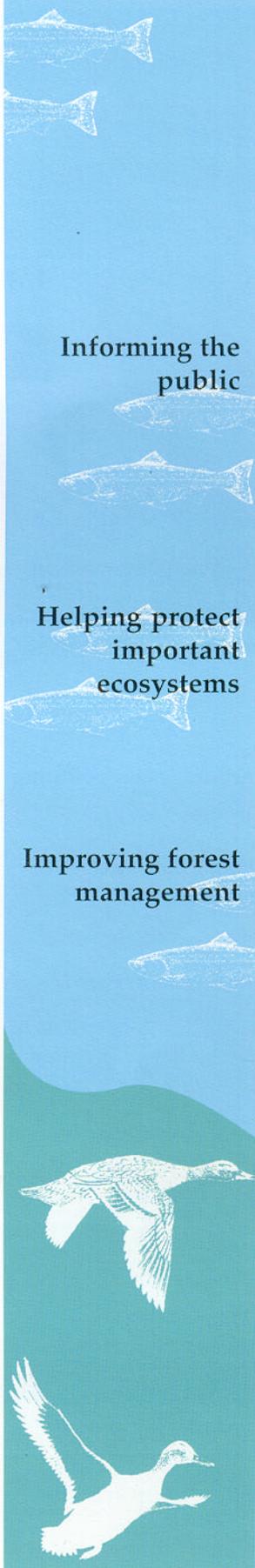
Lakes and stream valleys in the interior Fraser Basin contain many hectares of wetland marshes—important breeding areas for waterfowl. Ranching and grazing practices often conflict with these wetlands, leading to damage or loss of waterfowl habitat. FRAP's wildlife habitat conservation team has been working to restore damaged wetlands to improve their biodiversity and waterfowl productivity. The Interior Wetlands agreement was signed with Ducks Unlimited to make plans that will best address this problem.

At the heart of the issue are time-worn grazing practices that allow cattle to range freely, polluting the lakes and streams with their feces and trampling wetland habitats. The conservation plan puts in place a stewardship program that helps ranchers adopt environmentally friendly management practices: fences to restrict the access of cattle to water courses; reduced or eliminated grazing in critical wildlife areas; even positive steps such as building nesting structures. Education extends this further, providing funding for ranchers to improve their knowledge of wetlands conservation.



Fences prevent cattle from damaging streams.

Over 90% of the Fraser Basin is forested. FRAP, in cooperation with governments, universities and forest managers, has developed programs that aim to improve forest management practices for the benefit of forest ecosystems and the diversity of life they contain. Five main objectives guide the programs:



Informing the public

- to increase public awareness and knowledge of forest ecosystems and biodiversity in the Fraser Basin;
- to identify important areas for protection under the provincial Protected Areas Strategy and the regional CORE process;
- to provide improved information and decision-making tools for forest management;
- to contribute to sustainable forest management practices;
- to assure the maintenance of biodiversity in managed forests.

FRAP has worked on numerous projects to meet these objectives.

The first step is to ensure that all stakeholders understand forest biodiversity and the need to protect it. In partnership with B.C. Conservation Foundation and UBC, the Forest Diversity Program has generated a series of pamphlets, handbooks and FRAP fact sheets to inform the public. New this year is a public interactive information database at Kamloops that will provide up-to-date maps and data on local protected areas, to permit the public to participate fully in the CORE public consultations. This is a demonstration project for other public information systems in the future.

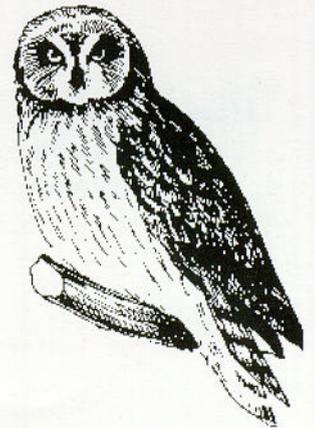
Helping protect important ecosystems

FRAP has several forest ecosystem projects that contribute to the current process in B.C. to identify and protect critical ecosystems. In the Cariboo-Chilcotin an Important Areas Mapping project used remote sensing satellites to aid in mapping land-use and vegetation. FRAP contributed start-up funds to the Conservation Data Centre, which identifies threatened species and habitats in the Fraser Basin, while a project that computerized nesting records of birds in the basin helps to identify important habitats to secure.

Improving forest management

A key role of the forest ecosystem diversity program is to promote environmentally sustainable forest practices. Projects with this goal include:

- workshops and studies on riparian (river bank) zones—key areas of logging that are identified for study in B.C.'s new Forest Practices Code;
- woodpecker habitat research—key species to understand in relation to forest land-use practices;
- studies to identify which groups of species are dependent on which habitats and how they respond to changing land-use. These studies help forest managers to make good decisions on harvesting patterns that leave an optimum mix of landscapes that maintain biodiversity.



By year six, forest habitat programs will have completed guidelines for the protection of river-bank zones, demonstrated ways to maintain species diversity, integrated wildlife values into forest management policies and developed procedures to protect critical forest habitats.

Cleaning Up Pollution...

GOAL: *To arrest and reverse the existing environmental contamination and degradation of Fraser River ecosystems by developing targets and strategies to reduce pollution and by significantly reducing the discharge of persistent toxic substances into the Fraser River.*

One of the three main goals of FRAP, cleaning up pollution in the Fraser Basin is a massive and complex undertaking. To get to grips with this enormous task requires both study and action.

STUDY to provide answers to numerous questions about the ecosystems in the Fraser Basin, the sources, nature and quantity of pollution, and the possible technologies and approaches to cleaning it up; and

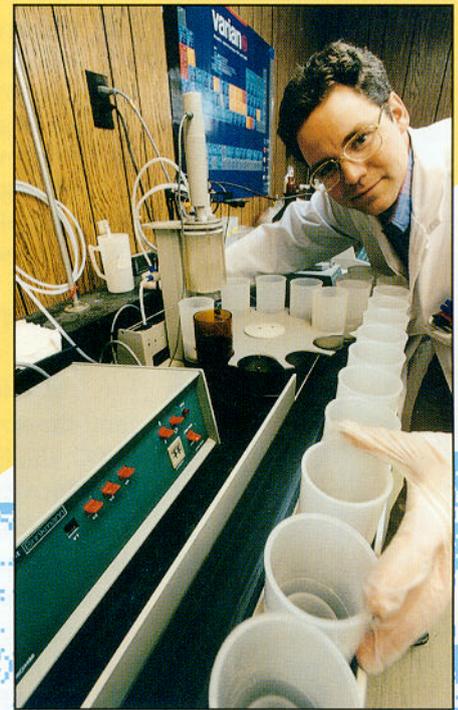
ACTION to implement new environmental guidelines, encourage less-polluting practices and enforce the anti-pollution laws and regulations.

The three major areas of FRAP that focus on cleaning up pollution carry out their complementary tasks in different ways. Their activities and goals are summarized below.

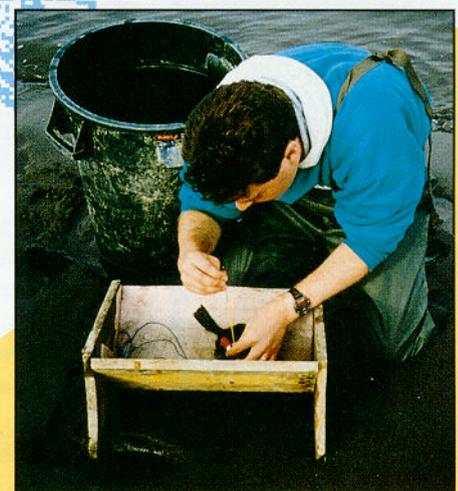
How bad is the pollution problem?

Over the first three years of FRAP, a great deal of work has focused on environmental quality studies to:

- Find out the present condition of the Fraser River, including the numerous river ecosystems;
- Study the effects of pollutants on plants and animals, and what species can be used to indicate environmental problems;
- Define concentration objectives or limits on pollutants that ensure environmental quality is sufficient for the long-term health of the river;
- Define reasonable objectives for environmental quality that can be used to measure how well clean-up activities are progressing and can provide objectives for the future.



Scientific analysis helps define the health of the river.



Starry Flounder are tagged to help assess water quality.

...an Overview

Who's polluting... and how much?

To stop or reduce pollution, FRAP's Pollution Abatement scientists first need to know:

- Where pollutants come from;
- What contaminants are present in water and air discharge sources;
- What quantities are being discharged into the basin.

Finding ways to stop or reduce pollution

What are the best and most cost-effective ways of cleaning up pollution, and how can they be put into action? FRAP's pollution abatement people have invested much time and energy in answering this question through programs that:

- Prioritize the pollution problems: what needs fixing first?
- Identify and review pollution control technologies and management practices;
- Develop new codes of practice that reduce or avoid polluting;
- Explore economic and non-economic incentives to stop or reduce polluting;
- Create partnerships to foster pollution abatement;
- Support demonstrations and training in environmental technology.

Making sure people toe the line

Enforcement of pollution laws and regulations is key to achieving lower levels of pollution, and FRAP has a strong commitment to this goal through:

- Inspection and investigation programs targeted at significant polluters;
- Laboratory backup to check on potential violators;
- Fines against polluters.



Sampling sediment to check for contaminants.

Environmental Quality: the Health of the River

Although there have been many studies on specific aspects, when FRAP started little was known about the state of health of the Fraser River as a whole, or about the myriad interconnected ecosystems that make up the complex web of life in the river and basin. A major aim of FRAP is to define the health of the river. This will provide a baseline against which to measure efforts to curb pollution and to achieve sustainable use of the river.



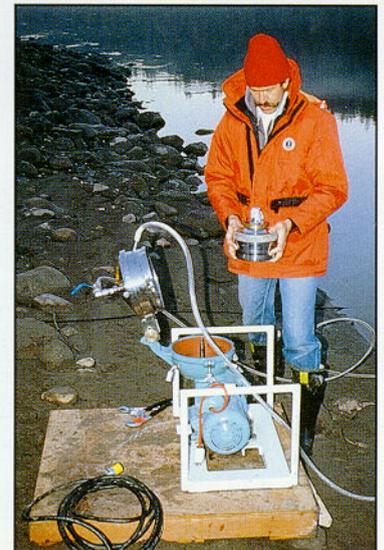
Snow geese: winter visitors to the Fraser Estuary.

Other aims naturally spin off from this central goal. To assess the river's health, an understanding of the various ecosystems in the basin is needed. The effects of pollution on environmental quality must also be understood, and targets or "ecosystem objectives" need to be set to guide pollution abatement efforts. As levels of pollution change, these must be measured and their effects understood. FRAP is also investigating the impacts of pollution on fish stocks and ensuring that water quality objectives and activities protect fish. In the first three years, FRAP has made good progress towards these aims.

A 26-member team of scientists from federal, provincial and university research communities is working together under FRAP to improve understanding of the basin. This knowledge-base is needed to measure the health of the aquatic ecosystem and the effects of contaminants on it, as well as help plan future clean-up activities. Many of the projects that follow briefly outline FRAP's work in this area.

Many chemical contaminants do not readily dissolve in water. Instead, they attach themselves to sediment particles carried by the river. By analyzing sediments, scientists can trace and measure these pollutants.

Several projects monitor contaminants in sediments in the Fraser River. Upstream of Chilliwack, scientists evaluated fine sediment sites for pollutants. Two other projects mapped the direction of bottom sediment movement and the final resting places of sediment in the lower Fraser River and in the mainstem Fraser upstream of Hope. The scientists are also studying how specific chemicals in pulp mill effluents are combining with river sediment. A Simon Fraser University researcher is using this knowledge and results from other FRAP studies to develop a predictive model



A sediment sampler helps gather data on pollution.

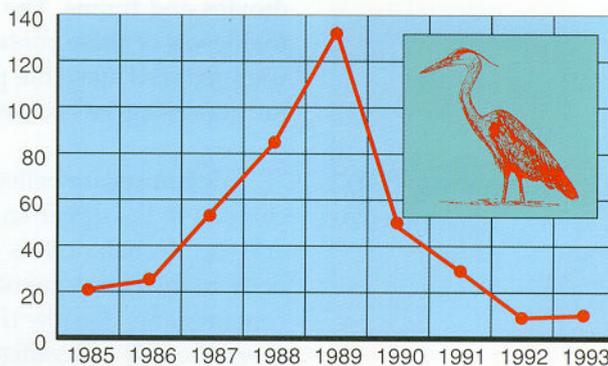
**Acquiring
knowledge
on the
basin's
environment**

**Pollutants in
sediments**

Animal indicators of environmental quality

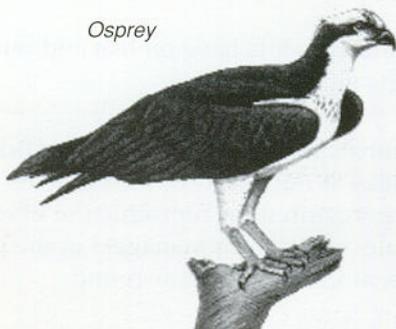
of the movement and fate of pollutants in the river. This information can be used to aid decisions on chemical discharge limits into the river.

FRAP scientists are developing indicators to help measure the environmental health of the river. It is not possible to monitor each and every organism in an ecosystem, but by studying certain species that are sensitive to environmental change, scientists can gain a picture of changes in environmental quality. The change in dioxin content in herons eggs, for example, provides a useful measure of the success of curbs on pulp mill contaminants.



Dioxin levels in heron eggs near the river mouth (parts per trillion)

FRAP scientists are investigating other wildlife and fish indicator species such as cormorants and Starry Flounder in the estuary, swallows in the Prince George area, osprey in the Quesnel and Kamloops areas and amphibians in the lower Fraser Valley. At the end of year three, the program has identified potential indicators to assess sediment quality, fish condition, wildlife contaminants and benthic (river-bottom) communities.



Osprey

The next half of FRAP will see these indicators used to assess pollutants from industrial plants, agricultural and urban run-off and to provide a

definitive baseline for the health of the river ecosystem.

Is the river a healthy environment to live in? One project seeks answers by focusing on the benthic community—mostly immature insects that live in the river-bottom sediments. These insects are a major food source for fish. By counting and identifying benthic animals present in relatively clean areas in the basin, FRAP can establish a baseline against which to judge areas that may be polluted or disturbed. A decline in these indicator insects alerts scientists to a problem and provides a means of measuring its effects. As part of this work, FRAP has started an insect library with the Royal British Columbia Museum. The library can be used to aid correct identification of collected species.



Double-crested Cormorant

Several projects in the Fraser Estuary, Burrard Inlet and False Creek are examining tissue samples from crab and sole for contaminants and for indications of stress from exposure to contaminants. This will help assess health in marine species and provide baseline data for future long-term monitoring of the effectiveness of clean-up activities.

Insect communities as indicators of river condition

Contaminants in crab

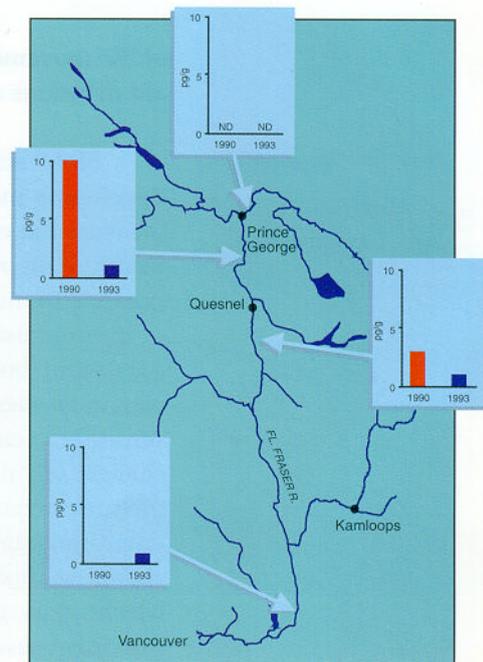
Assessing pollution curbs at pulp mills

Analyzing fish tissue

Effects of pulp mill effluent on fish and other animals

FRAP scientists sampled water and water-borne sediment near six pulp mills, to assess how effective recent changes in pulp processing technology have been in reducing output of contaminants such as dioxins and furans. The results indicate that levels of these contaminants have been reduced since the pulp mills introduced process changes in 1991.

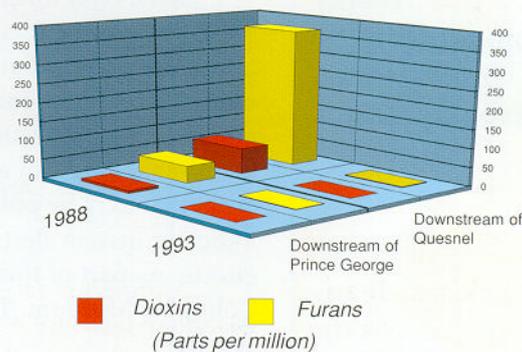
Scientists are collecting juvenile chinook in the upper and lower Fraser and the Nechako rivers to analyze fish body tissues for organochlorine contaminants. Results from the past three years showed a significant reduction of contaminant levels from those sampled in the same locations in the late 1980s. The reduced levels appear to result from regulations prohibiting the use of wood preservatives in sawmills and from reduced use of chlorine by bleached kraft pulp mills. More sampling and tests remain to be done to determine what is causing a stress response in fish even at low contaminant levels.



Dioxin levels in suspended sediments from the Fraser River are decreasing.

What effects do pulp mill effluents have on fish and wildlife health in the Fraser? Several FRAP projects tackle this issue.

- In partnership with scientists from the universities of British Columbia and Waterloo, one project looks at the effects of the effluents on fish size, weight and the presence of hormones required for reproduction in resident fish species such as peamouth chub. Results will inform managers of the possible long-term effects of pollution on fish present in the river year-round.
- Another project at Prince George is looking at swimming behaviour, respiration, disease resistance and physiological changes in young salmon exposed to mill effluent discharge at low water flows. These factors will be related to survival. BC Environment and the pulp and paper industry are partners.
- Scientists are studying migration and feeding of Rocky Mountain Whitefish around pulp mills above and below Prince George to understand how this important species picks up and accumulates contaminants found in pulp mill effluent.



Contaminant levels in Fraser River juvenile chinook have dropped significantly since 1988.

**Urban/
agricultural
impacts on fish**

- Another project is investigating the reproductive success of osprey above and below pulp mills at Kamloops and Quesnel.
- FRAP scientists are developing a quick and cheap biochemical test to check if fish have been exposed to organochlorine compounds found in pulp mill, municipal and other industrial effluents.

Farms and growing cities can affect fish productivity, and three linked FRAP studies in the lower Fraser are examining what these impacts are and how they can be lessened. Runoff from urban or city areas can include pollutants from cars, industrial sites and households. A study in the Brunette River basin is monitoring the contaminants in runoff entering the river that accumulate in bottom sediments and their effects on river insects.

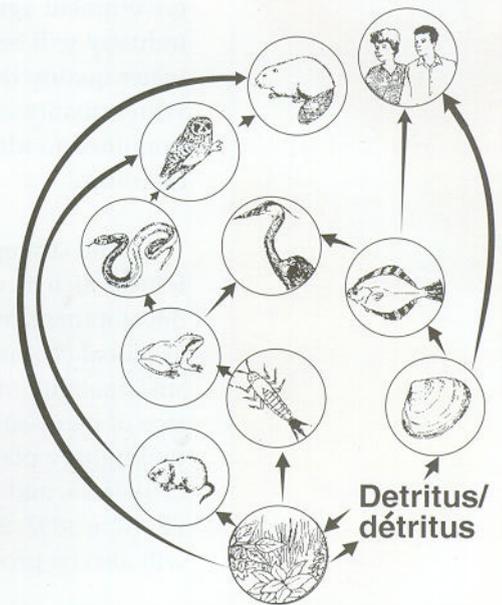
Runoff from farmers' fields also can contain contaminants from manure or pesticides toxic to fish. A second project seeks ways to improve water quality for fish through better farm practices, control of surface runoff and storm sewer discharge and local planning. Part of a FRAP-BC Environment project on agricultural practices and urban development in the Sumas River and Matsqui Slough areas, the results can be applied to other parts of the lower Fraser Valley. A related project looks at organisms living in the Sumas River to see how contaminants from agricultural activities are affecting them.

**The spread of
chemicals in
food webs**

Contaminants entering one species can quickly spread through the food web. One study is using artificial tree swallow colonies to measure the transfer of chemicals from the aquatic environment near industrial outfalls to other parts of the food web.

**Laboratory work
on the effects of
pollutants**

Several projects are looking at what contaminants do to fish and other organisms in the lab such as the effects of the anti-sapstain chemical DDAC on zooplankton and fish, and the effects of chlorophenol compounds on the development of white sturgeon eggs.



A food web from the Fraser Estuary

FRAP is also developing a portable lab that can measure the effects of effluents in simulated "mini-rivers", which behave like the river from which the water is pumped.

A project is assessing the ecology of the mud flats near Iona, Lulu and Westham islands to measure how well they have recovered after the diversion of sewage effluent away from the area. Results will help establish a baseline for possible changes in sewage effluent clean-up at Annacis and Lulu treatment plants.

FRAP's research team is investigating possible contamination of the basin's headwaters from long-range air pollution such as pesticides and metals in the atmosphere.

**Checking clean-
up success on
delta mudflats**

**Long-range
pollution**

Information on contaminants and organisms

Several projects have been completed to compile vital information on the basin's environmental quality including a bibliography of 4,000 scientific references and indexes on information sources on organic contaminants in soil, sediment, water and organisms for the Fraser Basin.

Computer models aid clean-up effort

FRAP is developing a computer model to predict the concentrations of contaminants in water, sediments, and organisms after different clean-up strategies are applied. Another model under development is a computer-based, decision-analyzing tool for resolving water-use issues in tributary basins. The model ensures that all water uses are considered in decision-making and creates a formal mechanism for comparing the effectiveness of alternative decisions.

Monitoring water quality

A monitoring program assesses the current condition of the water in the Fraser Estuary as a baseline for measuring changes in pollution levels. In cooperation with the Fraser River Estuary Management Program, FRAP took samples every two weeks from three sites to check for contaminants. Sampling included backwater areas important for fish, such as sloughs. Results help determine priorities for pollution abatement activities.

Plotting a water quality strategy

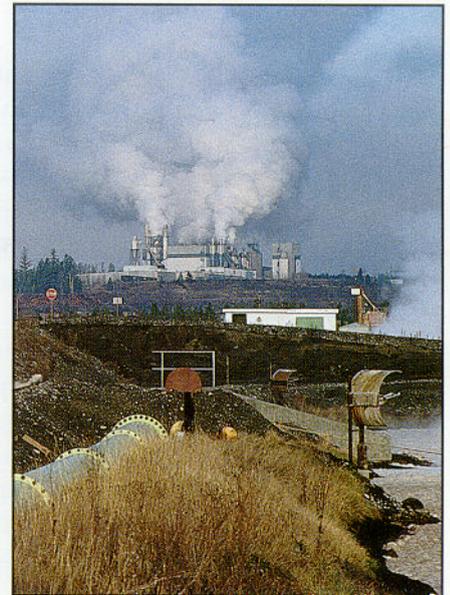
FRAP is collaborating with BC Environment and other government agencies to develop a water quality strategy for the Fraser River basin. Information collected by government agencies, universities and industry will be used to assess the state of water quality throughout the watershed. Water quality and fish habitat data will be examined to identify critical areas requiring clean-up.

The strategy will address immediate issues, such as urban and industrial development, as well as future concerns, such as global climate change. The aim is to ensure sustainability of the fisheries resource in the face of increasing human development. A preliminary plan will be developed by the end of 1994-95, and a final report by the end of FRAP in 1997. Summary reports for the public will also be produced.

Water sampling

Water quality will be sampled and related to fish habitat and land use in several of the demonstration projects selected by the Fraser Basin Management Board. Because several of these projects involve fish habitat restoration, sampling will point out water quality problems that may hamper fish survival and indicate possible areas for clean-up. Results in these case studies can be applied to other similar areas in the basin.

The efforts of the environmental quality program are critical to the main goals of FRAP. Its results will likely establish a benchmark for the health of the Fraser River for perhaps the next 20 years.



Pollution levels from pulp mills are dropping, thanks to tighter regulations.

Pollution abatement: reducing the problem

FRAP's pollution abatement team is at the forefront to reduce and stop pollution in the Fraser Basin. It has two specific targets:

- to reduce by 30% the amount of environmentally disruptive pollutants entering the Fraser Basin by 1997 and,
- to significantly reduce the release of "persistent toxic substances" into the basin's waterways by 2000.

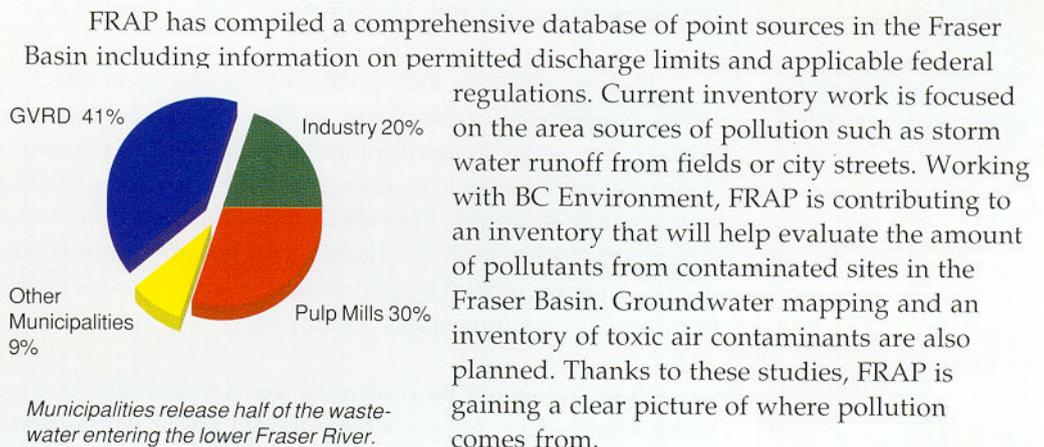
To meet these targets, FRAP has entered into partnerships with federal and B.C. provincial government agencies, municipalities and industry organizations. In the first three years, pollution abatement and its partners have carried out numerous projects. Many of these addressed the first two problems they face in cleaning up the river: identifying and defining the sources of pollution, and analyzing the types and amounts of contaminants entering the basin.



Pollution comes from many sources.

Finding the sources of pollution

Pollution takes many forms and comes from many sources. Discharges from industries and municipalities (point sources), and runoff from urban areas and agricultural land (area sources) all potentially contribute contaminants to the basin. Other sources include groundwater contamination, air pollution and contaminated waste sites.



Analyzing wastewater: what's in it and how much?

Many projects focus on analyzing the chemical content, toxicity and amount of contaminants entering the Fraser Basin from identified sources. These involve sampling and analyzing wastewater from municipal and industrial discharges, stormwater pipes and sewage overflows and many other sources. Compiled in a database, this information adds the second step toward curbing pollution: defining the nature and size of the problem.



Studying the effects of contaminants

What happens to local environments when contaminants enter them? A number of FRAP projects conduct impact assessments in zones close to waste-water discharges to find out. One study, run in partnership with the Fraser River Estuary Management Program, looked at zones around industrial outflows into the estuary. It found some local effects of industries in the sediments but not in the water. Further work is needed to check on the significance of the results for the overall health of the Fraser Estuary. Results of this and other studies will help set priorities for action in reducing pollution in coming years.

Promoting pollution reduction and prevention

As FRAP moves into its second half, a major pollution abatement thrust is to encourage people, industries, and municipalities to curb pollution through more environmentally friendly practices or management. Several FRAP projects worked on developing improved codes of practice for various industries. With funding from FRAP, the BC Federation of Agriculture developed guidelines for the greenhouse and nursery industries that are aimed at promoting environmentally sustainable practices.

Another project produced an environmental code of practice to reduce pollutants from the Ready-Mix concrete industry, now used as a model in many countries. Information sessions, technology demonstrations and training programs are other initiatives. The latter includes support for B.C. Water and Waste Association to train operators of waste-water treatment plants; a pesticide certification program designed to reduce chemical pesticide use by promoting the use of biological and other controls; and funding for a BC Research pilot study to optimize the consumption of organic waste by microbes in waste-water treatment systems.

In the next few years, many more similar actions are planned, including developing codes of practice for the fish processing industry, dairy producers and industries that discharge storm water.

Incentives to reduce pollution

Hitting people in their pocket-books can be an effective way of changing behaviour—the principle of the “polluter pays”. So can making it economically attractive to act in an environmentally responsible manner. Called “economic instruments”, economic incentives and disincentives to reduce pollution are under investigation by FRAP. One idea under consideration is emissions trading, where companies with permits to discharge pollutants can sell unused portions of their quota—making money by polluting less. User fees for garbage collection and water use are other “polluter pays” examples.

Incentives work by rewarding good behaviour—for example, returning cans and bottles for the deposit. One program under way is investigating economic uses for manure that would offer incentives to farmers to reduce manure stockpiles, which contribute to toxic runoff. FRAP is exploring and assessing many user-pay systems and economic incentives as tools to reach lower pollution levels.

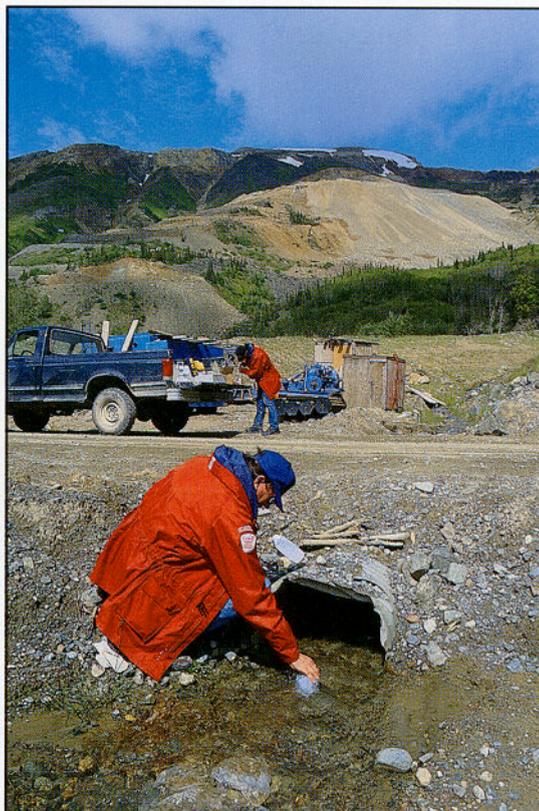
Enforcement and compliance

Enforcement plays a vital supporting role to the other activities of FRAP. Whereas pollution abatement and environmental quality scientists identify pollution problems and polluters, and develop means to curb pollution, enforcement backs them up with inspections and investigations to ensure compliance to established laws and regulations. In some cases, serious violations result in charges. Both DOE and DFO carry out enforcement under the laws and regulations of the Fisheries Act

Checking compliance

and the Canadian Environmental Protection Act. The long-term objective of the program is to achieve 90% compliance with environmental legislation in cooperation with provincial and federal enforcement agencies.

Enforcement in the first few years of FRAP focused on measuring compliance of those industries under federal regulation. FRAP carried out more than 300 inspections in the Fraser Basin at municipal treatment plants, pulp and paper mills, metal mines and wood preservation and treatment facilities, as well as hazardous waste storage sites and vendors of fuel and ozone-depleting substances. A number of inspections revealed significant violations; and enforcement staff launched 22 investigations in the first two years resulting in numerous warnings, four prosecutions and fines totalling \$21,000. In 1993-94, FRAP was on target to complete a program of 180 planned inspections. Initial enforcement results showed an 82% compliance rate—although this measures only those industries that have been inspected so far.



Sampling outflow from a mine to check on compliance with regulations.

A shift to non-regulated polluters

In the second half of FRAP, enforcement activities will change focus to pollution problems that are not specifically covered under regulations. There is little compliance information on these unregulated sources of discharge, such as from municipal waste-water, leachates from contaminated sites and runoff from industrial facilities. Inspections will target the worst polluters in this unregulated group, with guidance from the pollution abatement and environmental quality programs. FRAP anticipates that compliance levels will actually decrease at first, as enforcement starts to pick up problem polluters in these new sectors. Also planned is the development of inspection criteria to check compliance with new industry codes of practice developed by FRAP.

Fish habitat enforcement

FRAP is formulating a strategic enforcement plan for fish habitat, which will be completed in 1994-95. The plan will identify chronic problems affecting fish and fish habitat and will recommend ways to enforce compliance with habitat protection provisions of the Fisheries Act. So far, fish habitat enforcement under FRAP has been limited to *ad hoc* action by field staff. Over the next three years, however, it is expected that priority concerns will be enforced, with industries and individuals informed of expected compliance.

FRAP has contributed funding to the DFO radio room to provide the public with a central contact for lodging complaints of suspected habitat problems. A review of radio room calls is under way to see how the public can be more effectively involved in the reporting of habitat concerns.

Building Partnerships ...

GOAL: *To build partnerships with provincial and local governments, aboriginal and community groups, environmental organizations, industry and labour, and other stakeholders to develop a cooperative management program for the Fraser Basin based on the principles of sustainability.*

FRAP needs partners to accomplish its overall goal of a healthy Fraser River basin. The federal government through FRAP cannot act alone to clean up pollution and restore habitats in the Fraser Basin, the job is simply too large. And all those who have a stake in the future of the basin must be closely involved, both to have their say and share the work.

Perhaps most importantly, partnerships are crucial to ensure the basin stays healthy after FRAP ends. This requires a management plan for sustainability—one that balances current economic and social needs with environmental conservation so that the basin's rich resources are maintained for future generations.

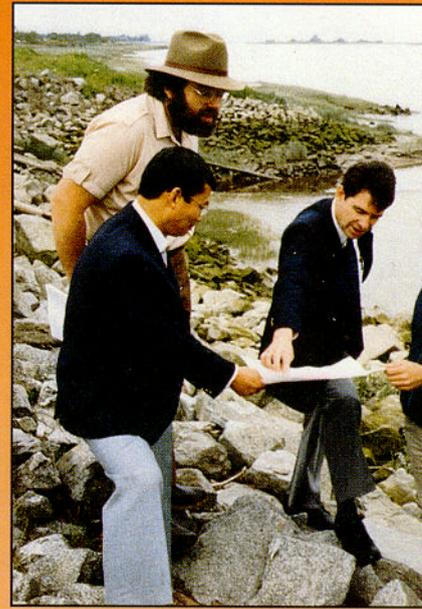
There are several types of partnerships at work in FRAP. Partners in planning that bring groups together to plan action now and in the future; partners in action that share the work of cleaning up and restoring the river; and partners in sharing knowledge with the public and all concerned.

Partners in participation and planning

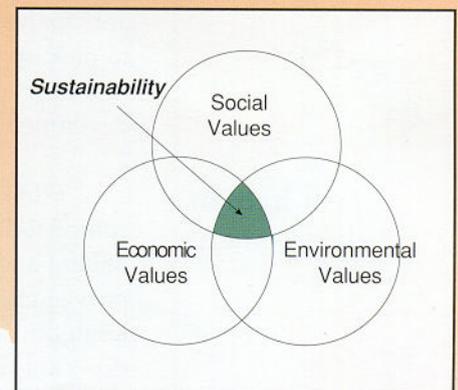
The Fraser Basin Management Board plays a key role in bringing together all basin stakeholders as partners in FRAP. Its job is to:

- assess the needs of the communities and industries in the basin,
- formulate a plan—a blueprint for sustainability—that maintains the basin's health by managing environmental protection, economic activity and community development in a way that meets today's needs as well those of the future.
- DOE and DFO: FRAP itself is a partnership between these two federal departments, each of which is responsible for half the cost of the plan.
- Partnerships between all levels of government: cooperation between federal, provincial and municipal agencies is crucial for meeting FRAP's goals.

Partners in action



Sustainability of the basin demands the involvement of all parties.



All needs must be considered and balanced to achieve sustainability.

... an Overview

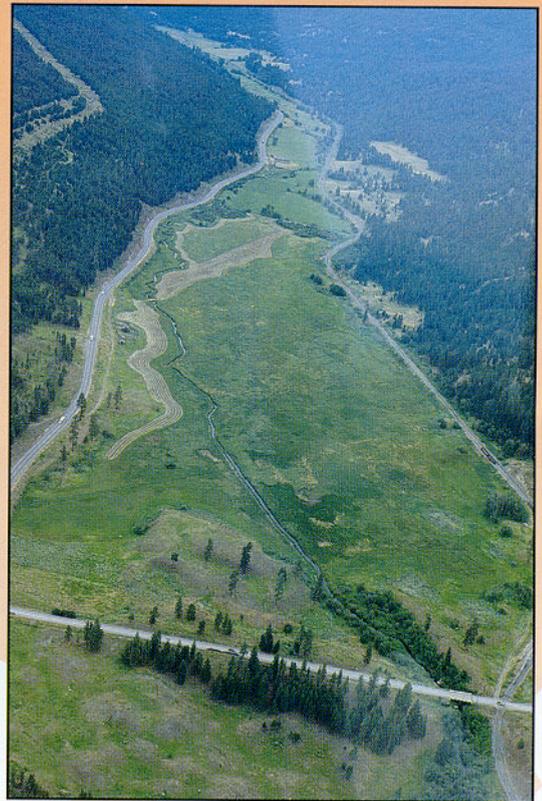


Providing and sharing information at open houses.

- Partners in multi-agency programs: the Fraser River Estuary Management Program and the Burrard Inlet Environmental Action Program. FRAP shares information and resources with these programs and collaborates on many projects.
- Partnerships work at many different levels: individual FRAP projects often depend on close partnerships with provincial government agencies, universities, and various community and environmental groups.
- Partnerships with First Nations in carrying out many FRAP projects, including those under the Aboriginal Fisheries Strategy.
- The public also must be partners. Public participation is integral to the Fraser River Action Plan. Communicating with the public is therefore an important task of the partnership initiative.
- By using demonstration watersheds and projects, where local groups can be seen working together to achieve a balance between economic and social development and environmental health, FRAP can show that sustainability can work. And the results become a model for elsewhere in the basin.

Involving the public

Demonstrating partnerships



The Nicola River is one of four demonstration watersheds.

Strength in Numbers

A healthy and productive Fraser River basin is FRAP's overall goal. But it also must make plans to ensure that the river stays that way: the management plan for sustainability. It means finding new ways to do business; ways that consider the long-term protection of the Fraser Basin. And it means devising a blueprint that will guide responsible stewardship after the end of FRAP.

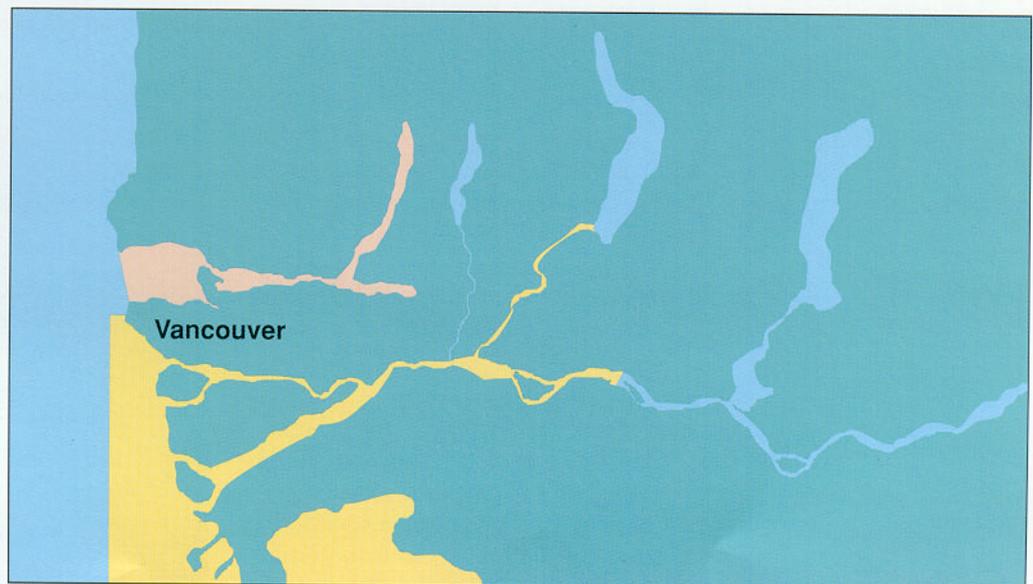
There are many governments and groups that have a stake in the Fraser Basin; there are many jurisdictions, many voices. The issues are complex and the stakes are high. Decisions must be made on what is to be done; priorities must be set; long-term plans put in place. And it is crucial that all parties act together. That is why FRAP's third major goal is to build partnerships with all who have a critical say in the basin's affairs.

Set up in May 1992, under a joint agreement between the federal, provincial and local governments, the Fraser Basin Management Program is a key vehicle for establishing partnerships under FRAP. Its 19-person board, drawn from all levels of government, from industry, community and environmental organizations and aboriginal groups, represents a broad spectrum of interests and beliefs. The board encountered some start-up problems—integrating the activities of so many different groups and governments is a difficult and complex task. However, the board remains clearly focused on its objectives, and the essential value of the program stands strong—to forge partnerships to provide more coordinated long-term management and decision-making.



**Fraser Basin
Management
Program**

**A key
vehicle for
partnerships**



 Fraser River Estuary
Management Program

 Burrard Inlet Environmental
Action Program

Areas of Jurisdiction

Focus on Burrard Inlet

A separate program for Burrard Inlet has similar goals to FRAP. The Burrard Inlet Environmental Action Program intends to cut down existing pollution and limit future discharges into Burrard Inlet, control loss of habitat, and where possible, fix existing environmental problems. Created in May 1992 by the federal departments of Environment and Fisheries and Oceans, the B.C. Ministry of Environment, Lands and Parks, the Greater Vancouver Regional District and the Vancouver Port Corporation, the program pools the expertise, information and efforts of these five partners towards cleaning up the inlet.



Managing the Fraser River estuary

The Fraser River's environmentally rich and expansive estuary lies in the most populous corner of British Columbia. The stresses of urban expansion, industrial development, and intensive agricultural use on the delicate estuarine ecosystems have posed challenges for the Fraser River Estuary Management Program, established in 1985 to find ways to manage these conflicts. Its goal is to provide the means for accommodating a growing population and economy while maintaining the quality and productivity of the Fraser Estuary's natural environment. A cooperative effort of federal and provincial government agencies, port authorities, regional districts, local municipalities and aboriginal groups, the program has many overlapping areas of concern with FRAP. And the two programs cooperate with funding and research efforts on numerous projects in the estuary.

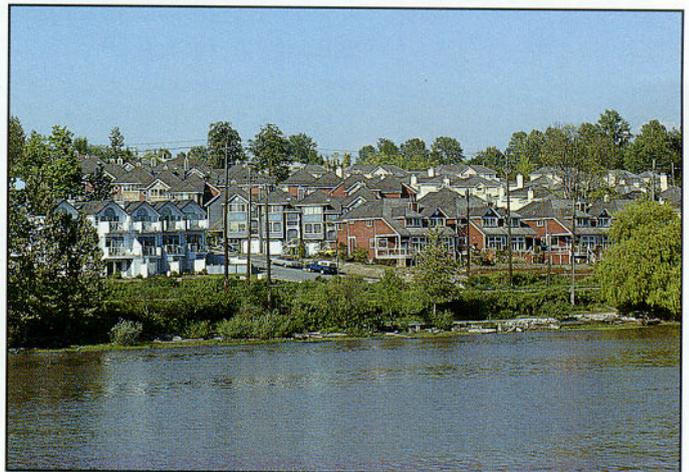


Sustainability in action

Demonstration watersheds and projects are models of people working together toward sustainability in smaller geographic areas of the Fraser Basin. Lessons learned in these sub-basins will be applied to the stewardship of the entire Fraser watershed.

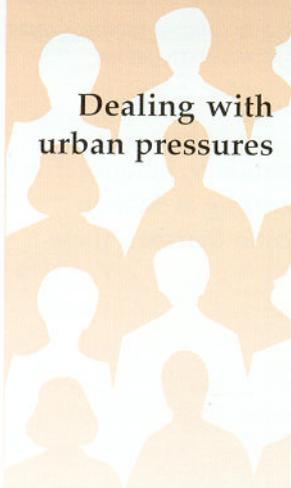
So far, FRAP has been involved in four demonstration watersheds, for which it has contributed funding, helped restore habitat and assisted local officials and citizens to implement these projects. While all four demonstration watersheds provide opportunities for locally driven planning, each one emphasizes different strategies for watershed management.

The Salmon River project in Langley demonstrates ways of dealing with urban pressures while preserving natural productivity. A project coordinator has been hired with FRAP support



Population growth and urban development put pressure on streams and wetlands.

Dealing with urban pressures



Encouraging public participation

Resolving conflicts on the Nicola River

Highlighting Native involvement

Demonstrating interior wetlands

and the Langley Environmental Partners Society, a non-profit group involving teachers, students and the public, was formed to restore habitat and raise public awareness. Habitat improvements supported by FRAP include removing barriers to fish and planting trees to stabilize stream banks and reduce channel shifting. Future priorities include increasing public involvement and habitat protection.

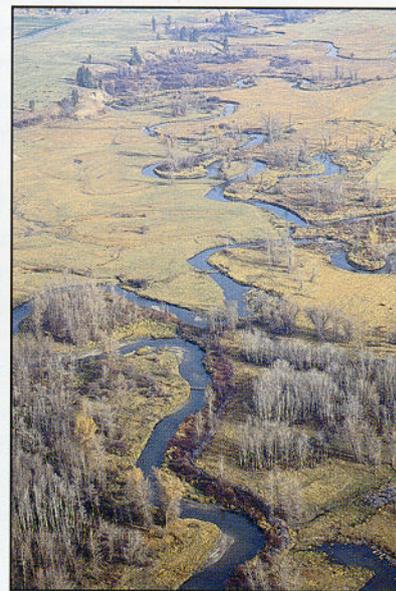
The Salmon River initiative near Salmon Arm emphasizes how to actively involve the public in land and water-use decisions. FRAP contributed to the hiring of a project coordinator, the establishment of a resource centre, habitat restoration and an educational video about the watershed. The project stabilized river banks, planted trees to provide cover and a food source for fish and wildlife and built fences to protect the river from cattle.

A demonstration project on the Nicola River near Merritt examines ways to resolve land and water-use conflicts with community participation, while maintaining economic and social sustainability. Work is in the early stages. The next steps will set priorities and find ways to involve the public.

The Nahatlatch River project near Boston Bar demonstrates First Nations involvement and the practicality of a local steward managing a watershed on behalf of multiple interests. FRAP funded an inventory of fish resources; the next phase is to protect resources and hire a steward to monitor fishing, land-use, public access and sensitive habitat.

FRAP is also a partner in the McGregor Model Forest, a Forestry Canada Green Plan project. It is also contributing to the restoration of a side-channel for fish in Prince George's Cottonwood Island Park, one of several demonstration projects recognized by the Fraser Basin Management Board.

Part of the interior wetlands program has been to create large demonstration projects, where the public can see the beneficial effects of good management practices on both grazing and wildlife. In partnership with Ducks Unlimited, the B.C. provincial government, local conservancy societies and Native bands, FRAP has developed four demonstration areas: in the Salmon River delta at Salmon Arm, Duck Meadow on Monte Creek, in the Nicola River valley and Chilcotin Marsh. Demonstrating a range of conservation techniques from ranch management practices, such as fencing and controlled grazing at Salmon River, to habitat enhancement methods for waterfowl in Chilcotin Marshes, these projects are models that can be used again in other areas.



The Duck Meadows project demonstrates the benefits of working together.

Joining forces with First Nations

Improving habitat

Contributions to science projects

Assisting fisheries management

A healthier Fraser River is not possible without the cooperation and expertise of the 96 Native bands in the basin. FRAP has strengthened partnerships with aboriginal peoples, who have had a special relationship with the river for thousands of years and continue to hold a large stake in its future.

Native groups are involved in many aspects of FRAP. The program is providing funds to these groups through the Aboriginal Fisheries Strategy, a DFO initiative designed to ensure the government's obligations to Aboriginal peoples are met while maintaining stability in other fisheries sectors. Native groups on the Fraser received \$2 million in each of the first two years of FRAP and \$3 million in 1993-94. \$3 million in FRAP funding is earmarked for each of the next three years. The following is a sample of the dozens of Native projects under FRAP:

The Shuswap Nation Tribal Council anchored trees and logs along the banks of Scotch Creek to reduce erosion and protect rearing and spawning habitat. Its members also stabilized banks along the Bonaparte River. The Nicola Watershed Stewardship & Fisheries Authority built semi-natural rearing ponds for chinook and coho fry in the Coldwater and Upper Nicola rivers to improve the survival of hatchery stocks.

The Chehalis Band sampled chum fry on their ocean migration through the lower Harrison River to assess their abundance, movement and residency in restored and natural rearing habitat. The Carrier Sekani Tribal Council contributed to research on the effect of logging on salmon stocks in the Stuart-Takla area. The band is documenting the movement of gravel and sediment through a spawning stream to determine the effects of water flow and spawning activity.

Native monitoring of salmon catches helps estimate the number of fish returning to home streams to spawn and identify changes in the rate of fish production. The Interior Indian Fisheries Commission helped to design improved catch monitoring for Aboriginal fisheries in the middle Fraser. Many Native groups were also active in stock assessment. The Chehalis Band produced detailed counts of chum and coho spawners in 34 lower Fraser tributaries, while several other groups used fish fences, aerial and ground surveys and tag recovery to improve stock and escapement estimates.



A Native researcher splits a gravel core from the Stuart-Takla watershed.

Strengthening enforcement and management

New approaches

Easing urban pressures

Cooperative planning

New approaches to development

Opening lines of communication

The Native Guardian program received funding to train members of the Lower Fraser Aboriginal Fisheries Commission, Tsilhqot'in Tribal Council and the Lheid-Lit'en Nation in duties such as monitoring Native fishery catches and salmon escapement, enforcing regulations and monitoring water quality. These activities greatly improved the management of river fisheries in 1993.

FRAP is exploring new ways of doing business in order to improve the stewardship of the basin's resources. Possibilities include establishing new working relationships with partners, improving communications and information-sharing, reducing duplication, streamlining procedures and setting common objectives.

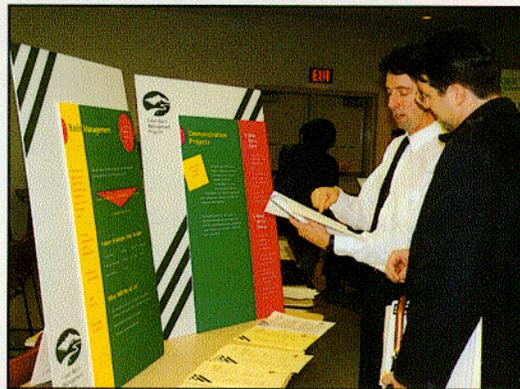
Population growth and urban development are putting pressures on the Lower Mainland environment, prompting FRAP to try to protect vulnerable urban streams. Threats to fish habitat in the Lower Mainland, which produces 50% of the Fraser's coho stocks, are considerable. FRAP and BC Environment are sponsoring workshops to engage federal, provincial, regional and municipal governments in finding better ways to protect the area's streams and wetlands, including a more efficient planning process for development. Agreements between governments, proposed changes to existing legislation and coordination of mapping and data collection are expected to result.

FRAP is actively involved in the province's land-use planning processes, such as CORE and Land and Resource Management Planning. FRAP's Integrated Fisheries Resource Management Plans for the Fraser Basin will be incorporated into the provincial planning process.

FRAP is co-producing a *Developers' and Planners' Guide to Stream Stewardship* directed at urban land developers and municipal planners. Other partners include BC Environment. A province-wide training program will promote the guide and highlight stream protection measures set out in the joint DFO/BC Environment Land Development Guidelines. Future plans include a design manual on environmentally friendly methods for developing lake, river and ocean shorelines.

Communications are an important part of the FRAP mandate. Its architects knew well that without public understanding and involvement, FRAP's goals would be hard to achieve. FRAP is about changing the way we treat our environment. It's about encouraging better management practices, less polluting industries, a population that cares enough to live within its environment in a sustainable manner. And above all, it's about all stakeholders together in partnerships to make it happen.

To accomplish this demands effective communications to reach out to people, get them involved, keep them informed and listen to their



Open houses help FRAP raise public awareness and gain public input.

input. FRAP's communications efforts have begun slowly. But the program has been expanding initiatives to raise awareness of Fraser River issues and to encourage the public to participate in the protection of the basin. Communications include:

- Open houses and trade shows, which allow FRAP to gain public input and explain its activities to stakeholders with displays, publications and a computerized video presentation.
- Publications, including three annual reports; *Discover Your Estuary*, a book that focuses on the aquatic environment of the Fraser Estuary; *Fraser Focus*, an insert to DFO's *Pacific Tidings* newsletter; as well as numerous pamphlets, handbooks, fact sheets and scientific reports.
- Educational tools, such as a video about the environmental, social and economic importance of the Fraser River, to be distributed to B.C. schools, and a Westland TV program on the Knowledge Network.
- Interpretive signs, installed at fish habitat restoration sites to explain to the public the work done and the partners involved.
- Computerized information, available through an interactive database that provides up-to-date maps and data on protected areas, and an electronic bulletin board system that contains many of FRAP's scientific reports and other publications.

FRAP Partners

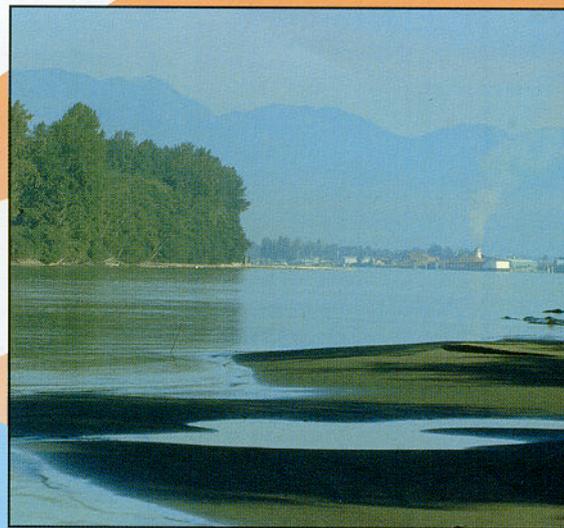
Alouette Regional Correctional Centre
 Agriculture Canada
 B.C. Conservation Foundation
 B.C. Cranberry Growers Association
 B.C. Federation of Agriculture
 B.C. Hydro
 B.C. Ministry of Agriculture, Fisheries, and Food
 B.C. Ministry of Education
 B.C. Ministry of Employment and Investment
 B.C. Ministry of Environment Lands and Parks
 B.C. Ministry of Forests
 B.C. Ministry of Health
 B.C. Ministry of Municipal Affairs
 B.C. Ministry of Small Business, Tourism and Culture
 B.C. Ministry of Social Services
 B.C. Mushroom Marketing Board
 B.C. Nursery Trades Association
 B.C. Ready-Mix Concrete Association
 B.C. Regional Districts
 B.C. Water & Waste Association
 Burrard Inlet Environmental Action Program
 Canada Heritage
 Canadian Forest Products
 Chutter Ranch
 City of Abbotsford
 City of Burnaby
 City of Langley
 City of Matsqui
 City of Merritt
 City of Prince George
 City of Salmon Arm
 City of Surrey
 Coast Agri Ltd.
 Commission on Resources and the Environment
 Delta Farmland and Wildlife Trust
 Ducks Unlimited
 Energy, Mines and Resources Canada
 Federation of B.C. Naturalists
 First Nations bands and tribal councils throughout the Fraser Basin
 Fraser River Estuary Management Program
 Fraser River Harbour Commission
 Friends of the Royal British Columbia Museum
 Geological Association of Canada
 Greater Vancouver Regional District
 Langley Environmental Partners Society
 Land and Resource Management Plans
 Malaspina College
 National Water Research Institute, Burlington
 Native and sports fishing advisory committees
 Nicola Ranch
 North Fraser Harbour Commission
 Pemberton Sportsmen's Wildlife Association
 Public Works and Government Services Canada
 Revenue Canada, Customs
 River Ranch
 Royal British Columbia Museum
 Royal Canadian Mounted Police
 Salmon Arm Bay Nature Enhancement Society
 Salmon River Watershed Round Table
 Science Council of B.C.
 Simon Fraser University
 Society for the Promotion of Environmental Conservation
 The Nature Trust
 Transport Canada, Canadian Coast Guard
 University of British Columbia
 UBC's Westwater Research Centre
 UBCM
 University of Victoria
 University of Waterloo
 West Coast Environmental Law Association
 Western Greenhouse Growers Co-op
 Westshore Terminals
 Wildlife Habitat Canada
 The Farmers of Delta and Surrey cooperating in the Greenfields project

Moving Forward

The Fraser River Action Plan is an ambitious venture never attempted before: to bring an entire river system back to a sustainable basis. As this report shows, FRAP and its partners have spent a lot of energy and effort striving toward its goals. Some of FRAP's objectives have far-reaching implications that stretch beyond the end of the program—achieving sustainability for the basin is a long-term proposition. Many challenges still lie ahead if the program is to leave its desired legacy: a management plan to ensure the Fraser Basin's continued health and viability.

Still on target

FRAP was unveiled as a six-year \$100-million initiative in June 1991. Since then, the program's budget has been reduced to about \$90-million by government restraint, and more cuts may be necessary. As a result, both DOE and DFO have had to review their plans, reallocate resources, curtail some projects and shift priorities. The original objectives, however, remain the same. But budget restraints and tight resources mean FRAP must rely more heavily on partnerships, and on the participation of the public and industry in sustainability.



Sustainability means balancing economic, social and environmental needs.

Habitat protection moves ahead

Good progress has been made in protecting and restoring fish and wildlife habitat. The next three years will see fish habitat restoration continue to expand, with 17 new projects planned for 1994-95. This includes efforts to safeguard critical but vulnerable habitat in the Fraser Estuary, increase habitat in the upper Alouette River and address water quality and quantity issues in the Nicola watershed. FRAP will also encourage public involvement in the stewardship of fish and wildlife habitat. Limited resources have hampered the push to improve compliance with habitat protection provisions of the Fisheries Act, but a strategic enforcement plan for fish habitat is under way.

The rebuilding of salmon stocks is making significant strides, and a comprehensive fisheries management plan will be in place by the end of FRAP. A great deal of work remains for the next three years to reconcile the needs of all fish species and fishing groups, biological factors and economic issues. Knowledge of the state of species and stocks has been much improved, although there are still gaps in data on chinook salmon and non-salmonid species. The last three years have also achieved a better scientific basis for making decisions on how to manage the valuable Fraser fishery and maximize its benefits.

In the lower Fraser, projects to track and protect wetland and upland bird and wildlife habitat will continue in partnership with various groups, and 1,200 hectares of farmland annually will be retained as seasonal bird habitat. Programs to increase ranchers' understanding of wetland values and promote better management practices will continue in the interior to the end of FRAP, and at least six interior

wetlands demonstration projects will be completed. And forest habitat programs will have completed work on forest management and the protection of critical forest habitats.

“Cleaning Up” moves to high gear



In the first half of FRAP, programs to clean up the Fraser River have focused on obtaining an accurate picture of the basin’s health—the sources, types and amounts of pollution, the ecosystems at risk and the effects of pollutants on them—and on the technologies to reverse the problem. Results, in general, show that the river is relatively healthy, compared to eastern rivers such as the St. Lawrence, but is threatened by growing impacts and problems that will become worse if not acted upon now.

The results also put FRAP in a good position to predict what is needed to clean up the basin. The next three years will see this knowledge put into action with new codes of practice for better management; with incentives to reduce or stop pollution; with tough new pollution regulations; with more “polluter pay” programs; with stepped-up enforcement to hit the worst polluters; and with clean-up programs at contaminated sites. After contaminated sites in the Fraser Estuary are cleaned up, FRAP will rehabilitate fish habitat in priority areas. FRAP fully expects to meet its goals of 30% reduction in pollution and a significant reduction in persistent toxic substances. And animal indicators and sentinel fish species will help monitor clean-up progress in the basin and provide a baseline for the river’s health.

Partnerships: the key to the future

A major emphasis in the next three years will be on building the partnerships that will maintain the long-term health and productivity of the basin. FRAP has begun the invaluable process of planning for the future of the Fraser Basin. Development of the management program—which must balance many key factors such as water quality, habitat, fish populations, land-use as well as economic and social factors—is advancing well. For the first time, there is a willingness among key partners to get the job done. But it is an enormous task, and much work still remains.

FRAP expects to complete Integrated Fisheries Resource Management Plans for the entire basin. But an overall management program demands the integration of many elements such as the provincial CORE planning process and the Water Act. Because many of these vital and complex pieces will likely be incomplete when FRAP ends, the management program will have gaps.

The future depends on us all

Governments alone cannot achieve sustainability of the Fraser Basin. This task depends not only on action by programs such as FRAP, but on all basin residents changing the way they treat the environment. No one can afford to be complacent—the risk from repeating past mistakes is just too great. Safeguarding the long-term benefits of the Fraser Basin calls for industries and individuals to reduce the amount of waste discharged and disposed into the environment. It also demands new ways of managing urban growth and a population willing to cut its consumption to protect resources for future generations.



The continued health of the basin demands that everyone works together.

Financial Report

	91-92 Expenditure	92-93 Expenditure	93-94 Budget
Partnerships			(\$ x 1,000)
BIEAP	232.9	335.0	336.0
FREMP	71.0	456.1	364.5
FBMP	-	513.0	586.0
Communications/ Public Involvement	58.0	146.0	283.5
Demonstration Projects	27.0	-	193.9
Basin Planning	95.5	195.7	135.0
Program Implementation	558.2	968.7	677.9
First Nations Participation	2,112.0	2,000.0	3,050.0
Sub-total	3,154.6	4,614.5	5,626.8
CleanUp			
Water Quality	-	64.0	93.2
Improved Science Base	-	-	291.8
Pollution Abatement	373.0	673.4	1,463.0
Environmental Quality	76.7	844.5	2,309.0
Enforcement	243.0	586.8	846.0
Economics	-	-	250.0
Sub-total	692.7	2,168.7	5,253.0
Restoration			
Wildlife Habitat	401.6	1,808.6	1,490.0
Geographic Information Systems	61.3	124.0	336.0
Fish Habitat Management	118.0	274.0	643.0
Fish Habitat Restoration	197.0	306.0	694.8
Fisheries Management	8.4	12.0	469.9
Improved Science Base	479.0	608.0	1,814.3
Enforcement and Compliance	48.0	249.0	361.9
Sub-total	1,313.3	3,381.6	5,809.9
Total	5,160.6	10,164.8	16,689.7
Gov't restraint	882.4	2,392.2	2,377.1
Grand Total	6,043.0	12,557.0	19,066.8

If you would like to
find out more about the
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Pour obtenir des renseignements
supplémentaires sur le
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les organismes suivants:

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Agente des communications
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