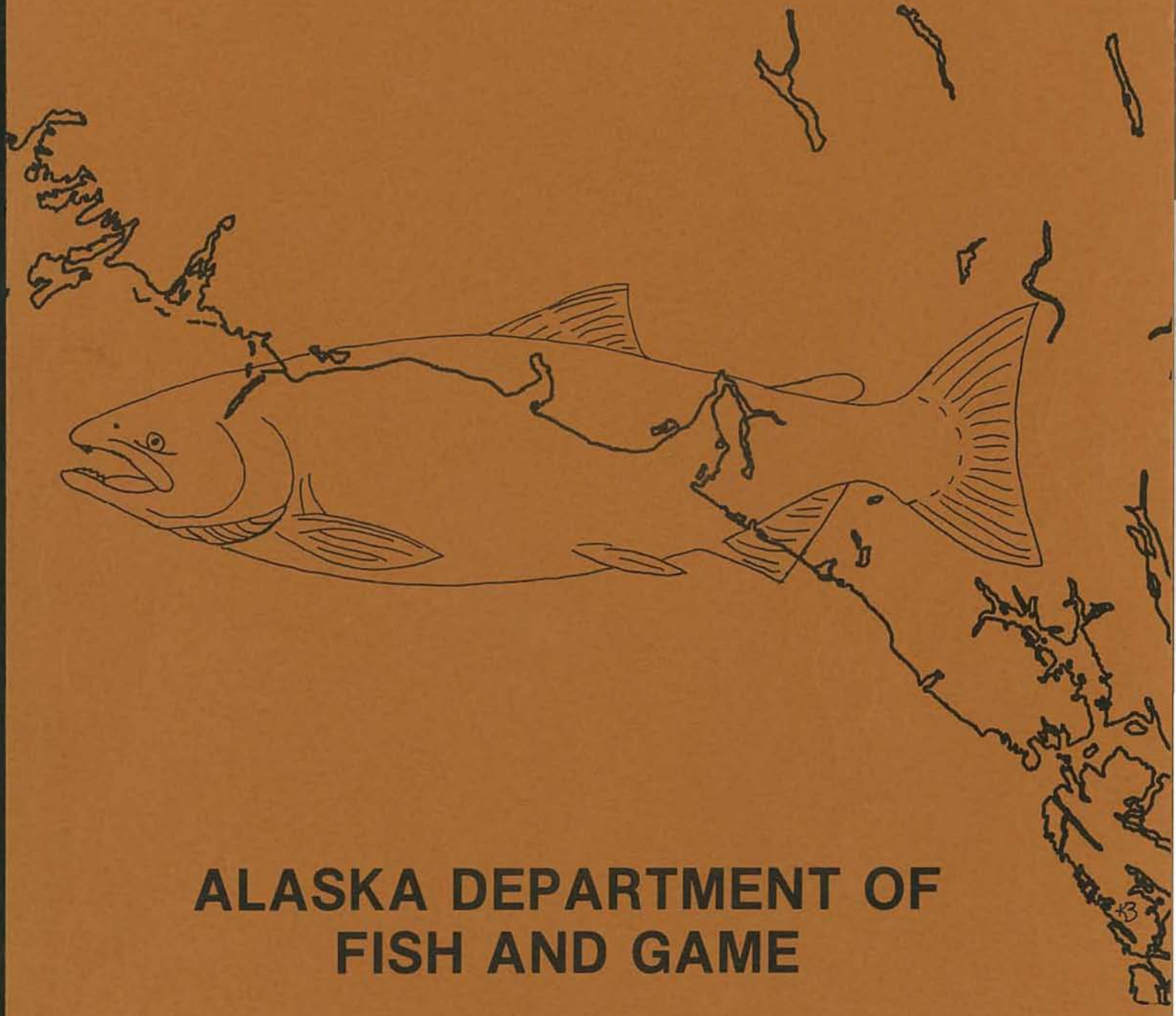
YAKUTAT COMPREHENSIVE SALMON PLAN



ALASKA DEPARTMENT OF FISH AND GAME

MARCH 1984

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

P.O. BOX 3-2000
JUNEAU, ALASKA 99802
PHONE: (907) 465-4100

March 1, 1984

Mr. Frank Ryman, Chairman
Yakutat Salmon Planning Group
P.O. Box 347
Yakutat, Alaska 99689

Dear Mr. Ryman:

This letter is to inform you, as chairman of the Yakutat Salmon Planning Group, that I have formally approved the Yakutat Comprehensive Salmon Plan.

Since the submittal of the plan for my consideration, it has undergone a process of review and comment by the Division Directors of the Alaska Department of Fish and Game (ADF&G) who are responsible for managing, enhancing, and protecting Alaska's fishery and its habitat. Previous to my review, an opportunity was provided for comment by both ADF&G technical staff and the general public, with emphasis on those associated with the fishery in user and consumer capacities.

I find that the Yakutat Salmon Planning Group has been responsive to the comments and suggestions resulting from the above-mentioned reviews.

Based on the comments I have received on the quality of the Yakutat Salmon Planning Group efforts and my review of the document, I believe that a useful and responsible document has been produced.

I offer my congratulations and appreciation to you and all members of the Yakutat Salmon Planning Group for cooperating with me and the department in producing a comprehensive salmon plan for the Yakutat area.

Sincerely,

Steven Pennoyer for

Don W. Collinsworth
Commissioner

cc: Yakutat Salmon Planning Group
ADF&G Division Directors

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF FISHERIES REHABILITATION, ENHANCEMENT & DEVELOPMENT (FRED)

BILL SHEFFIELD, GOVERNOR

P.O. BOX 3-2000
JUNEAU, ALASKA 99802
PHONE: (907) 465-4160

Mr. Don W. Collinsworth
Commissioner
Alaska Department of Fish and Game
P.O. Box 3-2000
Juneau, Alaska 99802

Dear Mr. Collinsworth:

The Yakutat Salmon Planning Group is pleased to submit for your approval the Yakutat Comprehensive Salmon Plan. This plan was developed in accordance with Alaska Statute 16.10.375 to address statewide salmon planning, and to partially address the Alaska National Interest Land Conservation Act of 1980 (ANILCA) Section 507, cooperative fisheries planning for the Tongass National Forest.

Sincerely,

Members of the Yakutat Salmon Planning Group

Michael Bethers
ADF&G - Sport Fish

Henry Porter
Yat-Tat Kwaan, Inc.

John Galazia
U.S. Dept. of Agriculture-
Forest Service

Larry Powell
Mayor, City of Yakutat

Harold Heinkel
ADF&G - FRED Division

Frank Ryman
Yakutat Fish and Game Advisory
Committee

Donald Ingledue
ADF&G - Commercial Fisheries

11-K24LH

YAKUTAT COMPREHENSIVE SALMON PLAN

Alaska Department of Fish and Game

Don W. Collinsworth
Commissioner

P.O. Box 3-2000
Juneau, Alaska 99802

March, 1984

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EXECUTIVE SUMMARY

Background

Passage of the Alaska National Interest Lands Conservation Act of 1980 has resulted in the need for comprehensive salmon planning to occur in the Yakutat area. The absence of an organized regional aquaculture association in the Yakutat area has necessitated the initiation of a planning effort by the State and Federal governments. A planning group was assembled with representatives from the Alaska Department of Fish and Game, the U.S. Department of Agriculture-Forest Service, the Yakutat Fish and Game Advisory Committee, the City of Yakutat, and the Yak-Tat Kwaan Corporation.

The planning group participated in the development of the Yakutat Comprehensive Salmon Plan, which reflects an overall mission statement committed to the increase of salmon production in the Yakutat area through sound biological practices, which will contribute to the social and economic benefit of user groups and be consistent with the public interest. The plan represents the first phase in an effort to achieve specific numerical salmon harvest goals by the year 2000 and beyond. The plan further outlines general avenues of strategy, which may then be employed toward the achievement of these goals, and sets a framework within which future cooperative efforts may be pursued.

Harvest Goals

Long-term harvest goals were derived from historic records of salmon harvested in the Yakutat area. These goals were set at or above the record 30-year average harvests and are presumed to be reflective of the

maximum productive potential of fisheries habitats in the area. Intermediate harvest goals were then derived with the expectation that they could be realistically achieved by the year 2000, given the constraints of strategy selection appropriate for the area. These goals as follows:

1. Increase the average annual harvest of king salmon to 7,000 fish, requiring production of an additional 4,000 harvestable fish.
2. Increase the average annual harvest of coho salmon to 175,000 fish, requiring production of an additional 27,000 harvestable fish.
3. Increase the average annual harvest of sockeye salmon to 225,000 fish, requiring production of an additional 66,000 harvestable fish.
4. Increase the average annual harvest of chum salmon to 13,000 fish, requiring production of an additional 2,000 harvestable fish.
5. Increase the average annual harvest of pink salmon to 140,000 fish, requiring production of an additional 30,000 harvestable fish.

Analysis of Goals

Attainment of these goals by the year 2000 will require increases in harvestable production and will still reflect shortfalls from historic harvest levels for some species of salmon.

The king salmon goal for the year 2000 requires a 133% increase over the recent (1977-1981) average harvest and will reflect a 36% shortfall from historic average harvest levels. The attainment of both the long-term and year 2000 goals for this species, through utilization of conservative

rehabilitation strategies, will require difficult and potentially restrictive harvest management decisions.

The coho salmon goal for the year 2000 requires an 18% increase over the recent (1977-1981) average harvest and will equal the historic average harvest levels. Long-term goals for this species have been set at a level that is 14% greater than the historic average harvest levels and are based on supplemental production adding to the currently healthy wild stocks.

The sockeye salmon goal for the year 2000 requires a 42% increase over the recent (1977-1981) average harvest and will still reflect a 43% shortfall from historic average harvest levels. The goals for this species will require reevaluation at the next five-year update; recent trends in harvest improvement must continue, so that intermediate goals for the year 2000 may be met on schedule. This will require a continuation of current harvest management practices.

The chum salmon goal for the year 2000 requires an 18% increase over the recent (1977-1981) average harvest and will equal the historic average harvest levels. Long-term goals for this species have been set at a level which is 15% higher than the historic average harvest levels and can be achieved through continuation of current management practices and improved marketing conditions.

The pink salmon goal for the year 2000 will require a 27% increase over the recent (1977-1981) average harvest. The recent harvest currently

exceeds the historic average harvest level and reflects the healthy condition of local wild stocks. Long-term increases will be dependent on continuation of current management practices and improved marketing conditions.

Potential Strategies

Increasing the average annual salmon harvests in the Yakutat area to historic levels and surpassing these levels for some species will require substantial investments and innovative programs to be implemented by the State, Federal, and private sectors in order to improve management techniques and habitat protection, reclaim lost habitat, rehabilitate depleted wild stocks, identify both natural and man-made factors affecting marine survival, and implement appropriate supplemental production.

The strategy options available to close the harvest gap (the difference between the current level of harvest and the year 2000 goals) are harvest management, habitat protection, habitat and wild stock rehabilitation, and supplemental production or enhancement. The greatest successes in closing the harvest gap can be achieved through implementing combinations of strategies that complement each other and provide favorable results with minimal risk and cost. Given the lack of available information on opportunities for the exercise of these strategies, research directed toward minimization of the existing data gaps will, over the life of this plan, be one of the crucial strategies necessary to coordinate the various State, Federal, and private activities that will be directed at achieving the year 2000 goals.

Goals Obtainable Through Constrained Strategies

As the historic catches for some species are considerably higher than present sustainable yields, goals for the year 2000 were set at levels that are lower than those which may be achieved over the long-term. One respect in which this plan varies from others, which have been prepared throughout the State, is that the target dates for achievement of long-range harvest goals and maximum sustainable salmon production are not specified. Instead, intermediate goals for the year 2000, achievable through utilization of conservative strategies, were set because they seem to provide a more realistic outlook for the purpose of salmon planning.

The plan assumes that no major supplemental production, i.e., hatcheries, will occur and that conservative enhancement strategies will be employed. The planning group concluded that strong habitat protection and maintenance, research on interceptive fisheries and ocean mortality, improved harvest management, and passive rehabilitation techniques would be the preferred strategies to be employed in obtainment of long-range harvest goals and would be most consistent with the expressed public interests. User groups suggested that resources be channeled towards habitat protection, management, and rehabilitation of wild stocks adjacent to the community of Yakutat. Large scale developments such as major hatcheries and the introduction of hybrid brood stocks in the area were determined to be unfeasible at this time.

The planning group felt it was important to point out that the employment of conservative management and rehabilitation techniques for rearing species may show positive results over the long-term but will, by necessity,

require a longer period of time to return to the record levels of harvest than would be needed through employment of large-scale enhancement techniques. This is due, in part, to the relative difference in availability of control opportunities that affect the survival rates of salmon at the various stages of their growth and development. The lack of predictability of salmon dispersal and migration on the high seas and the unknown and changeable impacts of adverse oceanographic and planktonic conditions, disease, natural predation, and incidental fishing mortality result in a limited availability of control and monitoring options for this stage of development, when compared to the number of options available to influence survival during incubation and rearing stages.

It is realized that the attainment of long-range harvest goals for king and sockeye salmon, through sole dependence on management and wild stock rehabilitation, could require many generations of successful reproduction and survival and, consequently, may entail indefinite periods of time. Environmental conditions and man-made factors, which influence salmon survival, must be recognized as having the capacity to greatly impact salmon production for any individual season. Rehabilitation of the area's salmon runs must be analyzed, using an average that spans many years of harvest data, in order to conclusively demonstrate favorable long-term trends in salmon production.

Considerable research will be required to select and prioritize potential management, rehabilitation, and enhancement activities and to accurately quantify enhancement and production potentials. When this level of information has been achieved, specific target dates for the attainment of the long-term goals can be set.

Analysis of Benefits Derived from Attainment of Harvest Goals

As expressed in the mission statement, the overriding assumption of this plan is that activities to increase salmon production will result in increases in the social and economic benefits to the Yakutat area. Actual quantification of such benefits is difficult and depends to a large extent on additional assumptions.

A preliminary evaluation of economic benefits arising from achievement of the year 2000 harvest goals shows a 29% increase in the adjusted gross value of salmon harvests in the Yakutat area, based on current (1981) salmon prices, current (1981) dollar values, and equally proportionate harvest increases among all salmon gear types. The adjusted gross value of the salmon fishery could, upon achievement of the year 2000 goals, increase by $880,000 (from $3.0 million to $3.9 million) annually.

Achievement of the long-range goals outlined in the plan, which are at or above the record average harvests, could result in a 59% increase in the adjusted gross value of the salmon fishery and represent a $1.8 million increase (from $3.0 million to $4.8 million--again based upon the same assumptions). It must be pointed out that these economic projections are preliminary approximations and may differ from those obtained through a detailed economic analysis.

Based on the limit in the number of participants in the set gillnet and troll fisheries, which has been imposed by the Commercial Fisheries Entry Commission, it is doubtful whether these harvest increases would directly result in more jobs in the fish harvesting segment of the local work force. As additional fish are produced, additional harvests may be

permitted, thereby increasing fishing time and the number of year-round job equivalents. In the case of sport or subsistence fisheries, increased possession limits or harvest opportunities may be allowed.

Increases in fish production and subsequent harvest increases could also result in greater activity for various support industries operating in the area, such as fish transport and processing, fishing gear sales, vessel support, and sport fish guiding.

Continuation and Implementation of Plan

The purpose of the overall planning effort is an attempt to build and stabilize fish harvests in the Yakutat area to their optimal levels and to dampen the effects of extreme negative trends in wild production. The plan will provide guidance to the Department, the Forest Service, and concerned private interests toward the development of appropriate fisheries investment programs for the Yakutat planning area.

This document represents the first phase in an overall salmon planning effort for the Yakutat area and is intended to summarize descriptive data and harvest records for the area, to formulate harvest goals for both the long-term and the year 2000, and to outline and discuss strategy options and philosophies, which may be employed in attainment of these goals.

This document will serve as the foundation upon which future phases of the planning effort will be initiated. Now that this document has been

approved and accepted by the Commissioner of the Alaska Department of Fish and Game (ADF&G), work should be initiated to divide the long-range goals into quantifiable short-range objectives specific to discreet areas and shorter time frames. The short-range objectives will be obtained through the exercise of defined strategies consistent with this document. The specific planning will then serve as the basis for future project proposals.

The planning group will make recommendations to the Commissioner that are based on the Comprehensive Salmon Plan. The responsibility of the planning group is to recommend the most effective ways to increase salmon production through methods consistent with the public interest.

CHAPTER 1 INTRODUCTION

1.1 Background

The passage of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) directed the Secretary of Agriculture to implement cooperative fisheries enhancement planning on the Tongass National Forest. Section 507(a) of the Act states that the cooperators will be the Federal Government, the State of Alaska, and "appropriate non-profit aquaculture corporations." Regional enhancement plans for Southeast Alaska (Comprehensive Salmon Plan for Southeast Alaska, Phase I, 1981, and Comprehensive Salmon Plan, Phase II: Northern Southeast Alaska, 1982) have already been written by the Alaska Department of Fish and Game and by the private, non-profit Northern and Southern Southeast Regional Aquaculture Associations. Those plans do not include the Yakutat area. For that reason, the decision was made to concentrate the initial cooperative planning effort on the Yakutat portion of the Tongass National Forest. The Yakutat and Southeast plans are then to be integrated during the next update of the Tongass Land Management Plan (1985) to reflect fisheries enhancement opportunities throughout the Tongass National Forest.

At this time, the Yakutat area does not have a non-profit, regional aquaculture association operating within its boundaries. Accordingly, planning has been implemented by the State and Federal Governments. However, throughout the planning process, it is essential to have user interests represented, just as the regional aquaculture associations are required to have a board of directors with varied user group representation.

A Yakutat Salmon Planning Group was assembled to oversee formulation of the Yakutat Comprehensive Salmon Plan. The group was comprised of representatives from the three fisheries divisions of the Alaska Department of Fish and Game and from the U.S. Department of Agriculture-Forest Service. The Yakutat Fish and Game Advisory Committee, the City of Yakutat, and the Yak-Tat Kwaan Corporation were also invited to be members. A fisheries biologist from the Alaska Department of Fish and Game was assigned to be task leader and staff planner.

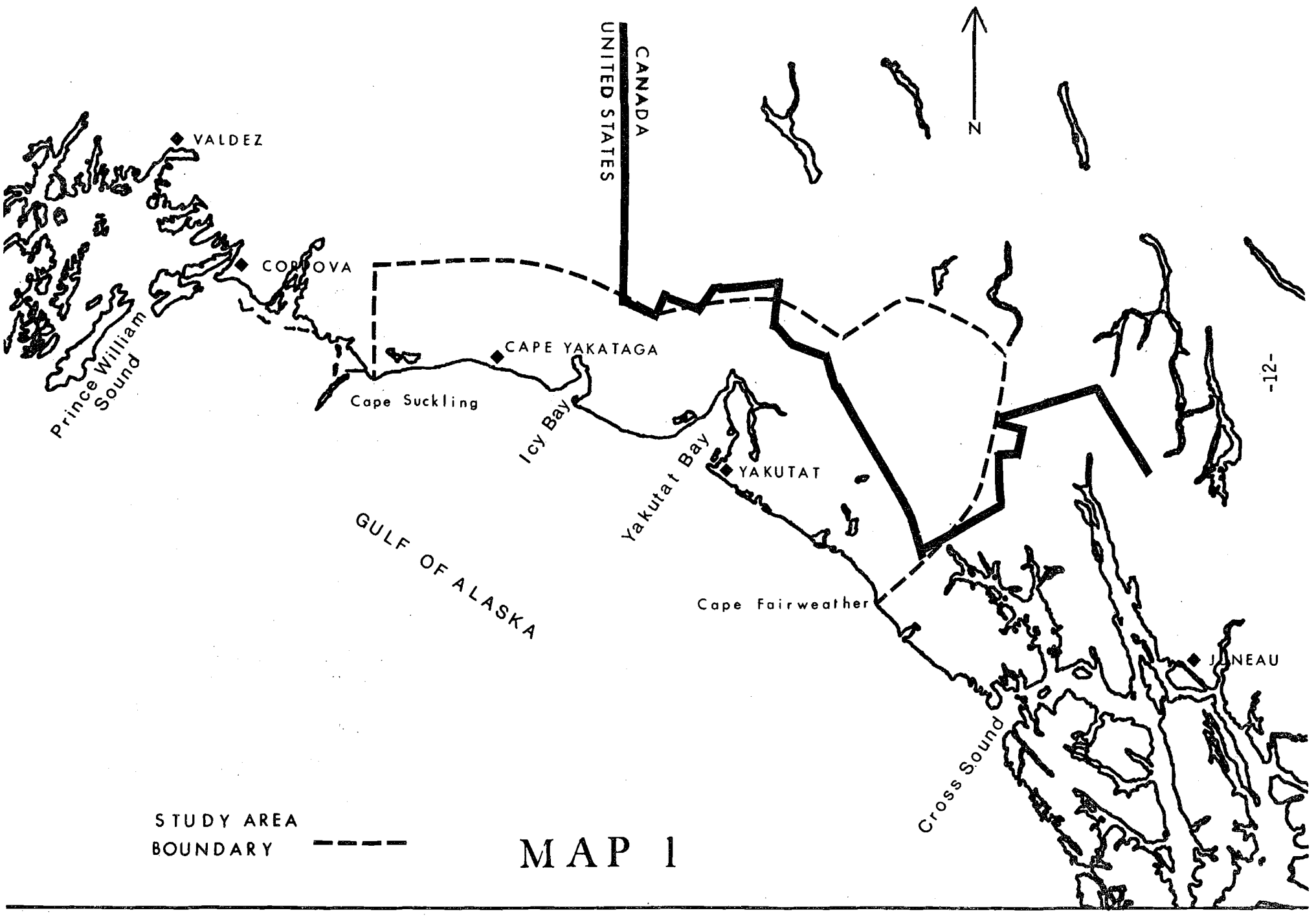
1.2 Area of Coverage

Although ANILCA mandated cooperative planning exclusively within the Tongass National Forest, the group thought it shortsighted to include only the Tongass National Forest portion of the Yakutat area. By considering the entire area extending from Cape Fairweather in the east to Cape Suckling in the west, comprehensive salmon planning for the Tongass National Forest and for the coastal areas from Dixon Entrance to Prince William Sound will be completed (Map 1). This is important since the area is an integral entity with many of Southeast Alaska's fishermen fishing throughout the entire Tongass area. Additionally, all pre-statehood historical harvest records are reported for the entire Yakutat area and often are not broken into individual systems within the National Forest. There are also geomorphological/fisheries related reasons to consider the area as a unit, as discussed in section 2.5.

1.3 Purpose

An overall mission statement was developed:

> "To promote, through sound biological practices, activities to increase salmon production in the Yakutat area for the maximum social and economic benefit of the user groups consistent with the public interest."


CANADA
UNITED STATES
N
VALDEZ
CORDOVA
Prince William Sound
CAPE YAKATAGA
Cape Suckling
Icy Bay
Yakutat Bay
YAKUTAT
GULF OF ALASKA
Cape Fairweather
JUNEAU
Cross Sound
STUDY AREA BOUNDARY

MAP 1

To accomplish this mission, the plan encompasses all aspects relating to the health and utilization of the salmon stocks and serves as a direction for rehabilitation and enhancement of salmon.

1.4 Approach to the Plan

The plan recognizes the need for long-range planning as well as the desire for concrete accomplishments in the short-term. The planning process has several phases. The first phase outlines long-range goals and strategies. From this, a number of viable projects will be specified, and a five-year action plan will be derived. This document represents the first phase and sets an outline within which future projects may be implemented.

At the March 24, 1983 meeting of the planning group, a framework for the initiation of future cooperative planning efforts was discussed, and a request was forwarded to the Commissioner of the Alaska Department of Fish and Game, seeking help in the clarification of leadership roles and the coordination of concerned agencies. These considerations are necessary, if the goal of implementing further cooperative salmon enhancement planning in the Yakutat area is to be pursued.

The approach to the plan includes a review of existing information on the salmon fishery of the Yakutat area. That information is contained in historical accounts and records and in present and ongoing data. The synthesis and analysis of these data establish the status of the fishery. The fisheries data in this plan were compiled during 1983 and represent the most current information available.

The initial draft was reviewed by all interested parties and agreement was reached on the status of the fishery, the expectations of potential harvests during the life of the plan, and the data gaps that may have to be bridged to make the periodic refinements necessary to the plan.

1.5 Public Participation

Public participation in the planning process has been implicit in the structure of the planning group. The various avenues of public interest in the fisheries resource have been represented by the State of Alaska (particularly the Department of Fish and Game), the U.S. Department of Agriculture - Forest Service, the local Fish and Game Advisory Committee, the Municipal Government, and the local Native Corporation. The intention of this structure was to provide a broad base so the public could have access to the planning process.

The initial planning meeting was held in Yakutat on June 2, 1982, to advise local residents of the plan. Following a description of the planning process and a review of fisheries enhancement methods, comments and ideas were received. At that meeting, it was suggested that the draft plan be presented to as wide an audience as possible for review, comment, and revision.

A presentation on the planning process was also made to the City of Yakutat's Planning and Zoning Commission.

The Draft Yakutat Comprehensive Salmon Plan was made available for public comment and review on April 15, 1983.

Following the 34-day period, in which the draft plan was in wide circulation for review and comment, public meetings were held in Yakutat on May 18 and 19, 1983, to receive oral comments. The planning group also met to review the written comments that had been received. Both the May 18, 1983, public meeting and the availability of the draft Yakutat Comprehensive Salmon Plan for review were extensively advertised.

At the July 11, 1983, planning group meeting, the plan was finalized, and the group voted in favor of submitting the final draft to the Commissioner of the Alaska Department of Fish and Game for approval.

1.6 Approval and Authority of the Plan

The Yakutat area has not been formally designated as a salmon production region, as specified in Alaska Statute 16.10.375. However, the Commissioner has indicated, through correspondence to the Yakutat Salmon Planning Group, that for purposes of plan development the Yakutat area will be treated as if it were a designated region.

Therefore, the responsibility for the plan is vested by the Commissioner in the planning group, who, consequently, have developed the plan and solicited public input.

Based on departmental and public review, the plan was revised and forwarded to the Commissioner of the Alaska Department of Fish and Game for review and approval. The Commissioner formally approved the Yakutat Comprehensive Salmon Plan on March 1, 1984. The plan now may be used as the official guideline for efforts to increase salmon production in the Yakutat area.

1.7 Effective Life of the Plan

To develop a meaningful plan, it was necessary to identify a period of time that serves as a framework within which specific targets could be set. The group set the year 2000, or 17 years after initiation of the plan, as the effective life of the plan. This was set partly to conform to the expected life of neighboring plans: Southeast Alaska, Cook Inlet, and Prince William Sound.

The planning document is meant to be dynamic and interactive, and it is expected that the assumptions, priorities, goals, and objectives contained therein will be verified every five years. At the time of each update, the planning group will evaluate user group needs and new data and will incorporate them into the plan. This plan is only the initial effort in what is to be a continuous planning approach. An outline of the planning and updating process is presented in Appendix A.

1.8 Key Assumptions

It is necessary that assumptions be made to conduct salmon planning. In this case they are:

1. The plan makes use of the best data available and makes valid interpretations of the information.
2. The plan does not present the total aspects of the physical/biological interactions occurring in the Yakutat area. In fact, it recognizes the necessity of developing a better understanding of the area.
3. The plan assumes that funding will be available to finance projects and to fund research programs. The programs are needed to optimize salmon productivity, using management, habitat protection, enhancement, and rehabilitation strategies.

4. As statewide salmon production increases and stabilizes, the State of Alaska and the salmon industry will develop an active salmon marketing program. Accordingly, the plan assumes that national and world markets will absorb the increased salmon production without a reduction in real price. (See Appendix 16, Comprehensive Salmon Plan for Southeast Alaska, Phase I, 1981, for an analysis of assumptions pertaining to the future salmon marketing conditions.)

5. The plan assumes that there will be a continuation of close cooperation between user groups, and State, Federal and private agencies, toward the end of providing the maximum sustainable harvest of salmon resources.

6. The plan assumes that manipulation or maintenance of land based habitat through fisheries enhancement, in conjunction with management strategies, will result in increased salmon harvests. This assumes that ocean survival and ocean food species are not the limiting factors in fish production, and that the majority of land-based wild stock habitats and carrying capacities are and will remain stable.

CHAPTER 2 REGIONAL PROFILE

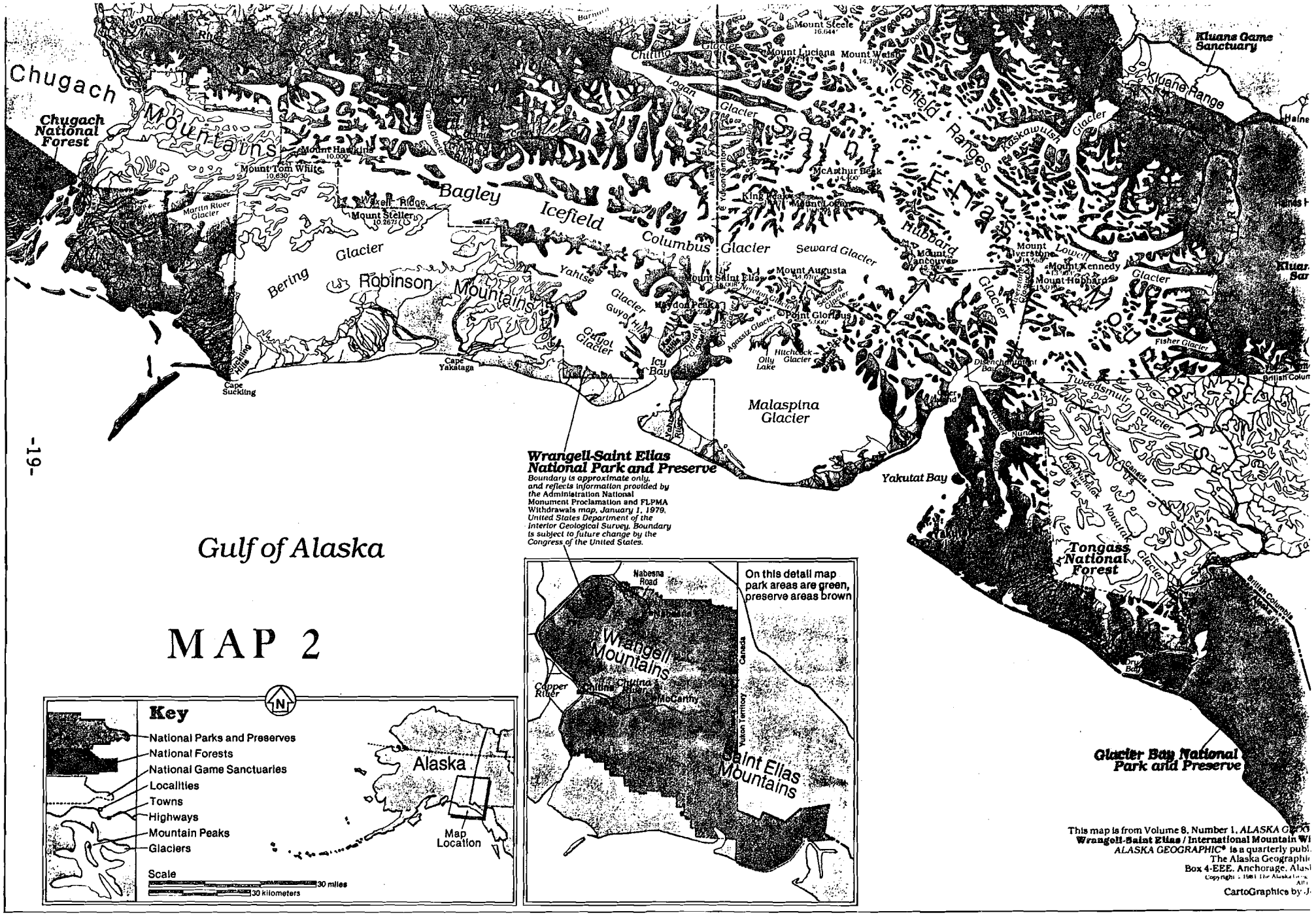
2.1 The Setting

The area considered in this planning document extends 250 miles along the northeast Gulf of Alaska coast (Map 2). It has a large concentration of mountains, ice fields, valley glaciers, and piedmont glaciers. The average width of the watershed, excluding the Alsek River, is only 40 miles and roughly correlates with the U.S.-Canadian boundary, east of Mt. Saint Elias. The watersheds include approximately 8,000 square miles in the Unites States and 11,300 square miles in Canada. The Canadian portion is primarily associated with the Alsek River drainage. Powers (1975) described the area in detail, including some of its history, geology, and biology. Some of the key points from that publication and others, particularly applicable to this plan, are covered in the following sections.

2.2 Overview of the Region

2.2.1 Major Mountain Ranges

The most massive mountain range in North America, the Saint Elias, forms the backdrop for the entire planning area. The Chugach Mountains on the west and the Fairweather Range on the east (a subsection of the Saint Elias Mountains) complete the boundaries of the area. Within the watershed are Mt. Logan--the second highest peak in North America at 19,580 ft.; Mt. Saint Elias--the third highest peak in North America at 18,008 ft., and Mt. Fairweather--the highest peak in British Columbia at 15,300 ft. Two smaller foothills, the Robinson Mountains, north of Icy Bay,



This map is from Volume 8, Number 1, *ALASKA GEO*
Wrangell-Saint Elias / International Mountain Wi
ALASKA GEOGRAPHIC® is a quarterly publ.
The Alaska Geographi
Box 4-EEE, Anchorage, Alas

CartoGraphics by J.

and the Brabazon Range, inland from the Yakutat Forelands, are separated from the main range of mountains by major geological faults and large glaciers. The physiographic nature of the region is discussed in detail by Wahrhaftig (1965) and Wright (1981).

2.2.2 Major Glaciers and Bays

Throughout the district are immense glaciers, including (from west to east) the Bering, Guyot, Malaspina, Hubbard, Yakutat, Novatak, Alsek, and Grand Plateau. The Malaspina and Bering Glaciers each total over 2,000 square miles and, at their termini, are the largest piedmont glaciers in the world. The 92-mile-long Hubbard Glacier is the longest North American valley glacier, and it has a tidewater terminus over six miles wide. The Guyot, Yahtse and Tyndall are other large tidewater glaciers. Of the 8,000 square miles of planning area watershed in the United States, approximately three-quarters, or 5,500 square miles, are primarily rock and ice.

As the major glaciers retreated inland, three large bays were left in the otherwise smooth arc of the northern Gulf of Alaska. In the 1800's, the present shoreline of Icy Bay did not exist. The modern shoreline has resulted from the rapid retreat during the last 80 years of Guyot Glacier. Similarly, Yakutat Bay is thought to have formed in the last 600 to 1,000 years by the retreat of Hubbard Glacier.

The lands from Redfield Lakes to Ocean Cape and the submarine ridge across the mouth of Yakutat Bay to Point Manby on the Malaspina Forelands are the result of Hubbard Glacier's terminal and recessional moraines.

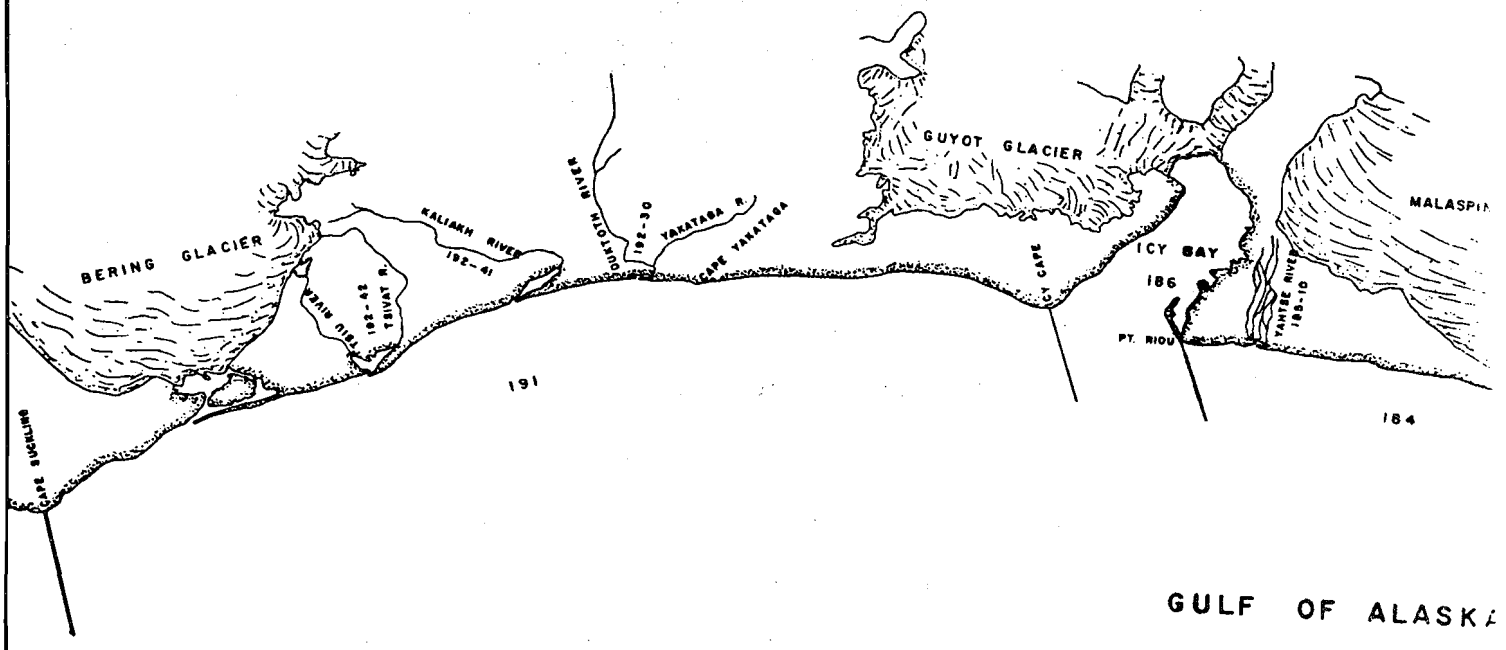
At the time of the early explorers, Disenchantment Bay, at the northern end of Yakutat Bay, was filled by the southern extremities of the Hubbard Glacier. The deep salt water fiords at the heads of Icy and Yakutat Bays are the result of glaciation, as are the broad U-shaped valleys which have been carved through the mountains. Dry Bay, at the mouth of the Alsek River, is smaller than the other bays and filled with the fluvio-glacial debris of Novatak Glacier.

A recently published volume on glaciers (Molina 1982) reviews the nature of glaciers and, specifically, the glacial history of the Yakutat planning area.

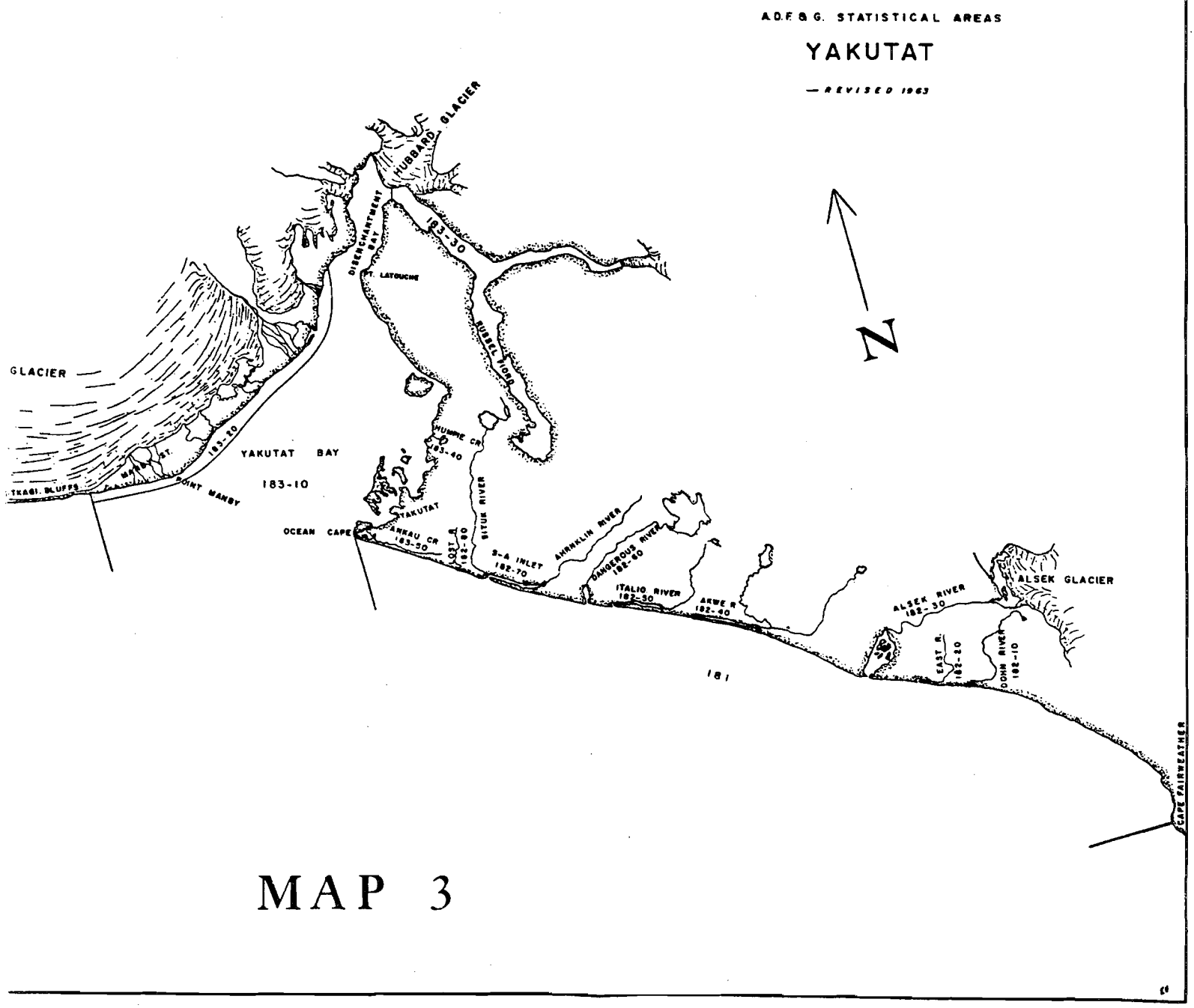
2.2.3 Major Rivers

One large river crosses the area: the Alsek. It flows from Canada to the Gulf of Alaska and drains approximately 10,800 square miles of land, of which only 300 are in the United States. It is one of few rivers that cross major coastal mountain ranges of the Gulf of Alaska perimeter, and it is the only river transecting the Saint Elias Range. It is ice-free and remains open throughout the year. The portion within Alaska is heavily laden with glacial silt.

The other rivers in the area are short with relatively low volume (Map 3). The anadromous fish production in some of the non-glacial river systems is significant. To the west are the Kaliakh, Duktoth, Tsiu and Tsivat. On the Yakutat Forelands portion are the Situk, Ahrnklin, Dangerous, Italio, Akwe, Ustay, East Alsek and Doame.


BERING GLACIER
KALIAKH RIVER
192-41
DOUGLOTH RIVER
192-30
YAKATAGA R.
CAPE YAKATAGA
GUYOT GLACIER
CAPE
ICY BAY
186
PT. RIOU
YAHTSE RIVER
189-10
MALASPI
191
184
GULF OF ALASKA

MAP 3


A.D.F.&G. STATISTICAL AREAS
YAKUTAT
— REVISED 1963
N
HUBBARD GLACIER
DISENCHANTMENT BAY
LAFOUCHE
182-30
HUBBELL FIORD
GLACIER
YAKUTAT BAY
183-10
183-20
MT. ST.
TYAGI BLUFFS
POINT MANBY
183-40
YAKUTAT
OCEAN CAPE
ANNAU CR
183-30
183-20
SITUK RIVER
S-A INLET
182-70
ANNAKLIN RIVER
DANGEROUS RIVER
182-60
ITALIO RIVER
182-50
AKWE R
182-40
ALSEK RIVER
182-30
ALSEK GLACIER
EAST R.
182-20
DOHN RIVER
182-10
181
CAPE FAIRWEATHER

MAP 3

2.2.4 Major Lakes

There are relatively few large clearwater lakes in the Yakutat area, considering the extent of the land mass. The largest lakes are glacial, including the Akwe, Bering (Seal River), Oily, Malaspina, Harlequin, Tanis, and Ustay. Many of the smaller clearwater lakes are major contributors to the fish resource i.e., Redfield, Situk, Mountain, and Italio Lakes.

With changing glaciation, lakes form and disappear. Mud Bay, at the south end of Russell Fiord, was at one time a freshwater glacial lake (known as Mud Lake) drained by the Old Situk River. It is now saltwater -- a part of the Russell Fiord. Numerous small kettle lakes remain from the terminal and recessional moraines of the glaciers. These now include the Redfield Lakes and the clear-water lakes of the Malaspina Forelands. Some of these lakes are landlocked and have no anadromous fish access, while others have intermittent access because of varying gound water levels that are often associated with intensity of precipitation, spring runoff, glacial runoff, and groundwater retention.

2.2.5 Tetonics

The entire northeast Gulf of Alaska is cut by active faults associated with the juncture of the Pacific and North American tectonic plates. Major earthquakes have occurred during recorded history throughout the area. Presently, the area is considered one of the most likely in the North Pacific for major earthquakes. Major uplift and subsidence, associated with seismic activity, have greatly changed the land forms. The 1899 series of Yakutat Bay earthquakes produced 47 feet of uplift, and is

the largest known vertical displacement ever to have resulted from one series of events. Between 1940 and 1980, 0.67 feet of uplift was recorded at the Yakutat tidal station.

2.2.6 Climate

The entire Yakutat area anadromous fish habitat is in the coastal maritime zone (excluding the Canadian portion of the Alsek drainage). Total precipitation at the Yakutat weather station averages 135 inches annually with a range from six inches in June to 21 inches in October. Snowfall has averaged 219 inches over the last 33 years with peaks in December and March. Mean year-round temperature is 39° F with a variation from 24° F in January to 54° F in July. The tremendous rainfall, mild year round temperatures and the low gradient, high water table, gravel substrates of all Yakutat area forelands combine to produce the extensive spawning and rearing areas that characterize the anadromous fish habitats found in the area's unglaciated lowlands.

2.2.7 Geology and Soils

The geology of the planning area is variable and includes metamorphic, igneous, and sedimentary rocks. Apparently, the earliest rocks in the area were formed in the Paleozoic Era, some 240 to 400 million years ago, while the majority of rocks are thought to be formed during the Mesozoic Era (65 to 240 million years ago). The large foreland plains, including the Yakutat and Malaspina Forelands, were formed relatively recently, during the Quaternary period (less than 1 million years ago).

On these relatively recent sedimentary plains, most of which have been formed by rapid accumulation of fluvial deposits since the area was last overridden by ice in the last 1,000 years, there is very little soil development. The entire soil profile over vast areas may be as little as four inches from surface to substrate.

2.2.8 Fish

Due to high rainfall, low gradients, and permeable gravel substrates, the forelands throughout the planning area are tremendous fish producers. Five species of Pacific salmon (sockeye, coho, king, pink, and chum) are harvested in the commercial, subsistence, and sport fisheries. A more complete description of these fisheries will come in later sections. In addition to salmon, there are rainbow (steelhead) and cutthroat trout, stickleback, Dolly Varden char, and smelt (primarily hooligan). Northern pike, found only in the Pike Lakes area of the Yakutat Forelands, are exclusively freshwater. The pike survived in a refugia -- a small pocket of ice-free land -- during the Little Ice Age 2,000 years ago.

In the mountains to the north of the forelands, the gradients of streams rise very steeply. Almost all the mountain streams and lakes are glacial and support little or no resident fish populations.

Salmon and halibut comprise the largest portion of the marine fisheries harvest. Shrimp, scallops, sablefish and crab (king, tanner, and dungeness) are also taken commercially. Subsistence users harvest all commercially taken species plus other assorted marine species, including herring, hooligan, clams, and seaweeds.

2.2.9 Wildlife

The Yakutat area is well known for its richness of species and concentration of wildlife. The Yakutat Forelands probably has the highest species diversity of the entire area because of its older age and range of habitats. There are some regions in the area, recently uncovered by ice, that have not yet been colonized. Much of the abundance of wildlife is also tied to the fish, including black and brown bear, numerous furbearers, and many species of migratory birds. Marine life, such as whales, seals, sealions, and birds, also depend on fish as an important component of their diets.

2.2.10 Vegetation

The type of vegetation is tied closely to the age of the land (or time since last glaciation), drainage patterns, and elevation. The lowlands, with the majority of the fish habitat, include old growth spruce-hemlock forests, willow and alder primary successional areas, and muskeg or marshland open areas. Parts of the western Yakutat Forelands and the coastal area west of Icy Bay have been commercially logged. The majority of the area is unvegetated, being principally rock and ice.

2.3 Overview of the Human Environment

In this section are those elements which relate to or arise from human activity and which may affect the salmon resource. At times these elements might seem obscure, but they can in some way affect the potential of the area to support salmon.

2.3.1 Land Status and Use

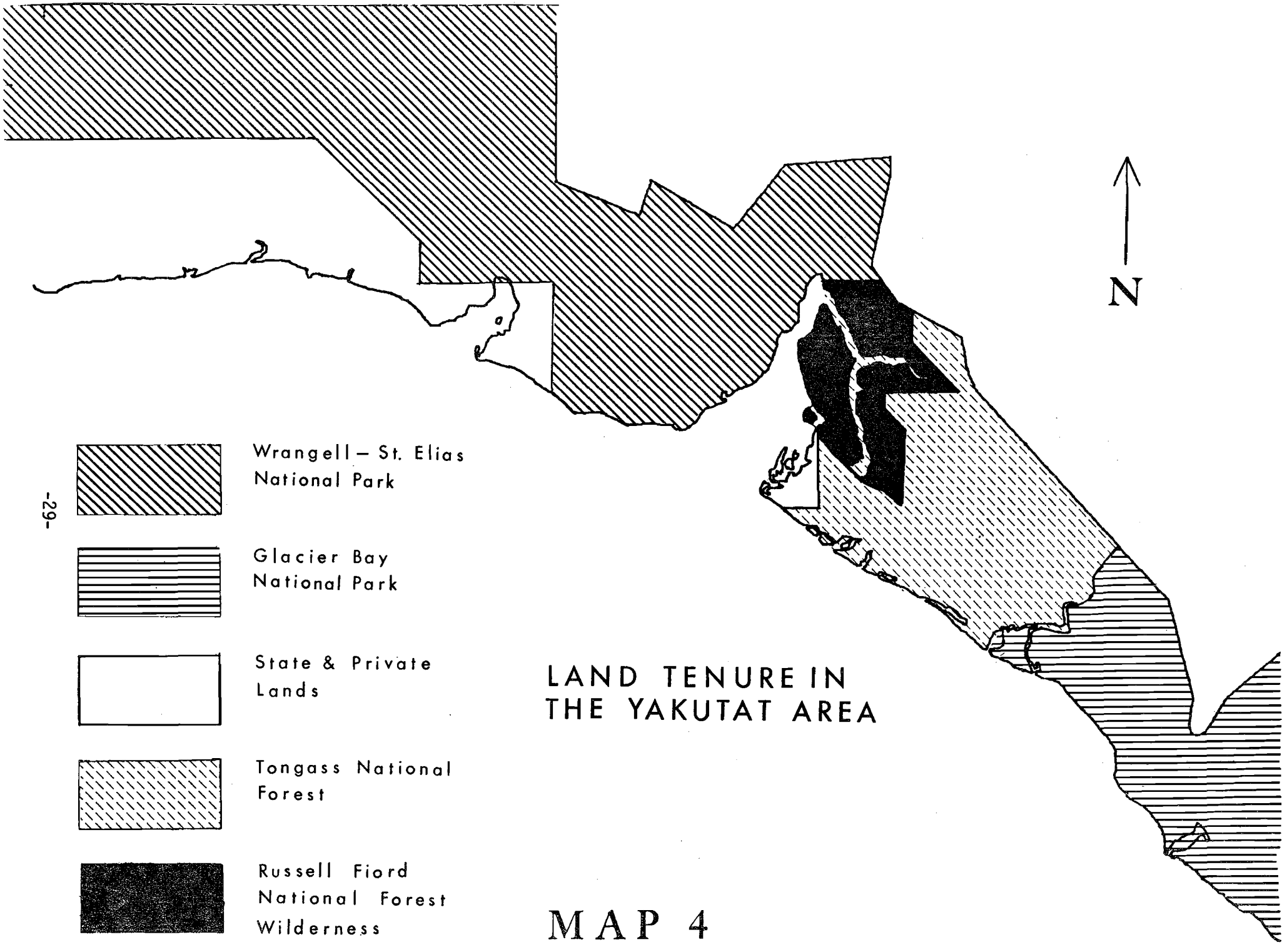
This plan and its intended accomplishments are partially dependent on land ownership and the spirit of cooperation that may be expected from the land owner.

2.3.1.1 Land Status

The majority of lands in the planning area are within Federal ownership, primarily the National Park and the National Forest Services (Map 4). The second largest land owner is the State of Alaska, followed by the Chugach Native Regional Corporation (interim conveyances) and the Yak-Tak Kwaan Corporation. The Sealaska Corporation currently holds potential selection rights in the area (Map 4B). Additional small land holders are the City of Yakutat and numerous individuals.

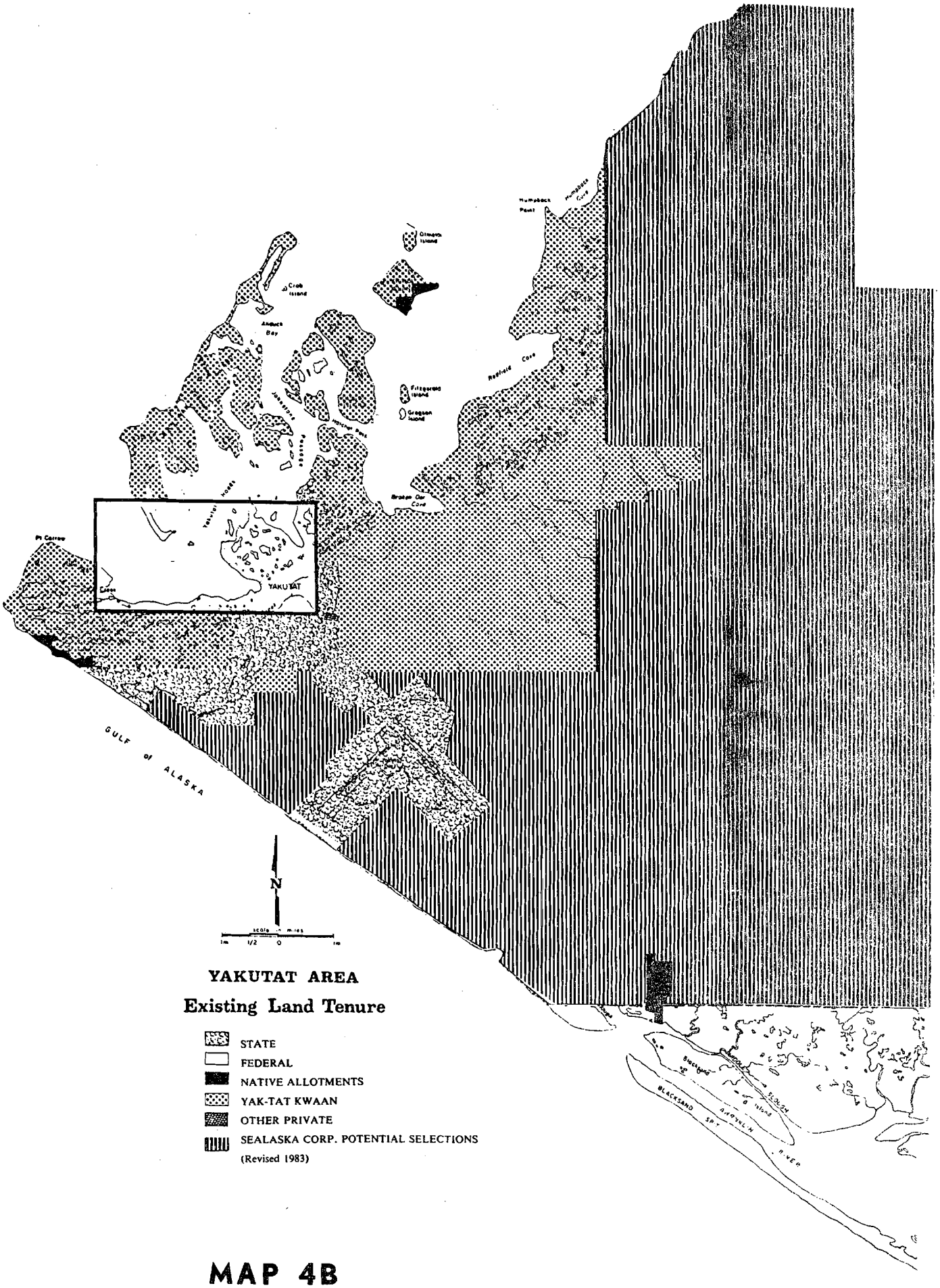
2.3.1.1.1 Federal Lands

Within each of the federal land holdings are various land use classifications. The Forest Service, through the 1979 Tongass Land Management Plan (TLMP), classified its land into Land Use Designations (LUD's), allowing different levels of development. The most restrictive classification is LUD 1, or wilderness. ANILCA designated a portion of the Brabazon Range, a small section of the Yakutat Forelands, and those areas of mountains and glaciers surrounding Russell and Nunatak Fiords as the Russell Fiord Wilderness. Within the wilderness are three major lakes - Harlequin, Situk, and Mountain - but very few fish streams aside from the Situk River and Mountain Stream. LUD 2 areas are to be maintained in a roadless state to retain their wildland character, except for very specific exceptions. The majority of the non-forested Yakutat Forelands are



LAND TENURE IN THE YAKUTAT AREA

MAP 4



YAKUTAT AREA

Existing Land Tenure

- STATE
- FEDERAL
- NATIVE ALLOTMENTS
- YAK-TAT KWAAN
- OTHER PRIVATE
- SEALASKA CORP. POTENTIAL SELECTIONS (Revised 1983)

MAP 4B

in this designation. LUD 3 and LUD 4 are to be managed for resource development: LUD 3 for a variety of uses including commercial timber, recreational development, hydroelectric power development, and fish and wildlife habitat improvement, and LUD 4 for intensive resource development such as timber harvest or mining.

Section 1315(b) of ANILCA states: "In accordance with the goal of restoring and maintaining fish production in the State of Alaska to optimum sustained yield levels and in a manner which adequately assures protection, preservation, enhancement, and rehabilitation of the wilderness resource, the Secretary of Agriculture may permit fishery research, management, enhancement, and rehabilitation activities within national forest wilderness..." This section allows fisheries enhancement in the Russell Fiord Wilderness, which was formerly illegal under the Wilderness Act.

The National Park Service has four classifications of land on the Wrangell - Saint Elias National Park and Preserve and three classifications on the Glacier Bay National Park and Preserve. For Glacier Bay, these are "park and wilderness," "park," and "preserve," while for Wrangell - Saint Elias "preserve and wilderness" is added. Regulations regarding fisheries harvest, manipulation, and enhancement have not been finalized within the parks and preserves. However, the intent of Congress is well documented in ANILCA and in the Congressional Record.

ANILCA section 205 states that "With respect to ... the Malaspina Glacier Forelands area of Wrangell - Saint Elias National Preserve and the Dry

Bay area of Glacier Bay National Preserve, the Secretary may take no action to restrict unreasonably the exercise of valid commercial fishing rights or privileges obtained pursuant to existing law ..." The Congressional Record of August 19, 1980 records the following statement: "Within National Parks, Monuments and Preserves, it is the intent of Congress that certain traditional National Park Service management values be maintained. It is contrary to the National Park Service concept to manipulate habitats or populations to achieve maximum utilization of natural resources." In summary, the National Park Service is mandated to protect commercial fishing rights in the preserves; however, it is National Park Service policy that fisheries habitat enhancement will not be allowed at this time.

2.3.1.1.2 State Lands

The majority of State land holdings in the study area are in the Yakataga District, i.e., from Icy Bay to Cape Suckling. There are also small tracts in the vicinity of the City of Yakutat. The implementation of fisheries enhancement projects on state lands is consistent with current laws and policies.

2.3.1.1.3 Native Lands

The forelands southwest of the Malaspina Glacier (approximately from the Yana River to Icy Bay) are within the regional selection of the Chugach Natives, Incorporated. Approximately 23,000 acres in the vicinity of the City of Yakutat are held by the Yak-Tat Kwaan local native corporation. The Sealaska Corporation holds potential land selections adjacent to those of the Yak-Tat Kwaan but has not filed application for permanent conveyance.

2.3.1.1.4 Other Land Holders

The City of Yakutat corporate area is approximately eight square miles, of which public lands are a very small portion. There are numerous private land holdings within the city of which the Evangelical Covenant Church of America and Yak-Tat Kwaan, Inc. are the primary owners. Throughout the planning area are small native land allotments and applications, as well as private holdings, primarily along rivers and streams. The owners would have to be contacted on an individual basis if work is contemplated that will affect their lands.

2.3.1.2 Land Uses

Throughout the planning area, land use is concentrated on the lowland areas, primarily the Yakutat and Malaspina Forelands, and the near shore areas from Icy Bay to Cape Suckling. The major existing uses and potential future uses are timber harvest, commercial fishing, oil exploration, placer mining, subsistence and sport hunting and fishing.

2.3.1.2.1 State Land Disposal

The State of Alaska has scheduled a land disposal of approximately 150 acres of subdivision and homesite lots in the Yakutat area for the 1985 fiscal year. Disposal of public lands, comprising critical habitat, will be a controversial issue in Yakutat. The City of Yakutat has made a policy decision to protect and enhance wild salmon habitat in and around the immediate Yakutat area as well as the overall zone of fishery resource influence, as identified in the Yakutat District Coastal Zone Management Plan (Alaska Consultants 1981).

2.3.1.2.2 Timber

Timber harvest is concentrated in the vicinity of the Yakutat community and to the west of Icy Bay on a narrow coastal strip of timbered State land.

In January 1981, approximately 100 million board feet of timber blew down in a violent wind storm near the City of Yakutat. These logs will be salvaged during the next five years on State, Forest Service, and Yak-Tat Kwaan land. Future logging on Forest Service Lands, as specified in the 1979 Tongass Land Management Plan (TLMP), is expected on the Yakutat Forelands as far east as Dry Bay.

2.3.1.2.3 Commercial Fishing

Commercial set gillnet salmon fishing necessitates small fishing camps in the river mouths. The highest concentration of these are in the Situk-Ahrnklin estuary and at Dry Bay. Since most areas are fished only two or three days per week, recreational use of the land occurs during the remainder of the week. Most commercial fishing camps are of a temporary nature.

2.3.1.2.4 Mineral Exploration

Both onshore and offshore gas and oil exploration have occurred in the past, while still more is planned for the future. If oil is found, it may have significant, direct impacts on the fisheries resource and, correspondingly, significant, indirect effects by increasing the population of the Yakutat area (Alaska Consultants 1976). The forelands in the entire planning area have been identified by the United States Department of

Interior, Geological Survey (USGS) as "A Most Favorable Petroleum Reserve Area."

Recent price increases in the world gold market have sparked a renewed interest in placer mining. Within the Yakutat area, interest has concentrated in the vicinity of Cape Yakataga. The State of Alaska, Department of Natural Resources currently has on file approximately 420 mining claims for this area. The majority of the claims are on the beaches.

Mining activity becomes significant when it is related to fisheries habitats. The sensitivity of newly forming spawning and rearing habitats, which are now developing following glacial recession in the Yakataga area, to alterations of the stream bed or changes in water chemistry and quality are documented (Hall 1983).

2.3.1.2.5 Subsistence and Sport Use

Subsistence and sport hunting, fishing, and gathering activity is concentrated primarily on the Yakutat Forelands, near the City of Yakutat. Sport fish guiding services operate primarily on the Situk, Italio and Tsiu Rivers, Dry Bay, and Anakau Lagoon system and specialize in king, coho, and steelhead fishing. Sport hunting guides operate throughout a much larger area. Hunting, fishing, and recreational cabins are scattered throughout the lowland areas.

2.3.2 Population/Economic Characteristics

In the planning area, Yakutat and Cape Yakataga are the only year-round communities. Less than 50 people live at Cape Yakataga. The 1980 United

States Census shows that 554 people live in Yakutat and its road-connected area.

Of these, 54% are Alaska native, 44% are Caucasion, and 2% are in other categories. In addition to the numbers listed, there are also significant seasonal increases. The most recent information (Alaska Consultants 1976) indicates that 38 'person years' are spent in fishing, 33 in fish processing, 70 in federal, state, and local government, 18 in transportation, communication, and public utilities, five in finance, insurance, and real estate, and 17 in service related jobs. Future increases to Yakutat's population will come from logging, and possibly from the development of a bottomfish industry and discovery of commercial quantities of oil and gas. For the present, however, fishing and fish processing comprise the economic base of the community.

2.4 Salmon Fishery

The history of salmon and its relationship with man in the Yakutat area began with the earliest native settlers. This section will begin with a history of Yakutat, with attributes to salmon highlighted. This is followed by a discussion of each of the fishery types (subsistence, sport, and commercial) and how they have changed through time.

2.4.1 Historical Perspective

The first outside contact with the native people in the Yakutat area was by a Russian exploring party in 1783. Early native settlements in the Yakutat area were scattered from Dry Bay to Yakutat Bay, especially the eastern shore of Yakutat Bay and the Situk River. The village of Yakutat

was not established until the late 1800's. In the early 1900's, the main part of the community moved to the vicinity of the cannery at Yakutat. The natives of the Yakutat area are primarily of coastal Tlingit origin. de Laguna (1972) has provided a detailed history and anthropology of the early inhabitants of the area.

Salmon have been a basic subsistence species for all inhabitants since the first natives settled in the Yakutat area. The commercial salmon fishery had its origin in the early 1900's, while the sport fishery became popular in the early 1960's.

The first reconnaissance for establishment of a commercial fishery occurred in the early Twentieth Century. Based on the tremendous fisheries resource found in the initial surveys, a cannery was constructed and began fish processing in 1904. Simultaneously, a railroad was built to the Situk and Lost Rivers to transport the fish to the cannery. Remnant sections, in poor repair, were still used until the 1960's when a road was built.

In 1904, the first year of major harvests, only 12 gillnets and 10 beach seines were utilized to take approximately 340,000 fish. The fishery grew rapidly with almost no (or ineffectual) harvest restrictions. In 1917, 212 fishermen with 21,000 fathoms of gear, harvested 790,000 fish. Not until 1927, with falling harvests, were enforced gear restrictions introduced and further closed periods established. Drift gillnetting, from the Situk-Ahrnklin estuary to Ocean Cape, was abolished in 1936. The devastating effect of unregulated beach seining in small rivers was recognized, and the use of beach seine gear was reduced from 1946 through

1951. The last beach seine fishery in Yakutat Bay was abolished in 1960.

Figures 1 and 2 show the historical trends of fish harvest by depicting 30-year moving average annual harvests of total fish caught and the contribution of each species or area. The data are the best available to date and combine the set gillnet, beach seine, troll, sport, and subsistence harvests. The majority of the harvest is from the commercial fishery, and the data, describing the fishery, are in the Alaska Department of Fish and Game, Division of Commercial Fisheries, Yakutat Seasonal Reports. The lowest catches occurred in the years around 1961, while the highest catches centered around 1921, near the beginning of the commercial fishery.

2.4.2 Subsistence Fishery

Most Yakutat residents depend on subsistence hunting and fishing for personal use. A recent survey showed that 56% of the households obtained at least one-quarter of their food by subsistence activities. (Environmental Services Ltd. 1983).

Subsistence fishing (the taking of fish and shellfish for personal use) has long been a tradition of the local residents (McNeary 1978). Subsistence fishing is normally not provided for during the commercial salmon fishing season. Subsistence permits are issued prior to and after the commercial season for all species of salmon, with the total permitted subsistence catch for 1975 to 1981 averaging 1,625 fish, of which there were 175 kings, 850 sockeye, and 600 coho. An unspecified number of

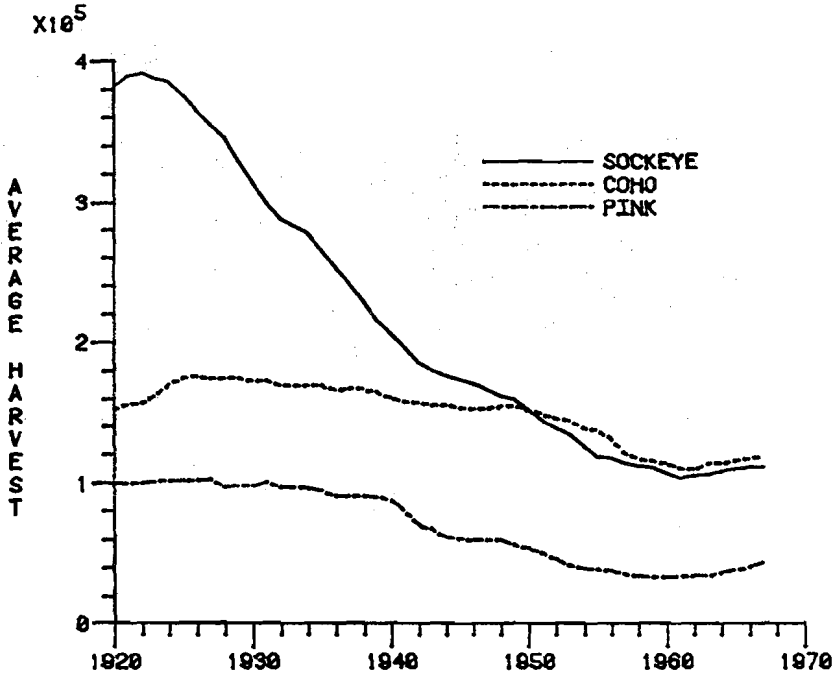


FIG 1A YAKUTAT AREA HARVEST AVERAGES BY SPECIES
(VALUES = 30-YEAR AVERAGE NUMBER OF FISH. SOURCE: ADF&G)

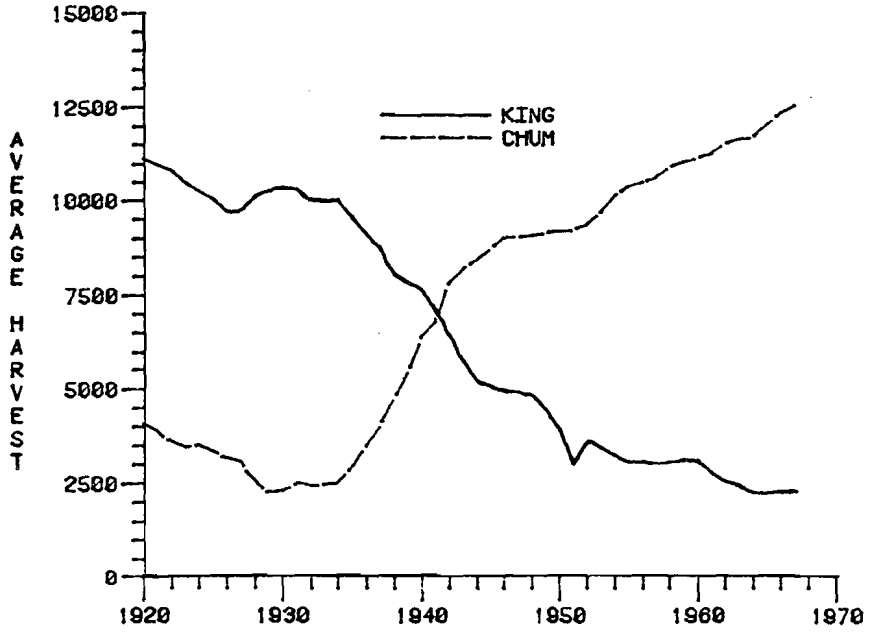


FIG 1B YAKUTAT AREA HARVEST AVERAGES BY SPECIES
(VALUES = 30-YEAR AVERAGE NUMBER OF FISH. SOURCE: ADF&G)
(TROLL-CAUGHT KING SALMON DATA EXCLUDED)

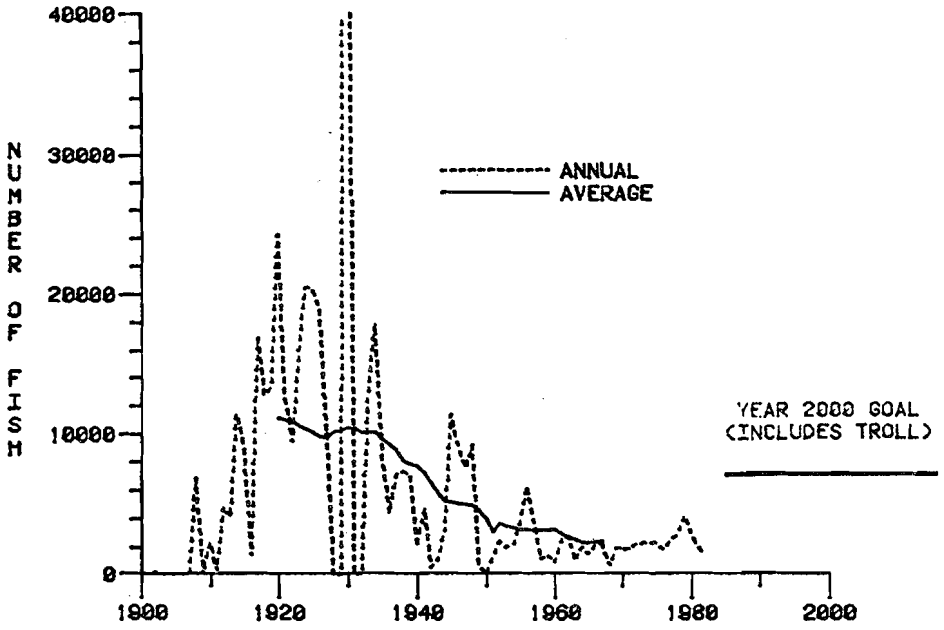


FIG 1C YAKUTAT AREA KING SALMON HARVEST. 1902-1982
(VALUES = TOTAL ANNUAL & 30-YEAR AVERAGE. SOURCE: ADF&G)
(TROLL-CAUGHT KING SALMON DATA EXCLUDED)

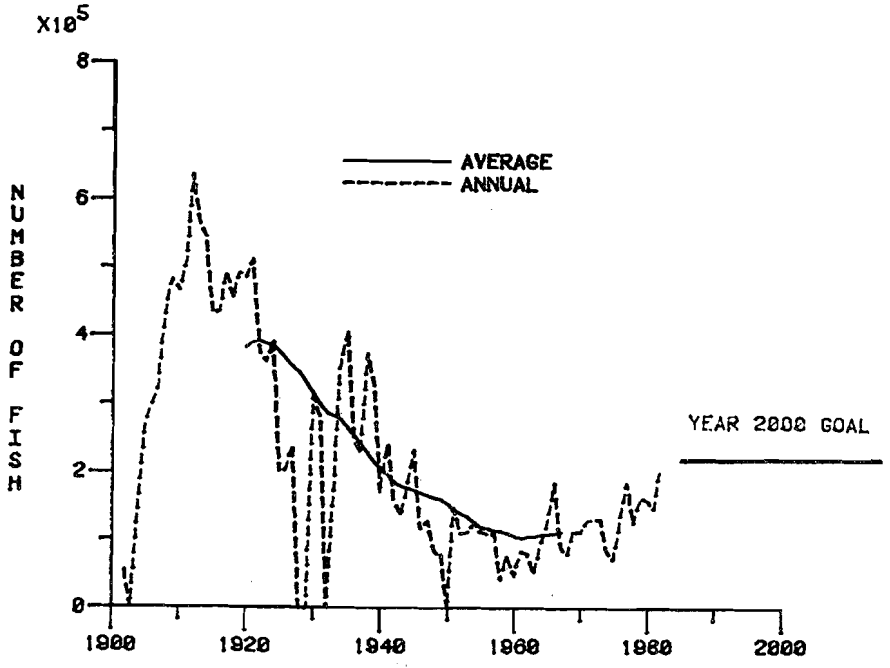


FIG 1D YAKUTAT AREA SOCKEYE SALMON HARVEST. 1902-1982
(VALUES = TOTAL ANNUAL & 30-YEAR AVERAGE. SOURCE: ADF&G)

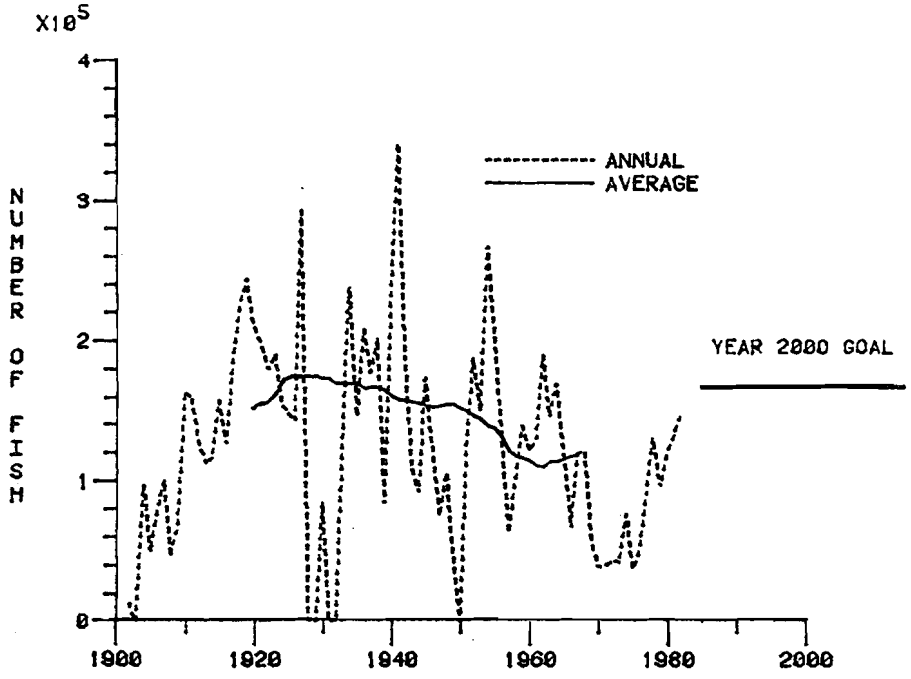


FIG 1E YAKUTAT AREA COHO SALMON HARVEST. 1902-1982
(VALUES = TOTAL ANNUAL & 30-YEAR AVERAGE. SOURCE: ADF&G)

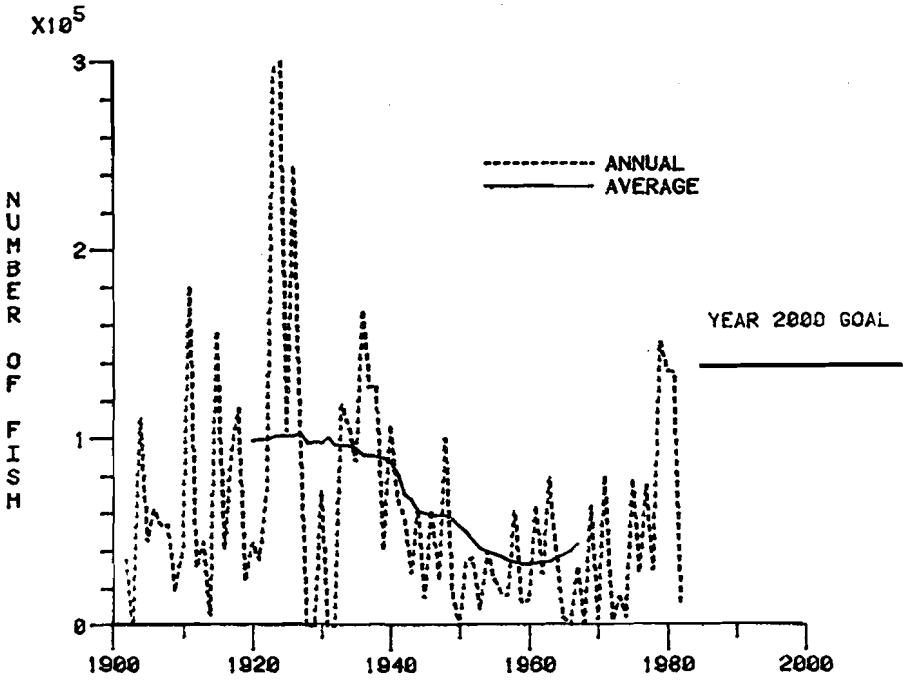


FIG 1F YAKUTAT AREA PINK SALMON HARVEST. 1902-1982
(VALUES = TOTAL ANNUAL & 30-YEAR AVERAGE. SOURCE: ADF&G)

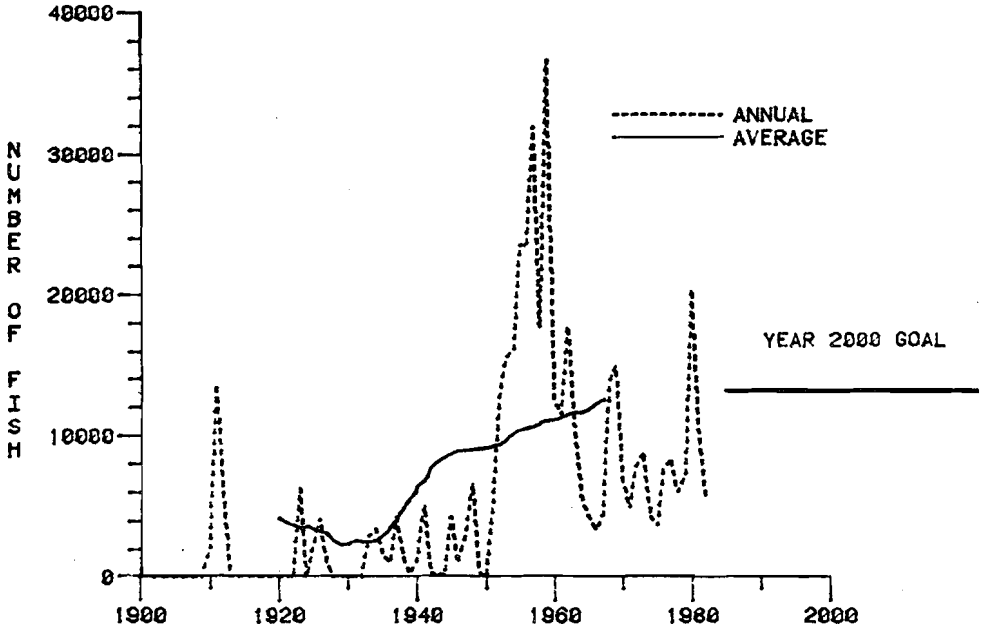


FIG 1G YAKUTAT AREA CHUM SALMON HARVEST. 1902-1982
(VALUES = TOTAL ANNUAL & 30-YEAR AVERAGE. SOURCE: ADF&G)

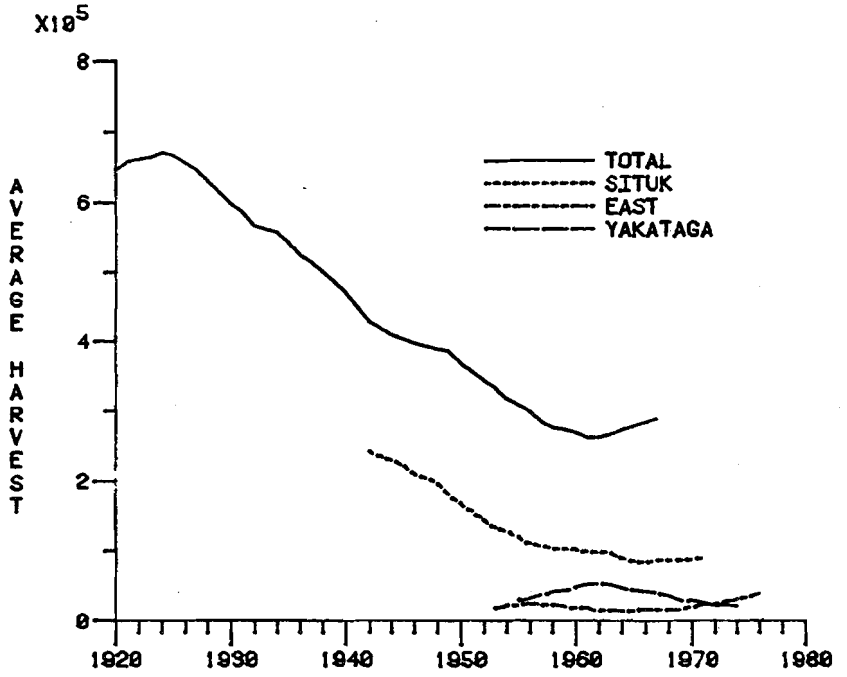


FIG 2A COMPARISON OF YAKUTAT AREA SET NET HARVEST AVERAGES
(VALUES = 10 & 20-YEAR AVERAGE NUMBERS OF FISH. SOURCE:ADF&G)

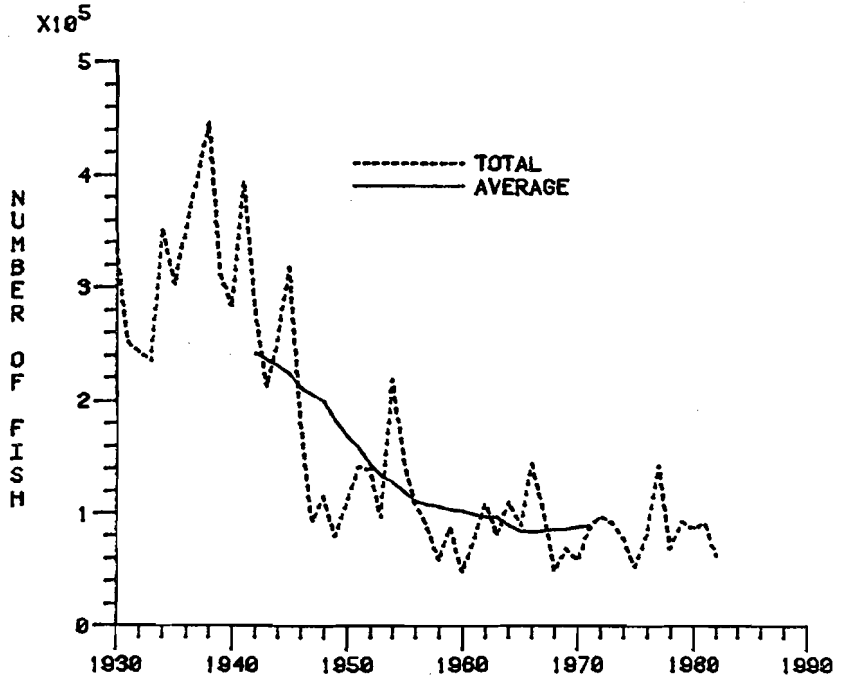


FIG 2B SITUK-AHRNKLIN TOTAL SET NET HARVEST
(VALUES = TOTAL ANNUAL & 20-YEAR AVERAGE. SOURCE: ADF&G)

pinks were also taken. State regulations specify that subsistence salmon may not be taken during the period commencing 48 hours before an opening or until 48 hours after the closing of a commercial set gillnet salmon fishing season in a river or bay fishery. However, a considerable number of fish are taken home from a fishermen's commercial catch during the fishing season.

In the Canadian, upriver portion of the Alsek River, a subsistence salmon fish trap operates seasonally. The estimated catch in this fishery for 1976 to 1982 averaged 340 kings, 5,440 sockeye, and 140 coho. A negligible catch of pink and chum salmon was thought to occur.

The future need for subsistence fish is expected to increase, during the planning period, in proportion to population increases in the Yakutat area.

2.4.3 Sport Fishery

Sport fishermen come from many foreign countries and all portions of the United States to sport fish in Yakutat's waters. The Situk River king and steelhead runs and the Situk, Lost, Italio and Tsiu River coho runs are particularly well known. The Situk is considered an excellent steelhead river with both spring and fall runs. The Yakutat area is also the only location in Southeast Alaska where freshwater king salmon sport fishing is permitted.

The Alaska Statewide Sport Fish Harvest Studies (Mills 1979, 1980, 1981) indicate that 2.73% (5,935) of Southeast Alaska's sport fish harvest and 2.68% (6,452) of Southeast Alaska's angler-days were spent annually in

the Yakutat area during the 1977 - 1981 period. The greatest harvests were of coho salmon, which averaged 2,469 fish. These numbers are only estimates that are based on questionnaires sent to a small percentage of Alaskan sport fishing license holders and are believed to be conservative. Alaska Department of Fish and Game biologists have estimated the 1982 sport harvest of coho to be from 5,000 to 7,000 fish.

With accessibility increasing from decade to decade, it can be expected that the sport fishery's pressure will increase throughout the life of this plan. However, it will be checked, somewhat, by the availability of local lodging. The Situk River is being considered for National Wild and Scenic River designation, and if designation occurs, it is assumed the sport fishery will receive increased national and world-wide attention. The Tsiu River, in the Yakataga District, is experiencing increased sport fishing pressure during the fall coho season, with chartered planes flying from Anchorage daily.

The Alaska Department of Fish and Game is currently preparing sport fish plans for fisheries in the Southeast Region (which includes Yakutat). When the Yakutat Sport Fish Plan is completed, it will provide input into the future updates of the comprehensive salmon plan.

2.4.4 Commercial Fishery

The commercial salmon fishing industry is one of the most important concerns of the people of Yakutat. The commercial fishery has been a basic part of the social and economic stability of the Yakutat area throughout the Twentieth Century. Prior to 1900, Yakutat area natives

subsisted primarily on local fishery resources and had no source of monetary income. The dependence of Yakutat's people on local fishery resources still exists and is now manifested as commercial fishing activity.

In 1981, the Yakutat commercial salmon harvest provided approximately $3.6 million (Tables 1 and 2) in gross value to the area's fishermen with the greatest dollar value in sockeye and coho.

The Yakutat area (management area D) gross salmon catch valuation is small in comparison to adjoining areas. Commercial salmon harvest value for Yakutat is 1/18 the magnitude of the value of Southeast (management area A) harvests or approximately 5% of the total value of all salmon commercially landed in ADF&G Region I (which extends from Dixon Entrance to Cape Suckling). In relation to Prince William Sound (management area E), Yakutat commercial salmon landings are 1/16 the magnitude and comprise approximately 6% of all salmon landed from both areas D and E.

These statistics should not be used to underestimate the importance of the salmon fishery to the area economy. The commercial fishing industry (particularly salmon fishing) comprises the current economic base for the area, and, as a renewable resource, it will remain an important component of the coastal economy.

There are two types of commercial salmon fishing currently permitted in the Yakutat area: troll and set gillnet. Set gillnet is primarily a terminal fishery, where the nets are placed near or directly in river and stream mouths. Interceptive set gillnet fisheries occur only in Yakutat

Table 1. 1981, Gulf of Alaska, Commercial Salmon Gross Catch Valuation[1]

Management Area	Gear Code		Value ($)
A - Southeast	01-Purse Seine		37,278,333.95
	03-Drift Gillnet		9,825,596.02
	05-Hand Troll		3,356,206.34
	15-Power Troll		15,307,672.65
	00-(Not specified)		448,831.10
		TOTAL:	66,216,640.06
D - Yakutat	04-Set Gillnet		2,648,841.79
	05-Hand Troll		97,649.09
	15-Power Troll		835,597.79
	00-(Not specified)		472.07
		TOTAL:	3,582,560.74
E - Prince William Sound	01-Purse Seine		46,103,521.05
	03-Drift Gillnet		11,469,777.77
	04-Set Gillnet		0.00
		TOTAL:	57,573,298.82
H - Cook Inlet	01-Purse Seine		6,882,516.12
	03-Drift Gillnet		10,253,032.64
	04-Set Gillnet		8,845,304.10
		TOTAL:	25,980,852.86
K - Kodiak	01-Purse Seine		26,007,596.76
	02-Beach Seine		808,386.19
	04-Set Gillnet		5,878,919.50
		TOTAL:	32,694,902.45

[1] Source: State of Alaska, Commercial Fisheries Entry Commission 3/19/83 #GXGR0050

Table 2. 1981 Yakutat Commercial Salmon Harvest Value Comparison.[1]

	HAND TROLL	Price	Price/Fish	POWER TROLL	Price	Price/Fish	SET NET	Price	Price/Fish	ALL GEAR	
King #Fish	257			14,294			2,069			16,620	# of Fish
Ave. Wt.	14.6	2.825	41.24	16.3	2.301	37.56	22.3	1.576	35.07	37.30	Ave. Price/Fish
lbs.	3748	2.825	10,588.10	233,316	2.301	536,860.11	46,038	1.576	72,555.88	620,004.09	Total Value
Red #Fish	86			64			149,573			149,637	# of Fish
Ave. Wt.	6.3	1.245	7.84	5.0	1.283	6.44	6.6	1.178	7.73	7.73	Ave. Price/Fish
lbs.	541	1.245	673.54	321	1.283	411.84	980,919	1.178	1,155,522.58	1,156,607.96	Total Value
Coho #Fish	8471			24,454			132,080			165,005	# of Fish
Ave. Wt.	8.0	1.220	9.76	7.99	1.450	11.58	10.0	.853	8.53	9.04	Ave. Price/Fish
lbs.	67,468	1.220	82,310.96	195,323	1.450	283,218.35	1,320,747	.853	1,126,597.19	1,492,126.50	Total Value
Pink #Fish	185			3,650			133,863			137,698	# of Fish
Ave. Wt.	4.2	.456	1.92	4.2	.574	2.41	3.80	.460	1.75	1.77	Ave. Price/Fish
lbs.	772	.456	352.03	15,330	.574	8,799.42	509,441	.460	234,342.86	243,494.31	Total Value
Chum #Fish	1			177			10,633			10,811	# of Fish
Ave. Wt.	6	.667	4.00	7.84	.657	5.15	9.8	.570	5.58	5.58	Ave. Price/Fish
lbs.	6	.667	4.00	1,387	.657	911.26	104,152	.570	59,366.64	60,281.89	Total Value
Roe #Fish	9,000			42,639			428,218			483,764	# of Fish
% Recovery	5.1	.951	.41	2.1	.577	.13	--	.533	.00	.02	Ave. Price/Fish
lbs.	3907	.951	3,715.56	9,353	.577	5,396.68	22	.533	11.72	9,123.95	Total Value
TOTAL #Fish	9,000			42,639			428,218			483,764	Total # Fish
Total lbs.	76,442			455,030			2,961,319			3,488,884	Total lbs.
Total Value			97,644.19			835,597.66			2,648,396.87	3,581,638.72	Total Value
Average Price/lb		1.28			1.84			.89		1.03	Average Price/Lb.
Average Price/fish			10.85			19.60			6.18	7.40	Average Price/Fish

[1] Source: State of Alaska Department of Fish and Game; Commercial Fisheries Entry Commission.

Bay. In 1974, the State of Alaska Limited Entry Program designated approximately 160 set gillnet permits for the Yakutat area.

Trolling is primarily an interceptive fishery where the harvests are of mixed origins. The local troll fleet numbers about 15 vessels, of which the majority are hand-troll. During the coho fishing season, larger boats from other Southeast Alaska areas join the Yakutat fleet, and, recently, the area has been fished by as many as 62 power-troll and 30 hand-troll vessels. Management of the commercial fishery will be further considered in the sections on stock status.

2.5 Geomorphology

A consideration of the location and topography of the Yakutat area should play a part in the framework of the Salmon Plan.

Like the adjoining coastal regions spanning the Gulf of Alaska, the Yakutat area is undergoing a large degree of topographical change when viewed on a comparative geologic time scale. The dominant causal factors for these changes result from the ongoing glacial advances and retreats and from tectonic activity along this portion of the coast. The ultimate effect, from the perspective of fisheries habitat, is a lack of long-term stability of individual spawning and rearing environments due to uplifting, subsidence, glacial blockage, and stream course change; this is manifested in the fishery by both expanding and declining populations in individual systems that are subject to otherwise similiar environmental pressures (i.e., ocean survival and fishing mortality).

With regard to fisheries rehabilitation plans for a specific salmonid system, consideration of topographic changes occurring over a hypothetical 50-year length of a useful project life may obviate the need for a particular strategy in one area through the creation of abundant new natural habitat, while creating a "no-win" situation with regards to rehabilitation in another area from irreversible habitat destruction. Yet, at the same time, habitat destruction and probable resultant loss of wild stock may then provide opportunities for salvage of donor stock and/or water supply. Careful consideration needs to be given to the cost and longevity of specific rehabilitation and enhancement investments to account for the ongoing natural changes to fish habitats. Examples of such changes and their effects on salmon populations can be seen in both the Situk and East River fisheries.

Within recent history, Russell Fiord was dammed by glaciers, whose waters exited via the then glacial Situk River (now called Old Situk Creek). The retreat of the glaciers rapidly drained the freshwater fiord (known as Mud Lake), causing a loss of sockeye rearing habitat from saltwater intrusion, unknown changes to instream water temperatures, and, ultimately, the isolation of Old Situk River from Russell Fiord.

Relieved of the tremendous weight of the ice mass, the terrain was allowed to "spring back" or isostatically rebound, i.e., uplift to its original elevation, resulting in a lowering of the water table in some areas and in increasing stream gradients in other areas. The lowering of the water table often results in the isolation of ponds and back channels that are necessary for salmon rearing. With isolation from water flows,

such channels and ponds can trap and kill rearing salmon as the water becomes eutrophic, i.e., overabundant in nutrients and phytoplankton, and, thus, anaerobic or oxygen deficient in the lower levels. Eutrophic bodies of water may eventually become choked with weeds and become meadow or marshland, and, finally, may be partially forested, completing their ecological succession.

This trend contrasts with the East-Doame River sockeye population (section 3.2.3.1), which has recently experienced an upsurge in both catch and escapements since the merging of the two rivers' outlets in 1966. This "natural enhancement" process is possibly the result of the creation of new estuarine rearing habitats, which have been advantageously utilized by the native sockeye population. Such habitat creation is not a unique or permanent event in the Yakutat Forelands as evidenced by the series of bands of upland timber and adjoining marshlands oriented parallel to the beach, which correspond to the present day beach and estuary land forms. This transition resulted from progressive progradation of the shoreline in areas of unusually high sedimentation by the building of offshore sandbars and subsequent filling with silt between the bars and shoreline. The process may have been enhanced by uplift of the land, relative to sea level, due to isostatic rebound and/or tectonic movements.

Other examples of rapid glacial advances, interacting with the fisheries, can be seen in the Yahtse River and Yakataga District coho fisheries (section 3.2.5.2.). This area has been more recently uncovered by glaciers and may be expected to exhibit pronounced colonization by salmonids and early stages of ecological succession.

Changes in land forms are common throughout the area, but the most rapid changes are near the areas with the largest glacial rivers, i.e., northwest of Yakutat Bay around Malaspina Glacier, Bering Glacier, and to the southeast near the Alsek River.

CHAPTER 3 ANALYSIS OF THE REGION'S CURRENT SALMON PRODUCTION STATUS

3.1 Introduction

The selection of goals, targets, and strategies for production of the area's salmon stocks must be based in part on current production. These numbers, when related to the historic harvest levels, apparent changes in the natural carrying capacity of the land, and the "intangibles," such as ocean survival, result in a "gap" in production.

In establishing future goals, a "present level" must be set in order to compare the future harvests. A single year's harvest is much too volatile to consider as the present level, and so a long-term average annual harvest level must be used. This plan will consider the five-year average from 1977-1981 to be the present level, while some comparisons will also use a 10-year average (1972-1981). The five-year average includes at least one entire life cycle of most species, while the 10-year average includes almost two cycles of the rearing species and as many as five of the non-rearing species.

The data used consist of summaries of large amounts of harvest data that have been collected (since 1902) for the Yakutat area. Detailed data are available from the Alaska Department of Fish and Game. The best available

data are always used in comparisons -- for instance, since 1969, harvest information is broken into set net and troll, but prior to 1969, Yakutat area troll data were limited. Also, detailed subsistence and sport fishing data are only used for 1975 to 1981. The following assumptions and data stipulations (also referred to in Section 3.2.1) are used when complete information is not available:

1. Although only post-1975 subsistence data is available, it is known that there were subsistence harvests in the past.
2. Pre-1969 Yakutat area troll data is limited. However, only in recent years has the troll harvest been a significant part of the fishery in the Yakutat area. Even recent data are of questionable value, because, although fishermen are asked to identify a specific statistical area for their catch, it is usually impossible to determine. A delivery of fish is often reported from only a general area, such as "the Fairweather Grounds," but might incidentally include some Yakutat area harvest as well.
3. King salmon troll data are not included in the harvests that are attributable to Yakutat streams. Kings harvested in the troll fishery may originate in distant streams. However, the majority of troll caught coho can be attributed to Yakutat streams and they are included in these data.
4. It is assumed that salmon are currently harvested at maximum sustainable levels on the Yakutat Forelands systems (from Yakutat to the East River). It is believed that these systems were historically fished beyond the maximum sustainable yield during the early years of the recorded commercial salmon fishery. In the past, other outlaying systems, including those in the Yakataga

District, were often underfished due to inaccessability. By using long-term averages, it is assumed that underfished years could have been compensated for by more intense fishing during other years.

Throughout their range, Pacific Salmon stocks originate from two sources: natural and supplemental production. The Yakutat area has limited production from either habitat improvement, rehabilitation, or enhancement. Appendix B lists the projects that have been completed, which are primarily located on the Yakutat Forelands.

3.2 Status of Fish Stocks

3.2.1 Introduction

In the Yakutat area, the production of individual streams and rivers has been highly variable through time (see Figure 2). This is thought to be based on the following factors: fishing pressure, the effects of rapid geomorphological change (such as uplift, advancing/retreating glaciers, and meandering stream and river channels), the normal processes of eutrophication through the accumulation of organic materials, and long-term changes in ocean survival rates.

The following section reviews the habitat and stock status of almost every major individual stream, lake, and river system. By understanding how fish are produced in each system, an assessment of the carrying capacity and projected enhancement and rehabilitation opportunities is possible.

3.2.2 Methods for Determining Status of Stocks

Data from the following sources are used to make the assessments of stock status. Most of the information originates from the Alaska Department of Fish and Game or from data that they have compiled. Limitations on use of the data are also discussed.

3.2.2.1 Commercial Harvest Reports

The commercial harvest of salmon began in the area shortly after the construction of the cannery and railroad at the village of Yakutat, in approximately 1902. Since that beginning, records have been kept of either the case pack of salmon processed (converted to numbers of fish) or the total number of fish harvested. Recently, with the advent of fish tickets and limited entry, the counts of commercially caught salmon have been quite accurate as to species, numbers, and pounds. In the troll fishery, numbers of fish caught are reported accurately, but there are often limitations in correctly reporting statistical harvest areas. Commercial harvest data used in this report are derived from Alaska Department of Fish and Game, Division of Commercial Fisheries, Yakutat Seasonal Reports.

The commercial harvest figures cannot be used as the only indicator of run strength in any given year. From year to year there are changes in the number of participants, the amount of gear and its efficiency, the number and length of openings, and the weather. If escapements were accurately known for every system, then harvest plus escapement would define production or run size. Since the commercial catch is 95-99% of

the total catch for the Yakutat area, generally, these figures alone will be used in stock status analysis.

3.2.2.2 Sport Fish Harvest Reports

Yakutat area streams are renowned for their sport fishing. The heaviest pressures are close to the Yakutat village system of roadways. Steelhead fishing on the Situk River is the most prized fishery; although in numbers of fish harvested, coho is the predominant species. In the vicinity of Yakutat, creel censuses have been conducted sporadically during recent years. In addition, data for the Yakutat area are gathered as part of a statewide sport fish harvest survey. This mail questionnaire solicits data on effort, species taken, and number caught. In the Yakutat area, there is only a limited refinement of the data into saltwater fishing (boat, shoreline) and freshwater fishing (Situk River, other streams, and lakes). The statewide harvest report is published annually by the ADF&G Sport Fish Division.

3.2.2.3. Subsistence Harvest Reports

Although considerable subsistence harvest has occurred throughout man's history in the Yakutat area, very little is known about actual numbers of fish taken. For the purposes of this plan, it is assumed that the subsistence use of fish has been relatively stable.

3.2.2.4 Escapement Monitoring

Spawning escapement is monitored in several ways. The Situk River has had a weir in place, sporadically, from 1928 to 1955, 1971, and annually since 1976. The weir forces the upstream migration through a counting

gate, where the fish are identified and enumerated. A weir on the Klukshu tributary of the Alsek River has been operated by the Canadian Department of Fisheries and Oceans since 1976. Aircraft are used to observe escapements on nearly all Yakutat area streams. Additionally, foot and canoe float counts are made on some streams.

3.2.3 Yakutat District - Yakutat Forelands, In-river Fisheries

3.2.3.1 Doame - East River

The first major system encountered north of Cape Fairweather is the Doame (also spelled Dohn, Done, Dohne, Doam) -- East (Alsek) River fishery. Until recently these were two distinct fisheries, with both rivers having separate outlets to the ocean. A powerful earthquake in 1958 uplifted the land in this area and may have reduced the flow of the Doame to the point that the outlet began to be blocked by sandbars. During the winter of 1966-1967, an ice blockage at the outlet of the Doame caused the rivers' estuaries to join into one, utilizing the East River outlet. The connecting shallows allow fish movement during most water conditions into the Doame. The systems are now managed as one fishery. The commercial fishery and allied resource uses of the Dry Bay preserve are described in detail by Gmelch (1982).

The East produces primarily sockeye and chum salmon, while the Doame produces only small numbers of coho. Figure 3 depicts the midpoints of a 10-year moving average of fish harvest, by specie, from data on the system since 1947. The graph shows a major increase in harvest level since 1964. This roughly coincides with the period when the Doame joined

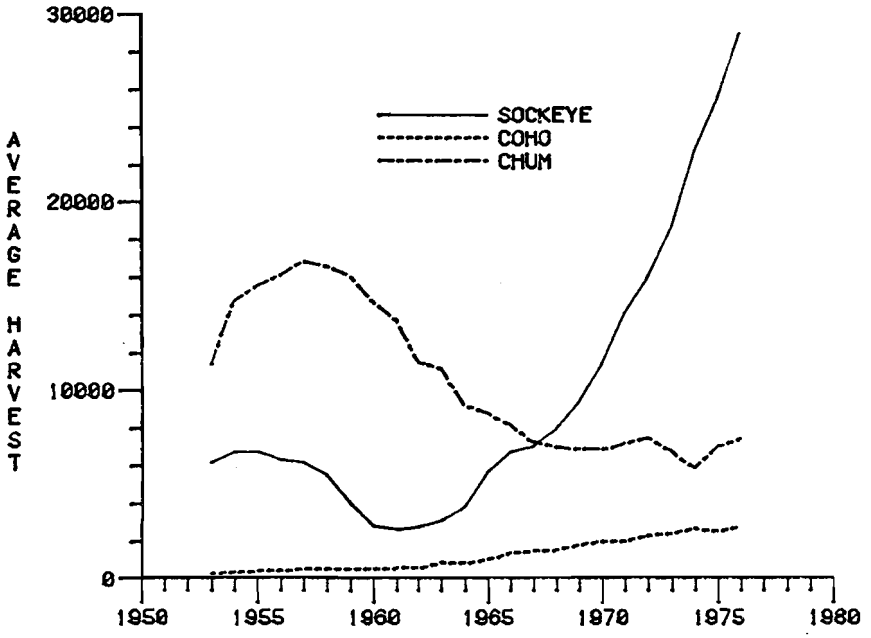


FIG 3 EAST RIVER SET NET 10-YEAR MOVING AVERAGE HARVESTS
(VALUES = AVERAGE NUMBERS OF FISH. SOURCE: ADF&G)
(NOTE: DOHN RIVER JOINED EAST RIVER IN 1966)

the East. However, the increases cannot be accounted for by the addition of the Doame fish, since they consisted of only 27% (based on 1956-1965 average annual harvest) of the total harvest. The increase in available fish has also increased the numbers of fishermen. In 1947 there were four fishermen, while in 1981 there were 58.

The productivity of the East River is based on groundwater upwelling. Water from the Alsek River infiltrates into the Alsek's south bank, immediately downstream from Gateway Knob, and eventually resurfaces as overland flow at the headwaters of the East River. Chum salmon are known to prefer this type of groundwater upwelling system.

Coho prefer the higher gradient spawning beds and abundant rearing space of the Doame River. During the 10 years (1956-1965) prior to joining the East, the Doame produced seven times the coho of the East.

This relationship probably still exists. At Lower Doame Lake, the Doame River flows only during the wetter periods of the year, thus limiting access to the lake and, hence, sockeye production.

As the last section of this chapter illustrates, although fish numbers in many Yakutat Forelands streams are considerably depressed over the long-term, the East-Doame population has been rapidly increasing. This may be related to the effects of changes in the hydrological characteristics of the area.

3.2.3.2 The Alsek River

Complicating the management and stock status assessment of the Alsek is the transboundary location and the glacial nature of the river. Commercial fishing occurs only in the United States, at Dry Bay. In Canada only subsistence and sport fisheries occur.

Escapements and fish production are difficult to assess in the glacial waters of the U.S. Total production is estimated from index counts made at a counting weir on the clearwater, Kluckshu River tributary in Canada. The 1972-1981 average annual U.S. commercial harvest was approximately 36,000 fish, of which there were 1,500 kings, 27,000 sockeye, and 7,500 coho. The 1976-1981 Canadian harvest in the subsistence fishery averaged about 350 kings, 5,450 sockeye, and 150 coho. Over the long-term (50 years), the annual harvest of sockeye has remained relatively stable, while king and coho harvests have reduced dramatically.

It is presumed that about one-half of the Alsek River coho production is from United States creeks on the west side of Dry Bay (Cannery, Clear, Williams, etc.), while the majority of sockeye and king salmon spawn and rear in Canada.

3.2.3.3 Akwe - Ustay Rivers

The Akwe - Ustay system of clear and glacial lakes, rivers, and streams covers over 100 square miles of land. Tanis Lake and River are also indirectly connected to the system as is the Alsek River by Muddy and Cannery Creeks, which flow into both the Akwe and the Alsek. Large numbers of sockeye and coho and smaller numbers of king, pink, and chum

salmon are harvested in the Akwe commercial fishery. Akwe Lake is the system's main sockeye rearing lake with lesser numbers rearing in Ustay Lake. Abundant coho rearing habitat exists in the miles of streams, beaver ponds, and small lakes.

The 1972-1981 average annual commercial salmon harvest was approximately 15,700 fish, including 80 kings, 7,800 sockeye, 7,400 coho, 290 pink and 130 chum. During the time period from 1977 to 1981, a doubling of both sockeye and coho harvestable surpluses over the previous five-year period occurred, with an accompanying increase in fishing pressure. Although sport fishing is uncommon on the Akwe, the system has potential for increased sport fish use.

The estuarine area of the river parallels the beach for approximately 10 miles before opening to the ocean. Potentially, the Akwe could eventually erode west to join the Italio River, resulting in unknown changes to both the Italio and Akwe River mouths and the need for new fishery management strategies.

3.2.3.4 Italio River

Historical salmon harvests in the Italio are six times the 1972-1981 average. Beach seine gear was fished extensively in the Italio along with set gillnet gear until 1946, when only set gillnets were allowed. The Italio was closed to set gillnets from 1963 until 1973; it now opens by emergency order. Only recently has production made a comeback, following the gear reductions and closures. Sockeye, coho, and pink salmon

are the primary contributors to the commercial fishery harvest. Small numbers of chum salmon are also taken.

Sockeye salmon rear in Italio Lake -- a crystal clear lake nestled in the mountainous foothills of the Brabazon Range. Until 1977, a waterfall partially blocked migration of fish into the Lake. At that time, the USFS and ADF&G cooperated in an effort that blasted a stepladder falls in the rock nearby, bypassing the main waterfall. Sockeye now ascend to the lake with little problem. In the 1930's, large sockeye runs entered the Italio and, in some way, must have ascended the falls.

The north fork of the Italio River decends in a 60 foot waterfall that is a barrier to anadromous fish. The area above the falls supports only resident populations of rainbow trout and Dolly Varden.

The 1972-1981 average annual harvest has been approximately 7,500 fish, including 1,175 sockeye, 4,900 coho, and small numbers of pink and chum. Total stream escapements have averaged 25,000 fish, which reflect the large number of commercially unharvested pink salmon. The 1977-1981 average annual sockeye harvest has been approximately 1,300 fish with an escapement of 11,000. Sockeye numbers appear to be increasing rapidly and may be more pronounced in the future with the returns from the Italio Falls laddering project. Pink salmon are harvested only incidentally to the sockeye and coho fisheries. Sport fishing use of the Italio has increased noticably in the last five years and is expected to increase in importance in the future.

3.2.3.5 Dangerous River

The Dangerous River is glacial and has no major tributaries. Its source, Harlequin Lake, in which the Yakutat Glacier terminates, is also fed by several clearwater streams that are utilized by sockeye and coho. The commercial fishery has been sporadic, ranging from no effort most years to a harvest of over 1,000 coho. Very few sockeye have been harvested from the Dangerous River.

3.2.3.6 Situk - Ahrnklin Rivers

The Yakutat area commercial fishery began with construction in 1902 of the Yakutat and Southern Railroad from the new cannery to the Situk River. Since that time, the Situk-Ahrnklin fishery has been the "bread and butter" of the village of Yakutat.

The watershed has been ideal for salmon production. Spawning and rearing occur in the many miles of small, stable, groundwater fed streams, the major river systems, and in the Situk, Redfield, and Mountain Lakes. Schmidt (1981) studied the potential fish yield in lakes and found that Mountain and Situk Lakes had the second and third highest productivity of 25 lakes measured in Southeast Alaska.

All five salmon species inhabit the Situk system. All have followed a similar decline and stabilization in harvest numbers since 1930, when the earliest records for individual fishing areas began (Figures 4A and 4B). The record average harvest of sockeye in the Situk-Ahrnklin fishery is believed to have occurred during the early years of the commercial salmon fishery in Yakutat, but this can only be inferred from comparison of data

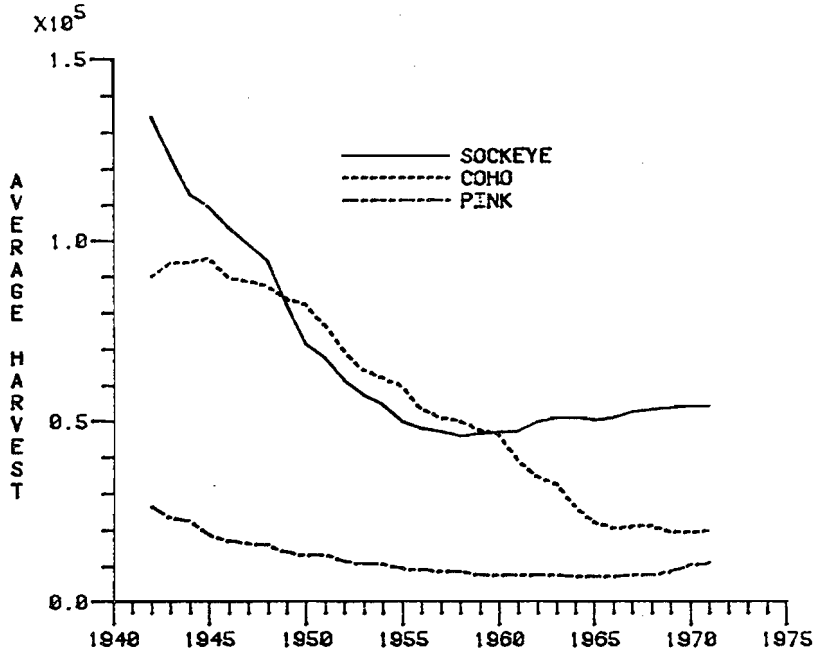


FIG 4A SITUK-AHRNKLIN SET NET 20-YEAR MOVING AVERAGE HARVESTS
(VALUES = AVERAGE NUMBERS OF FISH. SOURCE: ADF&G)

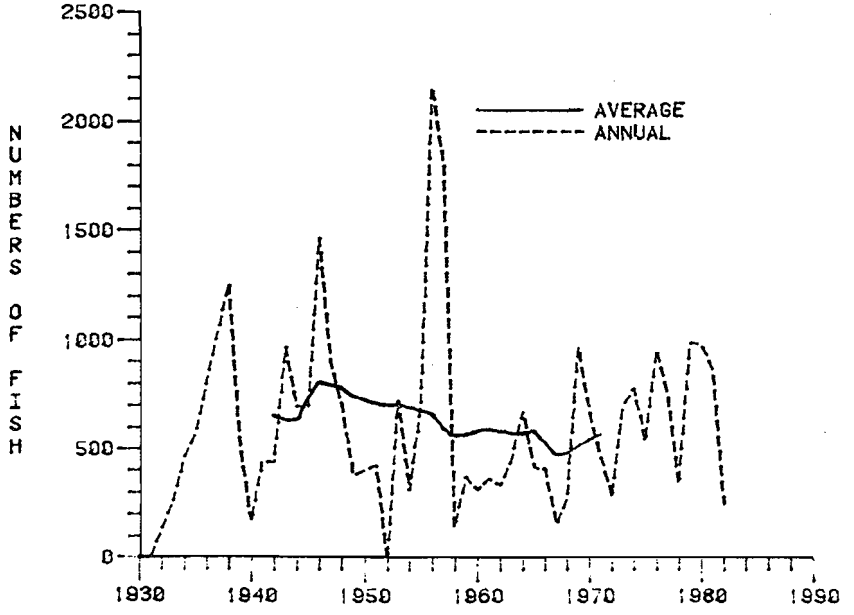


FIG 4B SITUK-AHRNKLIN SET NET KING SALMON HARVEST
(VALUES = ANNUAL & 20-YEAR MOVING AVERAGE. SOURCE: ADF&G)

on the relative contribution of the Situk-Ahrnklin to the Yakutat area total harvest (Figures 1D and 2A). It is assumed that the sockeye harvested from the Situk-Ahrnklin comprised a major portion of the total harvest from the Yakutat area. The highest recorded annual harvest of sockeye in the Situk-Ahrnklin fishery occurred in 1938 when approximately 278,000 fish were harvested by both set gillnet and beach seine, while the highest 20-year moving average harvest of 134,000 sockeye occurred between 1930 and 1953 (midpoint = 1942). The recent (1977-1981) five-year average harvest of sockeye in the Situk-Ahrnklin fishery was 45,000 fish.

Coho harvests in the Situk-Ahrnklin show the same overall trend. The highest recorded annual harvest of coho occurred in 1941 when 197,000 fish were harvested by both set gillnet and beach seine. The record 20-year moving average harvest of 95,000 coho occurred between 1934 and 1956 (midpoint = 1946). The recent (1977-1981) five-year average harvest of coho was 27,500 fish.

King salmon harvests in the Situk-Ahrnklin are small in comparison to other species but are an important species to all user groups. The record harvest occurred in 1956 when 2,160 kings were harvested in the set gillnet fishery. The highest 20-year moving average harvest of 809 kings occurred between 1935 and 1957 (midpoint = 1946). The recent (1977-1981) five-year average harvest was 784 fish.

The total 1981 commercial set gillnet harvest in the Situk-Ahrnklin fishery was approximately 93,000 fish, with an estimated value in excess of

$500,000. In addition to this, Situk fish are harvested in the Yakutat Bay interceptive fishery (Section 3.2.6.2.).

On the long-term, average harvests of sockeye seem to be rebuilding, while king salmon averages are maintaining a constant level, and coho are stabilizing at their 1960 low levels (Figure 4). Pink salmon have returned in large numbers in recent years, but harvests have been minimal due to their timing overlap with the more profitable sockeye fishing season.

The Situk-Ahrnklin was historically fished by beach seine, set gillnet, and drift gillnet. The drift gillnet fishery involved six to eight boats, which fished 250 fathom drift gillnets, setting their nets near the river mouth and picking them at the end of the drift near Ocean Cape. This fishery was closed in 1936. Beach seines were fished off the mouth of the river until 1951, when they were prohibited.

A substantial sport fishery has developed on the Situk, partially due to increased accessibility by road and plane. Primary sought species are steelhead, king and coho. Approximately 4,500 angler days of sport fishing effort were expended during 1981 in the Situk River (Mills 1981). Estimated average annual sport fish harvest for 1977-1981 was approximately 4,000 fish, associated with 2,200 angler days. (USDA-FS 1981). In addition to the commercial and sport fisheries, the Situk River provides one of the major subsistence fisheries for the community of Yakutat.

Logging has occurred on the watershed since the 1950's. Since that time a total of 488 acres, in three tracts, have been commercially clearcut. In January of 1981, a major windstorm blew down approximately 2,250 acres of timber in the Situk drainage. This timber will be salvaged in the next five years. In conjunction with road building, two rearing ponds have been constructed in the watershed, and three more will be built in the next one to three years. These ponds benefit rearing coho salmon, rainbow trout, and Dolly Varden.

Fish caught in the Situk-Ahrnklin fishery cannot be separated by stock of origin, although it is estimated that the Situk accounts for 80% of the sockeye and 40% of the coho production. Fish habitat in the Ahrnklin watershed is mostly non-glacial. Sockeye Creek, a non-glacial tributary to the Ahrnklin, has substantial runs of sockeye and coho, with sockeye rearing in lakes on the upper watershed. Substantial blowdown occurred in Sockeye Creek during the windstorm of January, 1981. Following minor debris removal, no impact on adult salmon migration could be detected.

There are numerous other small creeks that feed the Situk-Ahrnklin estuary, including Kunayosh Creek and the three branches of Seal Creek. All of these creeks support runs of pink and coho. Due to the mixed nature of the stocks from the Situk, Ahrnklin, and other tributary streams in the Situk-Ahrnklin estuary, it is possible for the fishery to overharvest the smaller systems. This may have occurred in Kunayosh Creek, where production has decreased dramatically for no known reason.

3.2.3.7 Lost River, Tawah Creek, Ophir Creek

The Lost River system watershed has been the most disturbed by human activity of any watershed in the entire Yakutat study area. Within this watershed lies most of the City of Yakutat, including the airport and associated roads and housing. The first impacts occurred in 1902 with the building of the Yakutat and Southern Railroad from Yakutat to the Situk River. A major impact in the early 1940's was the construction of a large airport, roads, and housing for a World War II garrison of over 10,000 troops. Oiling of ponds and DDT application for insect control probably had an adverse impact on the system's fish production potential. The area supported both a beach seine and set gillnet fishery until 1951 when only set gillnet gear was permitted.

Total salmon production of the watershed is now one-third to one-quarter the 1938-1942 period, with declines for all harvested species. In recent years, sport fishermen are often elbow to elbow along the lower river, fishing for coho.

Major impacts have occurred to the fisheries habitat of the system. Eutrophication has reduced habitat, principally in the Coast Guard Lake and the Tawah and Ophir Creek areas. The decrease in sockeye production from historical harvests of 12,000 fish to approximately 4,500 is probably directly associated with this effect. One other major impact is man.

Due to Yakutat's extraordinarily high seasonal water table, drainage ditches were constructed near the airport and all major roadways. The construction of these facilities and ditches have bisected and rerouted

numerous streams. The new resultant streams are also excellent fish spawning and, to a limited degree, rearing habitats. The question of whether this is a net benefit or significant detriment cannot be answered at present. Harvest records indicate considerable decreases in production at the time of the road and airport construction, however, this occurred at the same time as a general decrease in fish harvests throughout the Yakutat area. Man has also impacted vast acreage in the watershed by timber harvest, primarily during the 1960's and 1970's. The effect of thousands of acres of clearcuts on the watershed is unknown, although it may have resulted in increased sediment in streams and decreased retention of water in the water table. Eutrophication, relocation of streams, and timber harvest may all contribute to the decreased productivity of the Lost River system. The area is of special importance to many of the people of Yakutat, as indicated in their proposal for its nomination as an "Area Meriting Special Attention" as part of the Alaska Coastal Zone Management Program (Alaska Consultants 1981).

3.2.3.8 Ankau Lagoons and Creeks

Located on Phipps Peninsula, southwest of the City of Yakutat, and on the southeastern corner of Yakutat Bay, the Ankau salt chucks, lagoons, and creeks are a significant part of the local sport and subsistence fishery. This area has also been nominated as an "Area Meriting Special Attention."

The Ankau is primarily a saltwater lagoon with substantial tidal exchanges. It is used primarily for the schooling of migrating king, coho, and Dolly Varden that are destined to spawn in other systems. However, significant coho spawning and rearing occur in the freshwater portions of the Ankau.

Historically, fish traversed the Ankau and Coast Guard Lake to enter Ophir Creek, in addition to accessing Ophir Creek from the Lost River. The Ankau Lagoon and Ophir Creek are presently connected at all water levels.

Ankau fish are taken commercially as part of the Yakutat Bay fishery, although they probably contribute only a small percentage of the harvest in that fishery. This fishery is reviewed in section 3.2.6.2., describing mixed stock and interceptive fisheries. The Ankau also serves as the major subsistence producer of coho for the Yakutat community.

3.2.3.9 Humpback Creek

The outlet of Humpback Creek is a historic native village site, which was located to harvest the creek's pink salmon run. Although there are no known historic records, recent production has surged. During the 1970-1974 period, the total average annual production was 20,000 fish, while the recent average increased to 110,000 fish with a peak annual production of 158,000 fish. Such production is impressive for a stream averaging 15 feet wide and less than two miles long.

The recent turnabout in fish production came following stream improvement in 1974, when 50 check dams were constructed within the stream to retain spawning gravels. Since that time, the dams have been annually maintained. Debris was cleared from the stream following the widespread blowdown of January, 1981. The Forest Service is currently studying the feasibility of further rehabilitation or enhancement projects in this area.

3.2.4 Yakutat District - Malaspina Forelands, In-river Fisheries

The Malaspina Forelands include approximately 100 miles of shoreline from Esker Stream, near the head of Yakutat Bay, to the Chaix Hills in Icy Bay. It is a rapidly changing environment; recent advances and retreats of the Malaspina and Guyot Glaciers have affected both the terrestrial and aquatic environments. Lakes and streams are sometimes clear and turn glacial, or vice-versa, which result in changing fish habitat quality. With changing glacial conditions, new lakes are formed in potholes in the glacial ice, while old lakes drain and disappear. Around 200 years ago, the now small but productive Yahtse River was the major bay and drainage at the west side of the Malaspina Glacier. Salmon habitat will continue to change until the area stabilizes. There are numerous small streams along this section of coastline. Most will be covered in the following sections, starting at Esker Creek in Yakutat Bay and traversing northwest to Icy Bay.

3.2.4.1 Manby Shore Streams (Esker, Sudden, Kame, Oscar, Manby and Alder Streams)

The Manby (also spelled Mamby) Shore streams encompass about 40 miles of shoreline along the western portion of Yakutat Bay. Many of the streams originate as springs of the upwelling melt-waters of the Malaspina Glacier. The clear, upwelling waters are primarily populated by coho and sockeye. Salmon also traverse glacial Sudden Stream and Malaspina Lake to enter clearwater tributary streams and lakes. New habitat will continue to form as the Malaspina recedes and additional streams clear.

The streams' surplus fish production is harvested on the outside beaches in conjunction with the Manby Shore interceptive fishery. The actual harvest figures are included in section 3.2.6.3.

Recent escapement counts for coho in the Esker to Sudden Stream systems (about eight small streams, some of which are glacial and in which salmon cannot be seen) have averaged 5,600 fish during the 1975-1981 period. Manby Stream has averaged 1,500 coho and 900 sockeye during the same period. Alder Stream, at the west end of the Manby Shore, is almost entirely glacial and has very low production. It too could increase in capacity and productivity with glacial recession.

3.2.4.2 Fountain Stream

Fountain Stream is an unproductive glacial stream that drains the Malaspina Glacier. A small, clearwater, upwelling tributary parallels the beach near Fountain Stream and is a good coho producer.

3.2.4.3 Yana Stream

The Yana is another of the drainage streams for the Malaspina Glacier. Almost all its tributaries are glacial and non-fish producing. Extensive rearing area on the western side of the Yana may be used by fish spawned in the Yahtse River.

3.2.4.4 Yahtse River

Although most of the Yahtse is glacial, a few branches are clear and are very good coho producers. The majority of coho spawning areas are in the stream portions paralleling the coast at the eastern side of the

braided system and in a few of the streams at the west end of the system. The latter originate far from the glacier. Upwelling at all locations provides ideal spawning habitat.

The five-year average annual harvest for 1977-1981 was approximately 7,800 coho, about 18% less than the 1951-1963 10-year average annual harvest of 9,500 fish.

3.2.4.5 Icy Bay Systems

Small clearwater coho systems originate from upwelling waters at the south and the north ends of Riou Bay. Other systems, north of these and extending to the head of Icy Bay, are mostly glacial. The Priest River, on the western shore of Icy Bay, supports a small fishery for coho.

3.2.5. Yakataga District - Icy Cape to Cape Suckling, In-river Fisheries

The Yakataga District is bound to the east by the Guyot Glacier and to the west by the Bering Glacier and the Robinson Mountains. There are two distinct geographical areas in the District: Icy Bay to the community of Cape Yakataga and Cape Yakataga to Cape Suckling.

3.2.5.1 Icy Bay to Cape Yakataga

Along this section of the Gulf of Alaska, about 25 small streams originate from a low coastal ridge that lies parallel to the coast. The lowlands of this area have been barren of glaciers long enough for mature timber to have grown along the base of the ridge from tidewater to approximately

400 feet elevation. Approximately half of the lowlands have been logged as part of a recent State timber sale.

The streams in this section are only minor fish producers, with production often limited by glacial turbidity, gradient, and length. The Big River supports coho; Davis Creek supports pink, and the creeks from Muddy Creek to Crooked Creek may have coho, while the other systems are mostly glacial.

3.2.5.2 Cape Yakataga to Cape Suckling

This section of the Yakataga District is characterized by relatively long rivers and streams and by systems that are fed by upwelling springwaters. Coho comprise the majority of the fish spawning in the Tsiu, Tsivat and Kaliakh Rivers. Rearing takes place in numerous beaver ponds in both main and tributary channels and in a few small lakes. The Tsiu and Tsivat are upwelling systems, however, production of species other than coho or pink is minimal.

The highest 10-year average annual harvest of about 56,000 fish occurred in 1958-1967, falling off sharply in the late 1960's when the Bering Glacier terminus moved forward one-quarter mile and dumped large amounts of silty water into the main Tsivat spawning beds. The glacial water disappeared in 1970, and the 1977-1981 five-year average annual harvest was 31,000 fish, approximately 55% of the highest 10-year average.

The Kaliakh River is mostly glacial, however, the clearwater Kulthieth River tributary produces large numbers of coho. The Kulthieth provides

excellent spawning beds in the upper reaches and good rearing habitat along much of its length.

Other streams and rivers in this section of the Yakataga District are relatively small producers. Many are primarily glacial, with some clearwater tributaries. These clearwater tributaries usually support fish. The glacial systems include the Yakataga, Duktoth, Seal, and Tashalich Rivers. Eight Mile Creek, a clearwater system at the western boundary of the Yakutat study area, occasionally supports a small commercial fishery for pink and coho salmon.

3.2.6 Interceptive Fisheries

Interception occurs on the fisheries primarily unassociated with individual stream or lake systems. The harvest in these fisheries is composed chiefly of multiple stocks. Yakutat area fisheries are generally non-interceptive, as they occur within rivers or near their mouths. The traditional coastal interceptive fisheries in the Yakutat area are the Yakutat Bay and Manby Shore set gillnet fisheries and the troll fishery. An interceptive drift gillnet fishery was closed in 1936.

3.2.6.1 The Troll Fishery

Both hand and power troll gear is fished in the coastal waters of the Yakutat area. Unlike the Yakutat set gillnet fishery, in which a limited entry permit allows one to fish only in the Yakutat area (from Cape Fairweather to Cape Suckling), the Statewide troll permit holder is allowed to fish throughout the entire Southeast Region (from Dixon Entrance to Cape Suckling).

Trollers in the Yakutat area predominantly harvest kings and coho. Harvest statistics are available only since 1964, although trolling in the area is known to have occurred before that time. The annual king harvest has been stable, while the coho harvest has fluctuated dramatically. The king salmon troll harvest between 1977 and 1981 averaged 9,300 kings, while the coho harvest averaged 14,500 fish during the same period, with a low of 2,200 to a high of 31,400 fish. The king salmon harvested by troll gear are assumed to be primarily non-local stocks, while most of the coho salmon harvested are of local origin.

3.2.6.2 Yakutat Bay Fishery

The present day Yakutat Bay fishery is a set gillnet fishery along the eastern shore of Yakutat Bay. The area fished is from Ocean Cape to Humpback Creek. The fishery has two major components: the terminal fishery near the mouth of Humpback Creek (which accounts for the large harvest of pink salmon) and a truly interceptive fishery along the eastern outside waters of Yakutat Bay, targeting on mixed stocks of fish. The interception occurs as fish travel toward streams in the Yakutat Forelands. Yakutat Bay was the last area where beach seining was permitted. The seine fishery was used effectively to harvest pink salmon. Beach seining was abolished in Yakutat in 1960.

The total Yakutat Bay set gillnet catch for the years 1977 to 1981 has averaged 89,000 fish with a species distribution of 77,000 pink salmon, 10,500 sockeye salmon, 1,000 coho salmon, and less than 100 king and chum salmon.

3.2.6.3 Manby Shore Fishery

The Manby Shore set gillnet fishery occurs both within Yakutat Bay and in Sudden and Manby Streams along the western shore. The fish caught along the shore are thought to originate primarily from Yakutat Forelands streams. The Manby Shore fishery, during the 1977 to 1981 period, averaged 9,100 coho and 8,300 sockeye.

3.3 Overall Stock Status: Historic to Present

A brief history of the Yakutat salmon fishery, presented in section 2.4 and shown in Figure 2A, shows that until the early 1960's there was a general decrease in salmon harvests, and from that time on, there has been a similar increase in production. Overfishing of easily accessible fish systems in the early 1900's probably accounted for the long-term drop in harvests. Establishment of sustained yield harvest principles, beginning in the 1960's, and wider utilization of remote systems (now facilitated by aircraft) have probably led to the recent upward harvest trends. The largest increases have come in pink and chum salmon production. These species, the least desirable to the commercial fishery, may have been historically underfished.

CHAPTER 4 GOALS AND GAPS

4.1 Introduction

The attainment of a sustained salmon harvest equal to or greater than the record long-term average annual harvest is the long-range goal of this plan. This number should approximate the sustainable yield from the natural environment, assuming no detrimental habitat alterations

occur and improved fisheries management is implemented. Throughout the following discussions a goal will be set for the entire Yakutat area salmon fishery, and targets will be set for individual species.

4.2 Assumptions

A number of assumptions are made in establishing this goal:

1. The existing salmon habitat, on an area-wide basis, has not appreciably changed in the last 80 years and will not change over the long-term. Although individual systems may naturally produce less than historical numbers of fish, other systems are now becoming more productive. The sum of all the changes in the systems, when applied to present-day salmon habitat in the Yakutat area, would show that the current production potential remains equal to the historic potential of the entire area. In some instances, rehabilitation may be necessary to regain historic sustainable harvest levels in lakes and streams.
2. Past, present, and future ocean food supplies for salmon are not a limiting factor and ocean survival is essentially constant.
3. No major genetic changes have occurred to lessen the fish productivity potential.
4. No incurable diseases have infected the natural stocks.
5. No major change in the interceptive nature of the salmon fisheries, operating either within or outside of the planning area, has occurred.

6. The record 30-year moving average harvest value for each species reflects the harvestable portion of the maximum sustainable production potential of the natural habitat for that species.
7. No major supplemental production (i.e., hatcheries) will occur. Goals will be obtained primarily through exercise of strategies to manage and maintain healthy wild stocks, to rehabilitate wild stocks where necessary, and to protect fisheries habitat.

4.3 Harvest Goals and Targets

The long-range goal is based on the record 30-year moving average annual harvest since the beginning of commercial harvest in the Yakutat area. The goals for the individual species vary from their record 30-year average annual harvest due to changing demand, known or presumed changes in the carrying capacity of the natural systems, the availability of appropriate enhancement technologies, and the cost efficiency of enhancement or rehabilitation for that species.

Table 3 is a listing of the long-range goals and an interim target for the year 2000. Also listed are the dates and respective harvests of the record 30-year moving average annual harvests.

4.4 The Harvest Gap

The difference between present harvest levels and the goals set for the year 2000 is known as "the gap." The gap represents a shortfall in fish which is reasonable to span by the year 2000, assuming that limitations in strategy employment will occur. A breakdown of the gap, by total fish and individual species, is listed in Table 4.

Table 3. Record 30-year moving average annual harvests, and goals and targets for future harvests of Yakutat area fish. All numbers rounded to the nearest 1,000.

	King	Coho	Sockeye	Chum	Pink	Total
Record 30-yr. average annual harvest[1]	11,000	176,000	392,000	13,000	103,000	670,000
Years of record	1904-37	1910-43	1906-39	1952-81	1911-44	1908-41
Long Range Goals[2,3]	10,000	200,000	295,000	15,000	150,000	670,000
Year 2000 intermediate targets[3]	7,000	175,000	225,000	13,000	140,000	560,000
Long Range as % of record	91	114	75	115	146	100

1 Troll king salmon harvest data excluded.
2 Values represent estimates of potential harvestable production.
3 To include troll king salmon harvest when determined.

Table 4. Present average annual harvest compared to year 2000 goals and targets. All numbers rounded to the nearest 1,000.

	King	Coho	Sockeye	Chum	Pink	Total
1972-1981 average annual harvest[1]	3,000	101,000	134,000	9,000	68,000	312,000
1977-1981 average annual harvest[1]	3,000	148,000	159,000	11,000	110,000	427,000
Year 2000 goals[2]	7,000	175,000	225,000	13,000	140,000	560,000
1972-1981 average as % of year 2000 goal	43	58	60	69	49	56
1977-1981 average as % of year 2000 goal	43	84	71	85	79	76

1 Troll king salmon harvest data excluded.
2 To include troll king salmon harvest when determined.

4.5 Analyses of Goals and Gaps

Analysis of Table 4 shows that attainment of the year 2000 goal requires a 79% increase of the 1972-1981 10-year average annual harvest and a 31% increase of the 1977-1981 five-year average annual harvest. Harvest goals for individual species, as compared to the 1972-1981 average, will require increases ranging from 133% for king salmon to 44% for chum. The recent 1977-1981 five-year average shows that coho have already increased by 47% over the 1972-1981 10-year average and would now require an 18% increase over the 1977-1981 five-year average to reach the year 2000 goal.

There follows a discussion of the factors considered in setting goals for each species.

4.5.1 King Salmon

In analyzing the gap, note that the year 2000 goal and present harvest level data do not include king salmon taken by the troll fleet in the Yakutat area. The majority of king salmon caught in the Yakutat area troll fishery are thought to originate in other regions. The catch of Yakutat-derived king salmon by Gulf of Alaska seiners, trollers, gillnetters, and foreign high-seas gillnet and trawl fisheries remains unknown. This indicates the need for increased tagging and recovery efforts throughout the Gulf of Alaska and on the high-seas. As this catch is determined, it can be included towards the achievement of harvest goals for this species.

The king salmon is the most desired species and, simultaneously, the most difficult to manage and enhance. All user groups take Yakutat-derived kings. The commercial troll fishery harvests king salmon bound for the Yakutat area. The commercial set gillnet fisheries in the Situk and Akwe Rivers harvest kings incidentally during the sockeye season. King salmon are a targeted species during the early weeks of the Alsek River fishery. Sport fishermen in the Situk and Alsek prize the king salmon, and sport pressure is increasing. Subsistence harvest of king salmon occurs in Yakutat Bay, the Situk-Ahrnklin estuary, and the Alsek River. The king salmon goal for the year 2000 is 7,000 fish, which is 133% higher than both the 1972-1981 and 1977-1981 averages and 36% less than the record 30-year moving average annual harvest. To meet this goal, research, regulation, and management of all the fisheries will be necessary. Enhancement and rehabilitation of wild stocks, as described in Section 5.4, could also be effective for kings.

4.5.2 Coho Salmon

Throughout the history of the commercial fishery, the average harvest of coho has been relatively stable (Figure 2). The 1977-1981, five-year average annual harvest is only 16% under the record 30-year moving average annual harvest, which is indicative of healthy stocks.

The actual coho salmon production for the Yakutat area is unknown. The countless side tributaries to larger streams, sloughs, and beaver ponds, collectively, make for very productive coho rearing areas. The Yakataga area, especially the Tsiu and Kaliakh Rivers, includes extensive coho spawning and rearing habitat.

The year 2000 goal was set at 175,000 fish, or 99% of the record moving average. The principal strategy for attainment of the goal is enhancement, which would increase rearing habitat by utilizing barren and semi-barren natural systems through construction of additional man-made sites, and stocking these sites with recovered nomads. In existing gravel borrow pits, coho rearing has apparently been successful and may have partially contributed to recent increases in production. Coho enhancement probably has the highest benefit-cost ratio of any salmon improvement in the Yakutat area.

4.5.3 Sockeye Salmon

The harvest of sockeye has plummeted from the record 30-year moving average annual harvest, which occurred during 1906-1939 of 392,000 fish, to a 1977-1981 five-year average annual harvest of 159,000. Suspected reasons could be over-harvest, reduction in habitat quality, and increases in the interceptive fisheries.

In 1982, a very small percentage of sockeye tagged in southern southeast Alaska returned to the Yakutat area, indicating possible interception throughout Southeast. Another possible interception fishery on Yakutat-bound sockeye occurs in the Bering River drift gillnet fishery, operating southeast of Kayak Island. Both indicate the need for increased study of potential interception fisheries and migration patterns of wild fish.

Recent improvements in the sockeye harvest are principally attributable to large production increases from the East River. The five-year average annual harvest in the East River fishery for the period from 1977-1981

was 40,000, compared to the lowest 10-year moving average annual harvest from 1957 to 1966 of 2,600 fish. The 1982 East River sockeye harvest was approximately 98,000 fish.

Principal strategies to increase the sockeye harvest to the year 2000 goal (42% above the 1977-1981 harvest) are:

1. Further assessment of sockeye rearing lakes for nutrient content and potential for lake fertilization.
2. Research, regulation, and management of the interceptive fisheries.
3. Connection of barren lakes in areas of glacial moraine for rearing.
4. Research and assessment of the unique East River sockeye population and application of this knowledge to other natural systems and man-made spawning channels.
5. Mitigation of effects of ecological succession in selected areas.
6. Optimization of future harvest and escapement levels by analysis of production from parent-year escapements.

4.5.4 Chum Salmon

The record 30-year moving average annual harvest for chum salmon occurred during the 1952-1981 period, with peak annual harvests in the 1950's. The majority of the chum salmon harvests in the Yakutat area are attributable primarily to the East River fishery. The 1977-1981 five-year average annual harvest of 11,000 fish is only 2,000 fish or 15% below the record average levels. A conservative goal for the year 2000 is 13,000 fish or 100% of the record 30-year moving average. With proper management, no habitat enhancement projects need be targeted on chum, and the year 2000 goal can be attained.

Habitat enhancement that is geared towards increasing sockeye use of groundwater upwelling systems should also benefit chum.

4.5.5 Pink Salmon

The 1977-1981 five-year average annual harvest is 107% of the record 30-year moving average annual harvest set from 1911-1944, indicating excellent condition of the wild stocks. The year 2000 goal for pink salmon is 21% and 51% above the 1977-1981 and 1972-1981 average annual harvests, respectively. Production (harvest plus escapement) levels are already near the levels required to supply the year 2000 sustainable harvest goal.

4.6 Analysis of Benefits Derived from Attainment of Harvest Goals

As expressed in the mission statement, the overriding assumption of this plan is that activities to increase salmon production will result in increases in the social and economic benefits arising from salmon fishing to the Yakutat area. Actual quantification of such benefits is difficult and depends to a large extent on additional assumptions.

Table 5 shows a preliminary evaluation of economic benefits arising from achievement of the year 2000 harvest goals, with a 29% increase in the adjusted gross value of salmon harvests in the Yakutat area, based on current (1981) salmon prices, current (1981) dollar values, and equally proportionate harvest increases among all salmon gear types. The adjusted gross value of the salmon fishery could, upon achievement of the year 2000 goals, increase by $880,000 from ($3.0 million to $3.9 million annually.)

Table 5. Yakutat Commercial Salmon Harvest, Projected Benefit Estimates [A,B]

	1981	2000	Long-Range
King: #Fish	2,069[C]	7,000[D]	10,000[D]
Price/Fish	$35.07[C]	$37.30[D]	$37.30[D]
Total Value	$72,555.83	$261,100.00	$373,000.00
Red: #Fish	149,637	225,000	295,000
Price/Fish	$7.73	$7.73	$7.73
Total Value	$1,156,694.01	1,739,250.00	$2,280,350.00
Coho: #Fish	165,005	175,000	200,000
Price/Fish	$9.04	$9.04	$9.04
Total Value	$1,491,645.20	$1,582,000.00	$1,808,000.00
Pink: #Fish	137,698	140,000	150,000
Price/Fish	$1.77	$1.77	$1.77
Total Value	$243,725.46	$247,800.00	$265,500.00
Chum: #Fish	10,811	13,000	15,000
Price/Fish	$5.58	$5.58	$5.58
Total Value	$60,325.38	$72,540.00	$83,700.00
Roe: #Fish	465,220	560,000	670,000
Price/Fish	$.02	$.02	$.02
Total Value	$9,304.40	$11,200.00	$13,400.00
Total # Fish	465,220	560,000	670,000
Total Value	$3,034,250.28	$3,913,890.00	$4,823,950.00
Gain from 1981		$879,639.72	$1,789,699.72

A Based on 1981 dollar value.
B Based on continuance of 1981 salmon prices per pound.
C Troll king salmon harvest data excluded.
D To include troll king salmon harvest when determined.

Achievement of the long-range goals outlined in the plan, which are at or above the record average harvests, could result in a 59% increase in the adjusted gross value of the salmon fishery and represent a $1.8 million increase (from $3.0 million to $4.8 million--again based upon the same assumptions). It must be pointed out that these economic projections are preliminary approximations and may differ from those obtained through a detailed economic analysis.

Based on the limit in the number of participants in the set gillnet and troll fisheries imposed by the Commercial Fisheries Entry Commission, it is doubtful whether these harvest increases would directly result in more jobs in the fish harvesting segment of the local work force. As additional fish are produced, additional harvests may be permitted, thereby increasing fishing time and the number of year-round job equivalents. In the case of sport or subsistence fisheries, increased possession limits or harvest opportunities may be allowed.

Increases in fish production and subsequent harvest increases could also result in greater activity for various support industries operating in the area, such as fish transport and processing, fishing gear sales, vessel support, and sport fish guiding.

CHAPTER 5 STRATEGIES FOR ATTAINMENT OF YEAR 2000 GOALS

5.1 Introduction

Strategies to increase salmon production, achieve harvest goals, and close harvest gaps will initially require efforts directed toward increasing the survival of individual fish through each of the separate stages

of their life history, i.e., growth and development. Within the life history of an individual salmon, these stages range from the unfertilized egg to the adult spawner. For each of the several arbitrary but distinct stages of development, an assumed standard survival rate has been derived (Table 6).

Within a distinct life stage for a species, survival rates may vary, depending on average environmental conditions encountered. The environments vary from uncontrolled (wild) conditions to controlled conditions. In the early life stages, maximal control over variables affecting survival is obtained in a hatchery environment. As individual fish migrate to the open ocean and disperse, opportunities for control of survival diminish. Dispersed, maturing fish can be affected by oceanographic and planktonic conditions, disease, natural predation, and incidental fishing mortality. It is only as maturing fish routinely and regularly reassemble into migrating schools, in areas where discrete management opportunities exist, that strategies may be employed to any significant degree to increase survival and access to spawning locations and to facilitate reproductive success.

Attainment of long-range goals can only be accomplished by a combination of strategies. Conservative management of the fishery and habitat protection, exclusive of all other strategies, are the foundation upon which fulfillment of the year 2000 goals will be based. To improve management and provide for the maximum sustainable harvest, extensive research is required. To reach or surpass the long-range goals, mitigation of future

Table 6. Standard Assumptions on Salmonid Survival.[A]

Life Stage	Chinook		Sockeye		Coho		Pink		Chum	
	Wild	Controlled	Wild	Controlled	Wild	Controlled	Wild	Controlled	Wild	Controlled
1. Green egg to Fry	.10	.81[B]	.10	.81[B]	.10	.81[B]	.10	.81[B]	.10	.81[B]
2. Fry to Smolt	.10	.76[B]	.10	.76[B]	.10	.76[B]	-	-	-	-
3. Fry to Adult Spawner (marine survival)[C]	-	-	-	-	-	-	.007	.01	.007	.01
4. Smolt to Adult Spawner (marine survival)[C]	.03	.03	.10	.10	.10	.10	-	-	-	-
5. Egg to Adult Spawner[C]	.0003	.018	.001	.062	.001	.062	.0007	.008	.0007	.008

A From: Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement and Development Division. 1982. Standard Assumptions on Salmonid Survival (unmarked fish) and Fecundities. Directive No. 3, Chapter 4 (update).

B Hatchery environment.

C This value does not include fishing mortality and represents an estimate of total production to specified life stage.

man-made disturbances, rehabilitation of existing conditions, and enhancement of habitats will be necessary. The planning group recognizes that the choice and prioritization of strategies will commit the fisheries program to long-term results.

5.1.1 Criteria for Selecting Strategy Options and Priorities

In order to design specific plans to increase salmon production, all options must be examined to determine which will be most effective in meeting production goals. The greatest successes in closing the harvest gap may be achieved through the implementation of combinations of strategies which complement each other and provide favorable results with minimal risk and cost. Several criteria are used in selecting, combining, and prioritizing strategies for each species:

1. Appropriateness to species and area.
2. Availability of proven technology.
3. Risks and Constraints--Each strategy has attendant risks which must be evaluated. Some risk is unavoidable, but if the risk is too great, it will become a constraint on application of the strategy.

5.2 Habitat Protection and Mitigation

Habitat protection is one of the most important strategies for maintaining stable fish populations. Habitat loss in the Yakutat area from natural or man-induced causes is presently unquantified. It is generally recognized that logging, mining, and urban expansion have the potential of being detrimental to the ability of the environment to produce salmon. A critical strategy, therefore, is the protection and maintenance of

fisheries habitat through full enforcement of habitat protection regulations and the initiation of research programs to document both natural and man-induced changes in salmon habitat.

Logging, oil exploration, and placer mining activities, occurring in the area, will have to be carefully monitored to ensure that disruption of present and potential fisheries habitat does not take place. Siltation effects and streambed alterations, arising from improper activities, can be highly detrimental to salmon and trout populations.

When habitat loss is inevitable as a result of man's activities, appropriate mitigation should be initiated. Logging, road building, and mineral exploration should proceed with as few habitat impacts as possible. When impacts occur, enhancement techniques (section 5.4) should be integrated into the development plans. For instance, the construction of ditches connecting salmon streams to water-filled borrow pits (which were excavated in conjunction with road and timber development in the Yakutat area) has resulted in increased coho, trout, and Dolly Varden rearing space. However, the actual contributions of these new areas remain to be quantified (see section 5.3.7). If these developments have increased salmon production above levels required for mitigation, they may be considered as enhancement.

5.3 Research and Management Tools

Knowledge of the Yakutat area aquatic habitats and of fish population dynamics is critical in order to attain the year 2000 goals. The assumptions made in this plan will require thorough research and investigation.

The research and management tools, which will be necessary to achieve the harvest goals, are described in the following sections.

5.3.1 Escapement and Harvest Monitoring

Harvest management is a cost-effective strategy that can maintain current harvest averages, based on natural production, and increase production where opportunities exist.

Optimization of escapement in all systems and provisions for an orderly harvest of the surplus are the primary objectives of the fishery manager. Assuming that a system is stable during a period of time, spawner-recruitment curves can be statistically developed between parent-year escapement and present-year production. Refined optimal escapement levels can be set based on the correlations. However, reliable escapement and harvest figures are necessary. Once optimal escapement levels are determined, production levels can be increased if necessary escapement levels have been achieved.

5.3.1.1 Weir Counts

Continuation of weir escapement monitoring on the Situk and Klukshu Rivers is necessary. Placement of other weirs should proceed in order to better document and determine escapement goals.

An additional weir on Mountain Stream is needed to better assess the escapement to Situk and Mountain Lakes from the Situk River system, the largest single producer of sockeye in the Yakutat area.

5.3.1.2 Air, Float, Sonar, and Foot Counts of Indicator Reaches

Expansion of air, float, and foot counts of indicator reaches will be necessary to monitor escapement in systems without counting stations. Feasibility studies for sonar counting applications should be conducted for major Yakutat area systems.

5.3.2 Stream and Lake Surveys

Winter and summer habitat surveys of streams and lakes, coupled with enumeration of adult and juvenile use and a catalogue of rehabilitation opportunities should be completed for all major and minor systems. Surveys of spawning and rearing habitat should be concentrated during the winter as it tends to be the critical habitat limiting period.

Survey information enables the planner/manager to better understand the potential productivity of streams and lakes and to evaluate rehabilitation opportunities. Surveys and assessments of very few Yakutat area systems have been completed. The initiation of work on a Yakutat stream catalogue is obviously overdue.

5.3.3 Study of Ecological Succession

Loss of fish habitat in the Yakutat area may be affected by ecological succession. A study should be initiated to see if this is the reason for the apparent loss of productivity in some systems.

5.3.4 East River Sockeye Population

Sections 3.2.3.1 and 4.5.3 review the sockeye salmon stocks inhabiting the East River. These may be "zero freshwater check" fish. The Akwe

River also supports a large proportion of apparent "zero freshwater check" sockeye. Both systems should be closely examined to determine growth rates and migration patterns. Three hypotheses concerning these fish are tenable:

1. The primary and secondary production of the East and Akwe Rivers is so great that sockeye smolt during the first year in fresh water.
2. The fry leave the freshwater soon after emerging from the gravels. This habit is true for pink and chum salmon. A latent genetic expression to the habitat changes, periodically occurring in the East-Doame Rivers, may have been triggered by the merging of the two rivers in 1967.
3. Freshwater growth in glacial waters may result in smolts of reduced size with unusual scale patterns.

A research study to compare and understand the East River and Akwe River ecosystems, with emphasis on fish, should be initiated as soon as possible.

5.3.5 Stock Separation Techniques

Detailed electrophoresis, tagging, and scale sampling of juveniles and adults, with particular emphasis on coded wire tagging of Yakutat area king and sockeye salmon, as well as a coastwide recovery program should be initiated as soon as possible to delineate patterns and extent of interceptions of mixed-stock salmon bound for the area. Interceptions of Yakutat derived salmon stocks are presently unknown but may comprise a significant portion of the overall fishing mortality affecting these stocks. Results from these studies will be necessary for the development of better management and enhancement strategies and for the refinement of

the year 2000 harvest goals. These studies would require increased funding for the tagging and scale sampling programs and for the expansion of the coastal port sampling program to encompass the other fisheries operating in the Gulf of Alaska. Additional information may be gained from high-seas tagging efforts directed at mature fish.

5.3.6 Evaluation of Past Enhancement and Mitigation Projects

Since 1972, various enhancement and mitigation projects have been attempted near the community of Yakutat (Appendix B). The effectiveness of these efforts has not been fully evaluated. Many of the projects appear to have been successful, but it has yet to be learned whether fish are being produced there or if unrelated fish simply stray to those locations.

A thorough review of these past projects is needed to establish how effective they are and to provide insights into the design of future projects.

5.4 Enhancement

Enhancement involves the building of fish stocks to production levels beyond their former capabilities. In conjunction with improved in-season management and pre-season forecasts, enhancement may provide more stable harvests and thus allow for better planning and economical operation in the fish processing and marketing sectors.

An ongoing enhancement program is principal to attainment of year 2000 goals. The optimum time to put enhancement strategies in place is during a period of high production. Table 7 lists numerous enhancement techniques

Table 7. Strategies for narrowing the gap: enhancement.

ENHANCEMENT METHOD[1]	SALMON SPECIES					LOCATION/COMMENTS
	King	Coho	Sockeye	Chum	Pink	
SPAWNING CHANNELS		X	X	(X)		Best in major upwelling areas: East River (but see USNPS restrictions), Malaspina Forelands, Tsiu River, Dangerous River.
REARING POND DEVELOPMENT --incidental to other construction or logging		X				Yakutat Forelands and other areas where activity.
--specifically designed for fish production		X				Cost-benefits are best in Yakutat road connected areas; however, potential projects throughout the high water table sections of the area.
INCUBATION BOXES	X	X	X			Mouths of Mountain and Italio Lakes, and the rearing ponds.
FERTILIZATION	(X)	(X)	X			Potential in Redfield, Mountain, Situk, Akwe, and Italio Lakes; rearing ponds.
DREDGING	(X)	X	X			Tawah Creek, Coast Guard Lake, and between Situk and Mountain Lakes (use blasting).
FISH LADDERS OR ACCESS DITCHES		X	X			Slow-flow Lake, other Redfield & morainic area lakes; also see rearing pond development; monitor need on Italio.
STOCKING --egg take for development at other hatcheries	X					Consider return to Situk of broodstock used at Snettisham Hatchery.
--nomad recovery	X	X	X			Feasibility unknown; initially transfer Situk River nomads into Situk watershed lakes; potential in small Yakutat Bay streams. Utilize trapped coho from Ophir Creek for transport and rearing in lakes.
WATER FLOW CONTROL		X				Bean Belly Lake & others?
STREAM CLEARANCE --of natural systems (debris removal, gabions, debris placement)	X	X	X	X	X	Entire area, as projects arise; monitor blowdown.
--of man influenced systems (relocation, debris removal, flow control, gabions, debris placement, etc.)	X	X	X	X	X	All areas with man's influence, as projects arise; known projects at Colorado Road, Yakutat area culverts.
--gravel cleaning	(X)	X	X	X	X	Technology not yet perfected; target on recently deglaciated systems.
HATCHERIES	X	X	X			Not desirable or feasible at this time.

[1] Parenthesis "(X)" indicate an indirect benefit to this particular species.

that may prove feasible for the Yakutat area. Discussion of these techniques follows in section 5.4.1.

5.4.1 Hatcheries

Hatcheries, while being an expensive means of supplemental reproduction and rearing of salmon, provide for a greater degree of control or manipulation of growth and early survival than any other method of enhancement. Hatcheries exercise their most cost-effective control during the life stage of egg to fry. In most instances, the hatchery survival rate during this life stage is eight times higher than natural survival. Hatcheries should rehabilitate stocks in a relatively short time frame.

There is generally a linear relationship between the cost of hatchery fish and the life stage at which the hatchery releases the fish. More specifically, the longer the hatchery retains the fish, the more money becomes invested for each individual fish. This large investment-per-fish ratio is offset somewhat by the improved survival rates which are attained with fish that have become more fully developed in the hatchery environment. Preliminary estimates from enhancement economic analysis suggest a typical hatchery investment benefit-cost ratio between 2:1 to 3:1 (McMullen 1981).

5.4.2 Spawning Channels

The construction of artificial spawning channels can be an effort to both rehabilitate and enhance the spawning environment. Successful channels depend on the control of factors such as water flow, substrate,

sedimentation, and predation so that egg-to-fry survival averages are improved from that of uncontrolled adjacent stream conditions.

Potential sites for artificial spawning channels first require extensive study and evaluation. Sites recommended for implementation of this technique require a controllable, upwelling water source, the proper terrain, and sufficient salmon stock size to utilize the completed project. To date, the best identified locations include the East River, the Malaspina Forelands, and the Tsiu River. However, current National Park regulations prohibit man-made habitat alterations, such as spawning channels, in the Glacier Bay and Wrangell-Saint Elias National Parks.

5.4.3 Rearing Ponds

Rearing ponds have been extensively developed along the road system of the Yakutat area. Ponds (gravel borrow pits) are connected to existing streams by ditches which allow passage of rearing salmon and trout to the newly created waters.

Rearing ponds are presently being evaluated to determine their value as salmon rearing environments. Results of these studies will include plans and recommendations for development to achieve maximum production.

5.4.4 Stream Incubation Boxes

Incubation boxes have been employed successfully by the Alaska Department of Fish and Game for sockeye enhancement in the Paxton Lakes region, near Glennallen, and at Lake Nunavaugaluk, near Dillingham. Incubation boxes combine advantages of other techniques (such as hatcheries, artificial

spawning channels, stream stocking, water flow control, and predator control), and they are relatively inexpensive to construct and maintain. Basic requirements are availability of a high-quality, year-round water supply, accessibility for frequent monitoring and maintenance, protection from freezing, flooding, predation, and vandalism, and availability of a suitable brood stock.

5.4.5 Lake and Pond Fertilization

Fertilization involves the addition of nutrients to lakes that serve as nurseries for rearing salmon, particularly sockeye salmon. The intent of this action is to increase the quantity of phytoplankton and, subsequently, zooplankton, which is the primary source of food for the rearing salmon. Some studies have indicated a correlation between the availability of food to the young salmon, their size at outmigration, and their survival to return as adults. Beneficial effects of lake fertilization end when the process is discontinued.

The ADF&G has published a Policy and Guidelines for Lake Fertilization (1979), which outlines three stages for this type of project. The first stage, pre-fertilization study, calls for a detailed assessment of the physical, biological, and chemical status of the lake. This should encompass at least one full year's cycle. The study should draw conclusions about the rate and frequency of fertilizer application. The second stage is the application of the fertilizer in one or more sessions as prescribed by the study. The third and final stage is the evaluation of the effort in a post-fertilization study. The assessment of the effects of the application must be related to the overall physical/chemical

condition of the lake, growth of juvenile salmon, and the potential contribution of the effort to the salmon fishery.

Pre-fertilization studies should be initiated at Redfield, Mountain, Situk, Akwe, and Italio lakes, and in artificial rearing ponds.

5.4.6 Laddering and Access Ditches

The construction of fish ladders or accesses is a more structured and permanent method of stream habitat modification and enhancement.

Much of the ultimate success of an individual fish pass will depend on the thoroughness with which the pre-construction analysis has been carried out. Thought must be given to the effects on fish species other than the salmon that it is designed to benefit. Past experience, over a broad range of conditions, substantiates the fact that a well placed fish pass can yield a high benefit/cost ratio. However, fish passes must also demonstrate potential for a suitable net-added-value of acceptable magnitude.

In the evaluation of a potential stream accessing project, assessment should be made of the unutilized spawning or rearing habitat that will be made available, the portion of the barrier to be removed, and the availability of a sufficient spawning population to make use of the "new" habitat.

Sites under consideration for accessing in the Yakutat area include Slow-flow and Redfield Lakes, and the nearby Humpback Creek. The accessing project on the Italio River needs monitoring and evaluation and may require reconstruction and improvement.

5.4.7 Lake and Stream Stocking

There are many variations and possibilities in the application of the stocking technique.

Attention has focused on the many non-accessable lakes in Southeast Alaska and Yakutat, which may have a potential for rearing surplus king and coho juveniles. Such lakes would be stocked on an opportunity basis. This type of stocking would also have to occur on a rotation schedule, allowing for sufficient regrowth of the lake's indigenous zooplankton population before restocking, and may be combined with lake fertilization. Pre-stocking studies are required to select suitable lakes and to ensure that stocked fry will grow and survive to migrate to sea in sufficient numbers. Careful determination of stocking density and timing may be crucial to success.

The stream stocking technique may be employed via incubation boxes, as previously described, or may involve stocking of fry above a non-accessible stretch of a stream, permitting utilization of suitable upstream rearing habitat. Monitoring and evaluation of this technique and similar non-accessible lake stocking will be required to ensure that smolts can safely navigate downstream past the anadromous fish barrier.

The possibility of capturing "nomad" king and coho at river mouths or stranded juveniles from isolated channels and stocking these fish into borrow pits or lakes has been suggested for the Yakutat area. The environment of the lakes can be modified through lake fertilization or feeding, and the release of smolts controlled through gates or pens.

5.4.8 New Enhancement Techniques

The development of new techniques for fisheries enhancement is a continuing objective of all regional salmon enhancement plans. New techniques range from design and development of new incubation or rearing devices to advances in genetic engineering which could control sex-ratios and run timing for rapid brood stock development or increased harvestability.

5.5 Rehabilitation of Habitat

Rehabilitation entails the restoration of depressed stocks or impacted habitat to previous high levels of production. When habitat loss has already occurred, rehabilitation is appropriate if opportunities arise to reverse that loss. Examples are culvert and bridge removal, relocation or reconstruction, and the cleaning of spawning gravels. Similarly, enhancement technology may also be used to accelerate the process of rehabilitating a depressed stock through improvement of egg and fry survival.

Rehabilitation is a priority of the governmental agencies. Once all existing habitat disturbances are rehabilitated, there should only be a need for mitigation (section 5.2) or enhancement (section 5.4).

5.5.1 Lake and Stream Dredging

Dredging or deepening of lakes and stream channels has particular application along foreland areas that have become landlocked and/or eutrophic from lowering water tables. One of the most promising methods entails the use of blasting to maintain lakes and channels.

5.5.2 Water Flow Control

This modification technique may be employed to solve either the problem of extensive or insufficient water volume or to alter the velocity at which the water is presented to a given site. The devices which may be employed to achieve this end are many and vary greatly in attendant cost and difficulty from site to site. Target locations are those in which most other factors favoring salmon reproduction are present but where it has been determined that either the volume or velocity of the water is inappropriate. It then remains to identify what the proper water condition should be and the most effective and cost-efficient means of achieving that condition.

5.5.3 Stream Clearance

Stream clearance basically involves removal of barriers and debris from blowdowns and man-made disturbances. Because of its simplicity, the concept is one that is generally supported by user groups. There are, however, some attendant risks which should be considered. Complete removal of a barrier may cause a velocity barrier, scour downstream gravels, or eliminate pooling areas in the stream. Therefore, selective removal of a portion of the barrier sufficient to allow upstream passage of fish without substantially altering the flow or downstream conditions is the desirable level of effort.

The costs, in terms of time and equipment, are usually relatively small. Therefore, the number of fish to benefit can be smaller and still enable the project to produce a net gain of fish for the effort expended.

5.6 New Project Opportunities

Increased reconnaissance of enhancement opportunities (section 5.4) specific to the Yakutat area will be necessary for future planning efforts and eventual program implementation. Project scoping should include both projected impacts and potential outputs to the fishery from identified opportunities. As mentioned in section 5.3.2, there is at present no catalogued listing of either rehabilitation or enhancement opportunities for the Yakutat area. Mattson (1976) conducted a brief study of potential hatchery sites near Yakutat at the request of the Yak-Tat Kwaan Corporation.

A standardized "New Project Opportunity Form" (Appendix C) will be distributed to field personnel of both the Alaska Department of Fish and Game fisheries divisions and the U.S. Department of Agriculture-Forest Service and to interested fishermen and other users of the area's fisheries resource. The form will then serve as the basis for cataloging program opportunities (utilizing the strategy options discussed in this chapter) that will provide for the following: (1) habitat protection, (2) additional research directed toward improved management, (3) potential fisheries rehabilitation projects, and (4) potential fisheries enhancement projects.

Potential projects are then verified. In the case of site specific opportunities, a survey team would make a field investigation and then complete the "Potential Project Verification Form" (Appendix D). This form provides additional details on a project and quantifies potential costs, impacts, and benefits and serves as a record of comment by each

of the fisheries management divisions of the Alaska Department of Fish and Game.

Input from this source will then provide the basis for the next phase of salmon planning for the Yakutat area. Opportunities will be analyzed within the framework of this plan and combinations of applicable strategies will be integrated with respect to their potential to contribute to achievement of individual species goals. This process will result in specific fisheries program recommendations for individual sites or species. The prioritization of these programs and the refinement of the programs into five-year fisheries action plans will comprise a major portion of the upcoming phase of comprehensive salmon planning for the Yaktuat area.

APPENDIX A PLAN STRUCTURE, EVALUATION, AND MAINTENANCE

A.1 Background

Section 1.7 specifies the effective life of the plan to extend to the year 2000 and additionally requires the plan to be regularly updated every five years. In order to facilitate the evaluation and maintenance of the plan, it is important to understand the outline of the planning process (Figure 5). The outline then serves as the basis for diagnosing and maintaining the plan's functionality. During the update, specific attention should be focused on goals, strategies, gaps (Section 4.5), and the assumptions upon which they depend (sections 1.8 and 4.2). At that time, it may also be necessary to modify the planning process outline if situations arise which cannot be addressed. This can be determined as the various relationships between the data base, assumptions, and goals become better defined through ongoing interaction.

A.2 Outline and Diagnostic Procedure

A.2.1 Evaluation and Maintenance of Data Base

The data base is that set of information that describes the current and historical harvest statistics; the results from research projects related to long and short-term goals; the real and projected capabilities and outputs of rehabilitation, enhancement, and natural production opportunities located in the area; and, finally, the marketing and economic conditions, which become parameters in cost/benefit analysis.

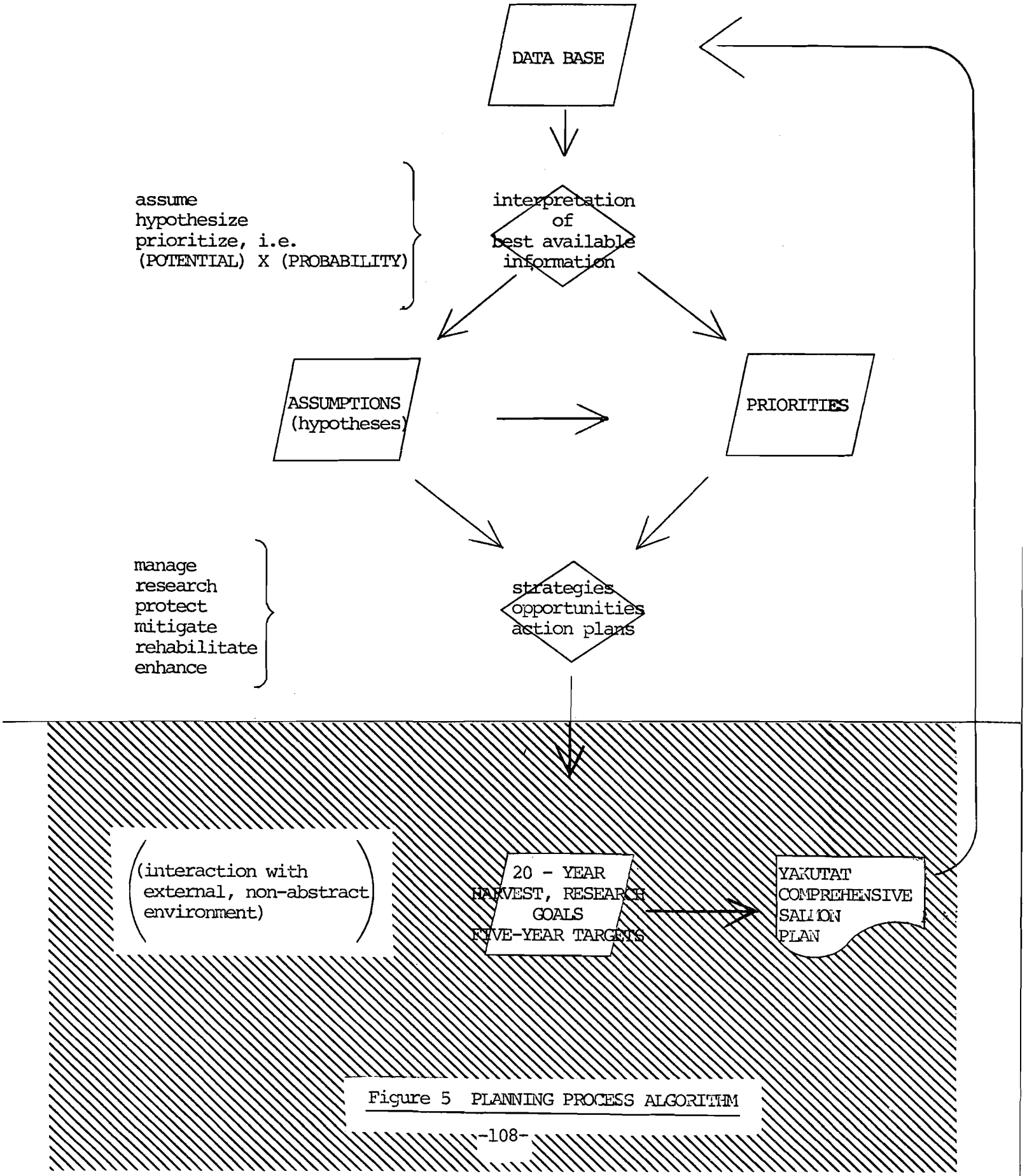


Figure 5 PLANNING PROCESS ALGORITHM

The data base should be evaluated with respect to its relationship and relevance to the goals and targets of the existing plan. Diagnoses should examine the data base for completeness, accuracy, and for its ability to provide the necessary background to quantify the goals and gaps. Shortfalls in the data base then provide definitions of new research goals to be set in the updated plan or serve to outline a revised set of assumptions. New information, incorporated into the data base, may serve to verify assumptions and satisfy previous goals.

A.2.2 Evaluation and Analysis of Assumptions

Immediate shortfalls or gaps in the data base then determine the assumptions necessary for the formulation of revised goals. Assumptions in the plan often deal with the "intangibles," such as: Are the record long-term average harvests for the Yakutat area an accurate indication of the area habitat's fish productivity potential? Will world markets continue to absorb increased salmon production without a reduction in real price?

As the data base is updated and refined, it is possible that one of the previous assumptions in the parent plan may prove false. Analysis of assumptions should proceed as a hypothesis test wherever possible. Changes in assumptions may in turn cause revision of priorities and subsequent goals.

A.2.3 Update of Priorities

As illustrated in Figure 5, priorities are influenced by the data base, both directly and through the assumptions. It is important to note that

assumptions exert a one-way, linear influence on priorities and not vice-versa.

The recent public attention on chinook salmon, in relation to the proposed U.S.-Canada Pacific Salmon Treaty and the resulting potential for revising planning priorities to emphasize goals for this species, exemplify the priority updating process.

Prioritization of goals and selection of strategies require difficult and occasionally arbitrary decisions, regarding allocation of strategic resources among the many potential opportunities. Criteria need to be developed to rank goals, strategies and opportunities with regard to both probabilities and potentials. Often a strategy or opportunity may have a great potential but be ranked as an intermediate priority because of a low probability of realization. Similiarly, opportunities with low potentials and low probabilities would receive a low priority.

A.2.4 Evaluation, Analysis, and Maintenance of Harvest and Research Goals

Harvest and research goals represent the final output of a parent plan and, at the same time may, serve as the basis for a new planning process. Harvest and research goals are achieved through the exercise of defined strategies, operating on specific opportunities via an action plan. The achievement or non-achievement of specific goals are then incorporated back into the data base as new entries and can then serve to self-regulate the plan as evidenced by the feedback loop (Figure 5). It is at this level that the loop is open for incorporation of new information, and the plan emerges out of abstract form and interacts with the real world

of time, fish production, funding, research results, public opinions, and environmental constraints, which then become integrated into the new data base. This interaction with the real world is, thus, the cause of subsequent plan revisions.

APPENDIX B

List of Current and Completed Fisheries Rehabilitation, Enhancement, and Mitigation Projects in the Yakutat Area.

Conversion of gravel pits to rearing ponds (usually required ditch construction)

-- Four recent pits around Yakutat airport
-- Six gravel pits along FH-10 (from Yakutat to Harlequin Lake) (1972-1982)
-- A minimum of three that remain from WW II
-- Mill pond from railroad construction

Relocation of stranded juvenile fish

-- During summer dry periods in the Yakutat road connected areas (since 1968)

Relocation of adult salmon

-- To bypass drainage ditches along airport runways (since 1978)

Construction of check dams to increase spawning sites

-- Humpback Creek (about 50 structures), constructed in 1976-1978 and maintained yearly
-- Bean Belly Lake (experimental construction of 13 structures) (1981)

Placement of spawning gravels

-- Bean Belly Lake (1977,1978)
-- Fish and Game Ponds (on-going)

Minor fish laddering

-- Italio Falls Lake (1977-1978)

Windfall removal (stream debris)

-- Sockeye Creek (1981)
-- Humpback Creek (1981)
-- Ophir Creek (1981)

Construction of in-stream pools

-- Ophir Creek: 4 pools (1978)

Reference or File No._____

Date:_____

APPENDIX C

FISHERIES REHABILITATION AND/OR ENHANCEMENT NEW PROJECT OPPORTUNITY FORM*

1. WHAT (give a brief description):

2. WHERE (be specific):

3. BENEFITS:

4. SUBMITTED BY (name, address, telephone, etc.):

Distribute this form to the following persons:

1. Your Supervisor

2. Regional Supervisor (s)
   Appropriate ADF&G Office
   a. Commercial Fisheries
   b. Sport Fisheries
   d. Habitat
   F. FRED

   Regional Office
   230 South Franklin
   Juneau, AK 99801

3. Director of Fisheries & Wildlife
   USDA Forest Service
   Box 1628
   Juneau, AK 99802

4. Program Manager Fish & Wildlife
   (Appropriate Forest Supervisor)

   a. Stikine Area
      Tongass National Forest
      P.O. Box 309
      Petersburg, AK 99833
   b. Chugach National Forest
      2221 Northern Lights Blvd.
      Suite 238
      Anchorage, AK 99508
   c. Ketchikan Area
      Tongass National Forest
      Federal Building
      Ketchikan, AK 99901
   d. Chatham Area
      Tongass National Forest
      P.O. Box 1980
      Sitka, AK 99835

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*This form is to be used by Fish & Game and Forest Service personnel to identify opportunities that may be worthy to pursue to help rehabilitate and/or enhance the fisheries. Use of this form is not limited to these agencies as all persons are encouraged to help identify opportunities.Use of this form will inform the agencies that have responsibility for projects. This form is not intended to

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5. ADDITIONAL NOTES OR COMMENTS

APPENDIX D

Ref. or File No._____
Date_____

POTENTIAL PROJECT VERIFICATION FORM

NAME:_____ ADF&G CAT. NO.:_____
LATITUDE:_____ USFS REF. NO.:_____
LONGITUDE:_____ DATE:_____
GEODETIC MAP NO.:_____ SURVEYED BY:_____
LOCATION:_____
AERIAL SURVEY NOTES:_____

TRAILS:_____

STRUCTURE WILL PRIMARILY BENEFIT:_____

AVAILABLE ESCAPEMENT DATA:

Year	Pink	Chum	Coho	Sockeye	King	Steelhead

Other Species Present:_____
TIMING:_____
ESTIMATED SPAWNING AREA:
1) Below Barrier:_____ How Surveyed_____
2) Above Barrier:_____ How Surveyed_____

REARING AREA:
1) Below Barrier:_____ How Surveyed_____
2) Above Barrier:_____ How Surveyed_____

DRAINAGE AREA:_____
DISCHARGE:_____
GRADIENT:_____
SURVEY OF BARRIER:_____
SKETCH MAP OF ENTIRE SYSTEM:_____
PHOTOGRAPHS:_____

DISTANCE OF SITE FROM SALT WATER:
DISTANCE OF SITE FROM NEAREST ROAD:

ENGINEERING CRITERIA:
1) Ladder Type:_____
2) Etc.:_____

CHECK LIST (These should be in lettor form to respective program Mgr. F.R.E.D.)

COMMERCIAL FISH MANAGEMENT COMMENTS:

SPORT FISH MANAGEMENT COMMENTS:

HABITAT PROTECTION COMMENTS:

F.R.E.D. MANAGEMENT COMMENTS:

COST OF ESTIMATE OF PROJECT:

REMARKS:

ADF&G F.R.E.D. Regional Office

230 S. Franklin Street
Juneau, AK 99801

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GLOSSARY

ADF&G: Alaska Department of Fish and Game

ALASKA STATUTE 16.10.375: "REGIONAL SALMON PLAN. The commissioner shall designate regions of the state for the purpose of salmon production and have developed and amend as necessary a comprehensive salmon plan for each region, including provisions for both public and private nonprofit hatchery systems. Subject to plan approval by the commissioner, comprehensive salmon plans shall be developed by regional planning teams consisting of department personnel and representatives of the appropriate qualified regional associations formed under section 380 of this chapter."

ANILCA: Alaska National Interest Lands Conservation Act of 1980

AQUACULTURE: Culture or husbandry of salmon (or other aquatic fauna/flora)

AREA: In this document, defined as the Yakutat area, from Cape Fairweather to Cape Suckling.

CARRYING CAPACITY: The maximum number of salmon fry or juveniles (individual organisms) capable of life-support in a stream or ocean (closed system).

ECOLOGICAL SUCCESSION: The seral change of plant and animal communities, i.e., the make up and distribution of life forms which change in the development toward a stable state.

ELECTROPHORESIS: A biochemical technique useful in establishing genetic differences of fish, and used to help separate out different stocks of fish from a mixed stock.

ENHANCEMENT: A strategy designed to supplement the harvest of naturally produced salmon species by using artificial or semi-artificial production systems or to increase the amount of productive natural habitat.

ESCAPEMENT: Those salmon in a spawning run which are not caught or "escape" the fishery to return to freshwater to spawn, whether in a spawning ground or hatchery.

EUTROPHICATION: A process in the change or aging of a water body in which the nutrient level (phosphates and nitrates) and the productivity increases, with an accompanying depletion of dissolved oxygen in the bottom waters.

FRED: Fisheries Rehabilitation, Enhancement and Development Division, ADF&G

GAP: Year 2000 harvest goal minus present harvest level.

GEOMORPHOLOGY: The scientific interpretation of topographic features. The typing and categorization of relevant geologic forms and structures and the processes by which they change.

GABION: A water control device, consisting of rocks held in place by wire mesh and used to stabilize banks, control erosion in streams, and prevent stream gravel from shifting.

INCIDENTAL CATCH: Harvest of a salmon species other than the desired species for which the fishery is managed.

INSTREAM INCUBATOR: A device, located adjacent to a stream that is used to contain, incubate, and hatch salmon or trout eggs.

INTERCEPTIVE FISHERY: The harvest of migratory salmon outside of and prior to arrival to the terminal fishing area.

ISOSTATIC REBOUND: Geologic uplifting in an area following the retreat of glaciation. The alleviation of weight or pressure of a glacier results in a new stasis or equilibrium between the force of gravity and the earth's crustal buoyancy.

LUD: Land Use Designation

MAXIMUM SUSTAINABLE HARVEST: The harvest level at which equilibrium is achieved between optimal escapement and maximal harvest.

MITIGATION: The replacement or repayment of fish lost in one area due to habitat destruction by the use of enhancement techniques in another area.

MIXED STOCK FISHERY: The harvest of salmon at a location and time during which several or more stocks are intermingled.

NATURAL PRODUCTION: Fish that spawn, hatch, and rear without human intervention, i.e., in a natural stream environment.

NET-ADDED-VALUE: Total value of fish produced after subtraction of cost of an improvement.

NOMAD: A pre-smolt king or coho salmon that prematurely enters saltwater estuaries due to overcrowding of rearing areas. Survival of nomads is thought to be low. Nomads can be important in colonizing new habitats formed through glacial recession.

PERSON YEAR: The number of full-time, year-round job equivalents which is derived from an actual number of part-time, seasonal jobs.

PRODUCTION: Harvest and escapement, or total run size.

REAL PRICE: The financial reward for catch per unit of effort expended in a fishery, adjusted for inflation.

REARING AREA: Back channel, pond, and estuary areas used by juvenile salmon for freshwater development.

REHABILITATION: A strategy directed toward restoring depressed natural stocks to previous levels of production.

RESTORATION: Increasing the annual harvest of salmon to historic levels using management, habitat protection, enhancement, and rehabilitation strategies.

RUN: Returning salmon stock(s) bound for its spawning area which is often further described by its timing and numbers.

SALMON STOCK: A population of salmon identified with a specific water system or portion thereof.

SCALE ANALYSIS: Study and measurement of annular growth of fish scales. Because different salmon stocks in a mixed stock fishery have different growth rates, measurement of annular growth can be useful in population differentiation.

SPAWNING CHANNELS: Man-made additions to salmon spawning habitat, which can control water flow, substrate, sedimentation, and predation so that egg-to-fry survival averages are improved.

SUPPLEMENTAL PRODUCTION: The use of salmon enhancement techniques and aquaculture to augment natural production and achieve steady-state maximum sustainable harvests.

TERMINAL FISHERY: Harvest of salmon in an area where a segregated stock or stocks can be discretely harvested.

TLMP: 1979 Tongass Land Management Plan

USDA-FS: United States Department of Agriculture, Forest Service.

USGS: United States Department of Interior, Geological Survey

USNPS: United States Department of Interior, National Park Service

WEIRS: Generally a fence or dam or other device by which the stream migrations of salmon (or other fish) may be stopped or funnelled through for enumeration or holding purposes.

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