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Kodiak Regional Comprehensive Salmon Plan 1982–2002

by

ADF&G Staff

April 1984

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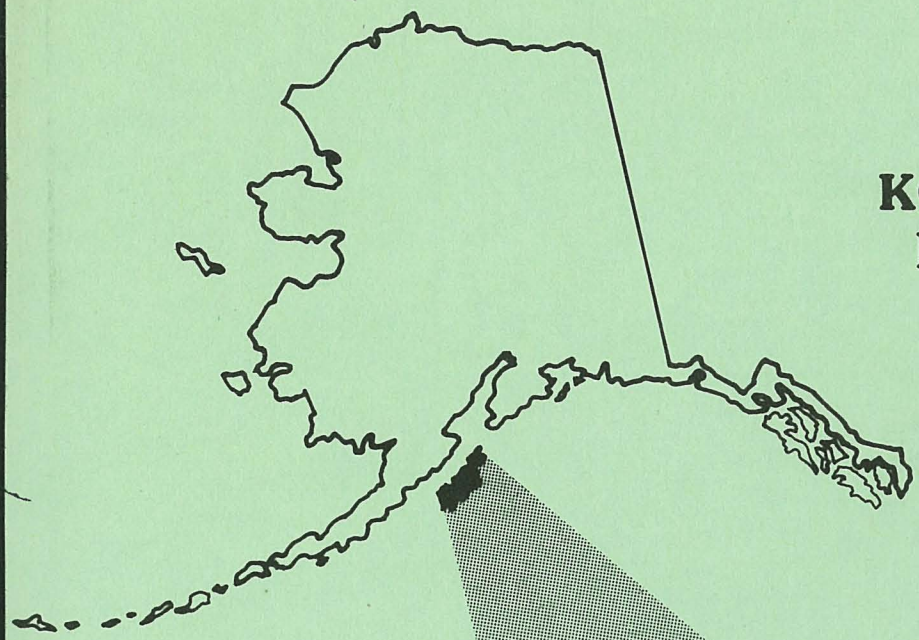

Developed By
KODIAK REGIONAL
PLANNING TEAM

KODIAK REGIONAL COMPREHENSIVE SALMON PLAN

1982 - 2002

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KODIAK REGIONAL PLANNING TEAM

STATE OF ALASKA

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DEPARTMENT OF FISH AND GAME

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April 13, 1984

Mr. Hank Eaton
Chairman
Kodiak Regional Planning Team
Box 1423
Kodiak, AK 99615

Dear Mr. Eaton:

This letter is to inform the members of the Kodiak Regional Planning Team (KRPT) and you, as the chairman, of my formal approval of the final draft of the Kodiak Regional Comprehensive Salmon Plan, 1982-2002.

Prior to the submittal of the plan for my consideration, I have been informed that it was subject to a public review and comment period which was extended to allow additional time for comment. A review by the Alaska Department of Fish and Game (ADF&G) technical staff was also conducted simultaneously. Since then, the plan has undergone a process of review and comment by all division directors within ADF&G who are responsible for managing, enhancing, and protecting Alaska's fishery and its habitat.

I am confident that the KRPT has been responsive to the comments and suggestions resulting from the reviews mentioned above.

Based on the efforts of the KRPT in preparing the plan and comments I have received on the quality of these efforts, I believe that a viable and responsible document has been produced.

I offer my congratulations and appreciation to you and all members of the team for cooperating with the department and me in producing a comprehensive salmon plan for the Kodiak region.

Sincerely,

Don W. Collinsworth
Commissioner

cc: Members, KRPT
ADF&G Division Directors

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INTRODUCTION TO THE PLAN

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1.0 INTRODUCTION TO THE PLAN

1.1 INTRODUCTION

This document is the comprehensive plan for the management, rehabilitation, and enhancement of the Kodiak Region's salmon resources during the next twenty years.

This introductory section discusses the history of legislation for the management, rehabilitation, and enhancement of the salmon fishery, outlines the geographical area of interest, describes the formation of the fishermen in the Kodiak Region into a Regional Aquaculture Association, and describes the work of the Regional Planning Team in preparing this document.

1.1.1 Legislative Background

The salmon in the State of Alaska are a valuable resource. Due to fluctuations in the salmon fisheries in the 1960s, the State Legislature in 1971 recognized that action was required to rehabilitate and enhance the state's salmon fishery. On this basis, it created the Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.). One of the major responsibilities of this division of the Alaska Department of Fish and Game (ADF&G) is to "develop and continually maintain a comprehensive, coordinated state (regional) plan for the orderly present and long-range rehabilitation, enhancement and development of all aspects of the state's fisheries for the perpetual use, benefit and enjoyment of all citizens and to revise and update this plan annually."

Recognizing the need for private sector involvement in the rehabilitation and enhancement efforts, the legislature, in 1974, passed the private non-profit (PNP) hatchery statutes (AS 16.10.375.550). It was the intent

of the act to "... authorize the private ownership of salmon hatcheries by qualified non-profit corporations for the purpose of contributing by artificial means to the rehabilitation of the state's depleted and depressed salmon fishery."

In 1977, the legislature concluded that it was important to gain regional input from organized fishermen's groups and the public. Therefore, it amended AS 16.10.375 to recognize the importance of regional planning. A portion of the statute states, "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."

1.1.2 Kodiak Regional Aquaculture Association

In 1982, the Kodiak Fisheries Advisory Committee concluded that it was important that a comprehensive regional salmon plan be developed for the Kodiak Region and that a qualified regional aquaculture association be formed. This request was implemented by ADF&G and approved by the legislature in the form of a $100,000 planning grant to be administered by the F.R.E.D. Division. The purpose of the grant was to develop a comprehensive regional salmon plan and to form a regional aquaculture association. The formation of the regional aquaculture association began in late 1982 and concluded with a formal request for certification being forwarded to the Commissioner of the Alaska Department of Fish and Game in May, 1983. The association drafted its by-laws, elected a nine-member Board of Directors, and participated in the review of the draft comprehensive salmon plan.

1.1.3 Geographic Area of Interest

While the characteristics of the Kodiak Region will be discussed in much greater detail in the following chapters, certain features of its location and characteristics need to be mentioned to set an appropriate context for review of the plan.

The Kodiak Region consists of the entire Kodiak management area, which includes the Kodiak Island Archipelago and the south and east slopes of the Alaska Peninsula from Cape Douglas, at the beginning of Shelikof Strait, to the southern entrance of Imuya Bay near Kilokak Rocks.

1.1.4 The Regional Planning Team (RPT)

In 1982, the Kodiak Advisory Committee appointed three members to the Kodiak Regional Planning Team. The RPT has six voting members, three representing the Kodiak public and three representing the Alaska Department of Fish and Game. Public members of the RPT are: Chairman, Hank Eaton, Kodiak; Don Vinberg, Kodiak; Leon Francisco, Kodiak. ADF&G members of the RPT are: Paul Pedersen, Commercial Fisheries Division; Pete Murray, Sport Fish Division; Roger Blackett, F.R.E.D. Division. All ADF&G representatives are from the Kodiak office. Other ADF&G participants are Lonnie White, Tim Joyce, Ken Manthey of the Kodiak office and Jerry Madden and Kevin Duffy from the private non-profit office in Juneau. To facilitate the planning process, a consultant, Leonard Lane Associates, Inc., was hired by the F.R.E.D. Division of the Alaska Department of Fish and Game. It was the consultant's responsibility to coordinate all planning activities and serve as the principal writer of the plan.

Meetings were held by the team on a regular basis. These team meetings were also attended by additional members of the Alaska Department of Fish and Game's Kodiak Regional Office. Public involvement in the planning process was formally handled through the efforts of the RPT. The Kodiak Regional Aquaculture Association was formed during the latter stages of the planning process and participated in the review of this draft plan. It is anticipated that the second phase of the planning process will continue under the auspices of the Kodiak Regional Aquaculture Association. The association will be responsible for appointing the public members to the RPT.

1.2 APPROACH TO THE PLAN

The comprehensive salmon plan for the Kodiak Region is being developed in two phases. Phase I of the planning process, which is represented by this document, is the creation of a long-range plan. This plan sets a framework for a Phase II Plan which will develop specific projects. The Phase I Plan includes a review of all relevant information regarding the salmon fishery in the Kodiak Region. This information is contained in historical records and in on-going data developed primarily by the Alaska Department of Fish and Game. The data were synthesized and analyzed in order to establish the status of the fishery.

Based upon the status of the fishery and a combination of both natural runs and current supplemental production, the RPT estimated the demands that would be placed on the resource during the life of the plan. They were able to develop goals and objectives required to fill the "gap" between what would be produced through natural runs and current supplemental production and what the RPT felt would be required to support the future demands on the fishery.

The plan is intended to undergo constant modifications during its life span as objectives are achieved or deemed unattainable. Additionally, technological advances in fisheries fields will provide new opportunities for the rehabilitation and enhancement of the salmon resource.

1.3 PUBLIC PARTICIPATION

Public participation in the planning process was part of the plan development through the structure of the planning team, use of a questionnaire, and finally, public comment on this draft plan.

The public members of the RPT were individuals nominated at a meeting of the Kodiak Fisheries Advisory Committee. These individuals have a long history of fishing activity in the region. They also represented a diversity in the major gear groups.

The RPT developed a questionnaire which was distributed to all user groups. The numerical results obtained from the questionnaire are contained in Appendix IV along with a copy of the questionnaire. Trends which were developed from the data are contained in Section 4 of the plan.

This is the public review draft of the plan. Comments will be reviewed, and appropriate action regarding changes in the plan will be discussed and taken into account by the RPT when they develop the final draft.

1.4 APPROVAL AND AUTHORITY OF THE PLAN

The responsibility for and authority to develop the plan is vested by the Commissioner of Fish and Game in the RPT. The RPT is directly responsible for developing the draft plan and soliciting public input.

The draft will then be revised accordingly and forwarded to the Commissioner of the Alaska Department of Fish and Game for review and approval. Upon approval by the Commissioner, the plan will be printed in final form and transmitted to the legislature. Once this is completed, the plan will become the official guideline for salmon enhancement and rehabilitation efforts in the Kodiak Region.

1.5 EFFECTIVE LIFE OF THE PLAN

To develop a meaningful plan it is necessary to identify a period of time that serves as a framework within which specific targets can be set. The general guidelines for this planning effort indicate that the plan should address a period of from 18 to 22 years. The RPT selected a period of 21 years, covering the last two decades of this century, 1982 through 2002.

It is possible within this time framework to:

(1) complete a single action,
(2) complete a series of dependent actions, and/or
(3) initiate an action which may not be complete before the termination of the 21-year period.

It should be emphasized that the plan is a living document which is expected to undergo modifications during its "life span." These adjustments cannot be unilateral. Rather, they must arise from the same organized and cooperative effort that created this document. Therefore, the plan is the initial effort in a general planning approach which will continue indefinitely.

1.6 ASSUMPTIONS

Certain assumptions have governed the development of the plan and are essential to the accurate understanding of its contents.

1. The plan uses the best data available and the most accepted interpretation of that information.

2. The plan assumes a regular, if not constant, reassessment of information and requirements and the subsequent modification of plan elements.

3. The plan assumes the continuation of close cooperation between the user groups and the state toward the end of providing an optimum sustainable harvest of the salmon resource.

4. The team feels that there will be more fishing pressure on the amount of available fish due to:

   (a) More efficient harvest and processing techniques.

   (b) A strong feeling that fishermen will want a reasonable net profit on a sustained basis.

5. Prices will continue to fluctuate during the plan period.

6. Economic viability must be maintained. In order to maintain the economic viability of the fishing industry in Kodiak, the amount of harvestable fish will have to increase as follows:

   (a) Pink Salmon: An increase to 18,500,000 fish in an even year and 13,500,000 fish in an odd year by the year 2002.

   (b) Sockeye Salmon: An increase to 1.9 million harvestable fish by the year 2002.

(c) Chum Salmon: An increase to 2 million harvestable fish by the year 2002.

(d) Coho Salmon: An increase to 507,000 harvestable fish by the year 2002.

(e) Chinook Salmon: An increase to 7,000 harvestable fish by the year 2002.

7. In order to achieve the Target 2002 status for natural runs, the RPT assumed within ± 20 percent that the factors affecting survival will remain approximately the same as those for the previous 5-year period. (For planning purposes this period was deemed to be more representative than the previous 10-year and 20-year periods.)

8. The market will show a continued increase in the amount of frozen product and a decrease in the amount of canned product.

9. There will be a continued trend toward vertical integration in the industry, i.e., fishermen owning the cannery for which they fish, thereby affecting prices and demand.

10. Land status will affect enhancement efforts over the plan period primarily due to Native Land Claims Settlements and the prohibition of construction and operation in the Kodiak Wildlife Refuge area.

11. Alaska marketing and processing techniques will need to be revised in order to compete in the world market in terms of quality of product. It is assumed that processors and fishermen will concentrate on quality.

12. There will be continuing oil exploration activities in the region that may affect the salmon fishery.

13. There is a strong possibility of more private hatcheries being developed in the region, provided early attempts are successful.

14. Markets will continue to be analyzed, and the return on investment data will be compared against the cost of building enhancement facilities and rehabilitation projects.

15. Public funds for rehabilitation and enhancement, as well as construction in the public and private sector, will be decreasing. Additionally, existing facilities may not continue to be operated by the State. However, an exception could be state loans made to viable private non-profit associations that can show a return on their investment.

16. There will continue to be a limited entry program that can withstand the test of the courts. While there may be a slight increase in the number of permits, it will not be significant.

17. The "Alaska limit", in terms of size of boats, will be retained for the Kodiak fleet.

18. Management and regulation will be a mitigating factor on how much of the resource can be harvested.

19. Sport fish harvest effort will increase due to an increase in anglers and improved angler access.

20. Processor capacity will continue to increase with the expected increased harvests.

21. Subsistence and personal use fisheries will continue to increase in terms of specific species in specific areas.

With the context of the development of the plan thus established, Chapter 2 will explore the conditions which prevail in the region as they relate to the present condition of the salmon resource and the potential of this resource.

SECTION 2.0

REGIONAL PROFILES

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L I S T O F T A B L E S A N D M A P S

2.0 REGIONAL PROFILE

2.1 PROJECT LOCATION

The Kodiak Region includes the Kodiak Island Archipelago and the south and east slopes of the Alaska Peninsula from Cape Douglas, at the beginning of Shelikof Strait, to the southern entrance of Imuya Bay near Kilokak Rocks. The Kodiak Island Archipelago includes Kodiak, Afognak, Raspberry Islands, and the smaller outlying islands.

The Kodiak Archipelago is within the boundaries of the Kodiak Island Borough. The land area within the borough is approximately 4,900 square miles, with Kodiak Island, the largest island in the state, accounting for about 3,600 square miles of the total.

The majority of the Alaska Peninsula portion of the region bordering Shelikof Strait is not within an organized borough. A small section near Cape Douglas is located in the Kenai Peninsula Borough.

The Kodiak Region, as defined for the plan, coincides with the Kodiak ADF&G Commercial Fish Management area for salmon.

2.2 OVERVIEW OF THE NATURAL ENVIRONMENT

Within this section, those elements of the natural environment which exhibit clear and potentially significant relationships to one or more phases in the annual life cycle of the salmon of the Kodiak-Shelikof Strait area, will be highlighted.

2.2.1 Kodiak Archipelago/Alaska Peninsula

The Kodiak Region is part of the south central region of Alaska which includes many areas draining into the Gulf of Alaska. The Kodiak Archipelago is separated from the Alaska Peninsula by Shelikof Strait.

Kodiak Island is the largest island in the state and it has approximately 900 miles of coastline. The coastline of the archipelago facing the Gulf of Alaska, is extremely irregular with many islands and fjords which have branching arms. Chiniak Bay has several offshore islands which protect the Municipality of Kodiak from direct impact from the Gulf's storms. Ugak and Kiliuda Bays also indent the coastline. Sitkalidak Island is the largest island on this outer coast. The southwestern coast is relatively smooth with only Alitak Bay indenting Kodiak Island.

The northwest side of the island along Shelikof Strait is characterized by the long narrow fjords, Uyak, Spiridon, Uganik and Viekoda Bays. It is on this northern shore that the Karluk River, once considered North America's most productive salmon river, empties into the strait.

Afognak Island is located northeast of Kodiak Island. Its eastern shore is separated from Shuyak Island by Shuyak Strait. Major bays are Kazakof (Danger) Izhut, Tonki, Perenosa, Foul, Paramanof, Malina, and Afognak Bays. Between Kodiak and Afognak Islands lie a number of smaller islands, the largest of which is Raspberry Island. Kupreanof Strait separates the Raspberry Islands and Kodiak Island. Whale Pass and Shuyak Strait are known for their strong tide currents.

The portion of the Alaska Peninsula along Shelikof Strait is a rugged, diversified area of narrow, steep-walled fjords, gently curving bays, wide and long beaches and intricate coves. The ice-shrouded Aleutian Range rises from the coast to elevations exceeding 4,000 feet, and numerous glaciers may be found in the area. The coastline north of Hallo Bay continues in a large sweeping arc that includes the eastern most promontory

of the Alaska Peninsula, Cape Douglas. Major bays from north to south are Hallo, Kukak, Kaflia, Kuliak, Missak, Kinak, Amalik, Dakavak, Katmai, and Kasvik. All of these are in the Katmai National Monument. Major bays from south of the monument are Alinchak, Puale, Portage, Wide, and Imuya Bays.

2.2.2 Major Mountain Systems

Two mountain ranges define the watersheds of the Kodiak Region. The Aleutian Range dominates the southern coast of the Alaska Peninsula. Rounded ridges rise from 1,000 to 4,000 feet in altitude, creating an abrupt and rugged coastline. The drainage divide between the Bering Sea and the Pacific Ocean is generally within ten miles of the southern coastline along the highest ridges.

The Kodiak Mountains form the Kodiak Archipelago. Kodiak Island has a rugged northeast-trending divide with summit altitudes between 2,000 and 4,000 feet. Afognak Island has its highest elevations (2,400 feet) on the northern side. Much of the island is mountainous. Only a few icy remnants of past glacial systems remain on the archipelago and do not contribute significantly to the drainage systems. However, on the Alaska Peninsula portion of the region, large areas of the upper zones are covered by snow fields and glaciers.

2.2.3 Surface Waters

Major river systems, creeks, and lakes are considered from two perspectives: their roles in the hydrology of the Kodiak Region drainage basins and their roles in the annual production of salmon. This section deals only with physical aspects and later sections will examine salmon support capacities.

The Kodiak Region contains at least 335 streams that produce anadromous fish. Kodiak Island has at least

1,000 lakes of four hectares or larger and has 299 known anadromous streams.[1] Afognak Island has many fish producing lakes. On the Alaska Peninsula portion of the region, there are many streams. Some of these systems have important lakes.

Streams in this region are typically short and often fairly steep. On the Kodiak Archipelago most rivers flow in fairly direct courses from the higher ridges to the nearest bays. Therefore, drainage systems are relatively simple and of small area. These small watersheds, when precipitation is heavy, cause localized flooding of short duration.

On Kodiak Island, streams are mostly swift, clear, and less than ten miles long. Major rivers are the Karluk, Ayakulik (Red River), and Dog Salmon Rivers. Karluk Lake (12 miles long and one mile wide) is the largest lake on the island. Other large lakes are South Olga Lakes (Upper Station), Akalura, Red, Frazer, Spiridon, and Uganik Lakes.

On Afognak streams are also short, and the major ones drain lakes such as Afognak, Big Kitoi, Laura, Pauls, Upper and Lower Malina and Portage Lakes.

On the Alaska Peninsula, small, single lakes and streams constitute many separate drainages. Dakavak Lake is the largest lake draining into Shelikof Strait. The Swikshak River, a braided system, is the only major drainage whose headwaters are in the Kenai Peninsula Borough. Other streams, which are extensively braided

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1 Van Hulle, Frank and John B. Murray, "Sport Fish Investigations of Alaska, Inventory and Cataloging." Vol. 19. July 1, 1977 to June 30, 1978. Sport Fish Division, Alaska Department of Fish and Game.

and have unstable beds, are the Katmai, Big, Ninagiak Rivers and Hallo, Soluka, and Kialagvik Creeks. The area also contains many unnamed streams.

2.2.4 Climate

The climate within the Kodiak Region is maritime and influenced by the warm Japanese current which swings along the Alaskan coast. Temperatures are mild with wet, cool summers and relatively warm winters. Snow occurs during winter months, however, snow depths are not usually excessive at low elevations.

Meteorological records since 1956 indicate appreciable variation in yearly precipitation throughout the Kodiak Archipelago. Average annual rain fall is approximately 56.41 inches in Kodiak City. However, records also tend to indicate a general persistence of an east-west precipitation gradient with maximum precipitation concentrated near Shearwater Bay along the Pacific coast of Kodiak Island and minimum precipatation on the Shelikof Strait side near Larsen Bay and the Karluk River. The total monthly precipitation is fairly uniform throughout the year, although intensive storms in the Gulf of Alaska during the fall can bring prolonged and heavy rain. Sustained extreme wind speeds range from 50 to 75 knots. Gusts as high as 100 knots are also experienced. Frequency of fog is approximately 10% of the time in the Kodiak Archipelago.

Table 2.2-1 provides weather information for selected sites within the Kodiak Region.

Table 2.2-1:

CLIMATE DATA - KODIAK CITY

Month	Temperature °F			Precipitation in Inches		
	Average	High	Low	Average	Min.	Max.
January	30.4	54	-8	5.01	0.24	15.77
February	31.4	56	-12	4.59	1.41	12.43
March	32.1	57	-6	3.85	1.36	8.12
April	36.9	64	7	3.81	1.13	6.15
May	43.2	80	20	4.35	1.00	11.89
June	49.7	86	30	4.12	1.42	11.78
July	54.1	82	37	3.54	1.01	8.09
August	54.9	83	36	4.30	1.68	11.13
September	50.0	71	26	6.11	1.20	12.60
October	40.7	61	10	6.29	1.56	14.53
November	34.8	54	0	5.41	0.19	14.79
December	29.9	54	-1	5.03	1.21	12.19
	TOTAL PRECIPITATION IN INCHES:			56.41	13.41	139.47

U.S. National Climate Center, NOAA, 1982.

2.2.5 Seismicity and Volcanism

The Kodiak Region is situated on the edge of the North Pacific Plate, a zone of tremendous seismic activity which encircles the Pacific Ocean. The southern Alaska Peninsula, adjoining the Aleutian Chain and the Kodiak Archipelago, constitute one of the most active seismic areas in the world. During Russian times, settlements at Three Saints Bay were destroyed by tsunami and earthquakes in 1788 and 1792. Since 1867 there have been at least two dozen major earthquakes and in the 20th century two reported tsunami. The historic 1964 earthquake and resultant tsunami completely destroyed Kaguyak and Old Harbor, while heavy damage was suffered in Kodiak, Afognak, Ouzinkie and several other coastal villages.

The subsidence and uplift, which is associated with the more severe of these events, can make dramatic and long term changes in the land forms and, therefore, in the character of the related surface waters. It is safe to assume that seismic activities will continue to occur with some regularity and that the results will be locally important.

Another facet of this physically active region is the presence of volcanos along the southern Alaska Peninsula. Eleven volcanic centers are found in the Kodiak Region of the peninsula. Five have probably had no historic activity. The Katmai volcanos have been included in a national monument. An explosive eruption from Mount Katmai, with vast pumice and ash deposits, caused extensive damage to buildings and crops on the Kodiak Archipelago in 1912. This pumice and ash had an effect on many salmon streams of Afognak Island and the northern portion of Kodiak Island. During the last sixty years, lava flows have occurred at Novarupta in

1912 and five times from Mount Trident since 1953. Nineteen recorded eruptions have occurred on Mount Katmai, Novarupta, Mount Mageck, and Mount Martin since 1912.

Volcanic activity could occur at any time. Eruptions of large magnitudes could have very significant impacts on the southern Alaska Peninsula, as well as areas of the Kodiak Archipelago.

2.2.6 Geology and Soils

The geology and soils are complexly interwoven and play a part in stream characteristics. In the mountainous areas of the Kodiak Archipelago a combination of high precipitation, steep topography, considerable exposed bedrock, a lack of aquifers, and thin soils causes runoff to be almost the highest in the state. However, on the lowlands, major streams transport water across relatively porous and permeable glacial and alluvial sediments where water is lost by seepage, consequently recharging the ground water system.

Turbidity of stream water can be the result of glacial flour from glacial abrasion. Many streams, which originate from glaciers on the peninsula portion, are silt laden, however, on the Kodiak Archipelago very few streams are so affected. Some sands, silts, clays, and volcanic ash can be picked up during flood stages and transported by a stream. Ash deposits on the archipelago and on the peninsula are a predominant surface feature over most of the slopes and valleys. In bog areas, water may become high in organic content, acidity and color levels. This brown water can significantly inhibit light penetration.

Oil and gas seeps have been recognized on the southern Alaska Peninsula. Studies do not rule out the possibilities of producing oil, however volcanic activity makes this area less conducive to petroleum development.[2]

2.2.7 Wildlife

The Kodiak Region is unique in its wildlife, especially on the Kodiak Archipelago. Brown bear, weasel, fox, and land otter are native to the islands. Black bear, wolves, wolverines, moose, and barren ground caribou do not inhabit Kodiak Island. Successful transplants of beaver, Sitka black-tailed deer, Roosevelt elk, and mountain goat have been made to the archipelago. A small number of Dall sheep, after an initial transplant, still exist. Feral reindeer occur on Kodiak Island.

On the Alaska Peninsula wolves, fur bearing animals such as beavers, river otter, red and arctic fox, and lynx are found. There are no Sitka black-tailed deer, Dall sheep, elk, nor mountain goat on the southern Alaska Peninsula. Barren ground caribou and moose use the north side of the peninsula more than the Pacific side. The coast is inhabited by several species of marine mammals. The wolverine has been identified by the Bureau of Sports Fish and Wildlife as being an endangered species, needing protection within the Katmai National Monument.

Many of these species are significant as game species and are sought in sport and subsistence hunting. This results in regular access to some areas of the watersheds.

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2 U.S. Department of Interior, "Proposed Katmai National Park Final Environmental Statement", 1974, (page 47).

Other wildlife such as birds and smaller terrestrial mammals occur in the region. Some of the wildlife species use streams and lakes as significant parts of their habitat requirements. In this context they influence the habitat of the stream or lake and may act directly on the salmon resources. This interaction with salmon resources may be as direct as the predatory character of the feeding brown-grizzly bears or somewhat indirect, such as the habitat alteration created by beaver dams.

Marine mammals in the bays and straits must be considered, as some are recognized as salmon predators. Sea lions are found throughout the area. Tugidak Island has what may be the largest population of harbor seals in the world.

2.2.8 Vegetation

The Kodiak Archipelago has two distinct forms of vegetation. On Afognak, Shuyak, and neighboring islands and on the northeast end of Kodiak Island, a dense forest of Sitka spruce occurs. Since these forests are relatively new to the area (800 to 1,000 years), the forest is slowly expanding south. The valleys may contain growths of cottonwood, black birch, and alder.

Most treeless areas support a thick cover of grass, although low brush and tundra vegetation such as mosses, sedges, and heathers grow in such spots.

The Alaska Peninsula area includes white spruce in the foothills, with alder, willow, cottonwood, and black birch throughout. There are essentially no commercially valuable timber stands in the southern Alaska Peninsula area, although significant amounts of commercially valuable timber occur on Afognak Island and the northeast end of Kodiak Island.

2.2.9 Fish

2.2.9.1 Salmon

Five species of salmon (sockeye, coho, chinook, pink, and chum) are harvested in the subsistence, sport, and commercial fisheries on the Kodiak Archipelago and southern Alaska Peninsula. These five species are the focal point of this plan. There are, however, other fish resources of value in the region.

2.2.9.2 Non-Salmon Anadromous and Freshwater Species

Rainbow trout (steelhead), Dolly Varden, and stickleback may be anadromous or may be exclusively freshwater on a site-by-site basis. Freshwater species on the Kodiak Archipelago include Arctic grayling and rainbow trout.

All fishes along the Shelikof Strait side of the Alaska Peninsula are from groups known to tolerate salinity and to be capable of marine dispersal. This includes the Dolly Varden char.

2.2.9.3 Non-Salmon Marine Species

Within the region herring and halibut are harvested on a commercial basis. Efforts continue in an attempt to develop a viable groundfish industry with a potential of a large resource harvest.

2.2.9.4 Shellfish

Shellfish play an extremely important role in the region, with major harvests of tanner, king, and dungeness crab, as well as shrimp and scallops. Swikshak Beach on the Alaska Peninsula, has razor clams which have been certified safe for human consumption.

2.2.10 Summary

The natural environment of the Kodiak Region has many features which directly affect the salmon resource and encourage human activity, resulting in an indirect effect on the salmon resource.

The Kodiak Region provides a wide variety of habitats for the salmon resource. The southern portion of the Alaska Peninsula borders on Shelikof Strait, where migration patterns show that salmon generally move from east to west in the strait.

The major mountain range on the Kodiak Archipelago has few glaciers. However, with the season's snow pack, there is usually sufficient water storage to sustain waterflow in streams year around. Most streams in the region depend upon annual precipitation to maintain their flow regimes. On the Alaska Peninsula, in many cases, the large glacier systems provide sufficient water to maintain flows year around.

The surface waters of the Kodiak Archipelago are less variable in terms of length than those in other parts of Southcentral Alaska. Generally rivers and streams are less than ten miles long and frequently are swift, coming from steep gradients. This makes their investigation, assessment, and understanding easier in comparison with surface waters in other parts of the state, which often have rivers with broad courses, covering large flood plains. However, with these clearly defined channels, it makes the system more vulnerable to a single altering factor. On the Alaska Peninsula some streams have unstable beds and are extensively braided, making it more difficult to assess the environment for salmon.

The major rivers and lakes are found on Kodiak Island along the west coast. On the north end of Afognak Island are several clusters of lakes which drain into Little Waterfall Bay, Discovery Bay, and Perenosa Bay. On the Alaska Peninsula, major rivers drain many different watersheds, and there are few lakes which drain to the Shelikof Strait side.

The climate plays a very active role in the Kodiak Region and its salmon fishery. The intensive periods of rain, in combination with snowmelt during warm trends, often result in flooding, which scours the stream channels when salmon eggs are buried there. With low flow and an extremely cold period, anchor ice may appear on streams causing egg mortality.

As it has in the past, seismic activity can have a permanent effect on the salmon resource, by causing changes in spawning grounds through alterations in river systems and by upthrusting or or causing the subsiding of land along the coastline.

Recurring full-scale volcanic activity has caused wide spread stream blockage, high turbidity, and excessive sedimentation of streams.

Other geological activity may also influence the salmon resource. Porous and permeable glacial and alluvial sediments can lead to seepage which lowers the stream flow during dry periods. Turbidity of water can be the result of glacial flows or can be caused by suspension of sands, clays, silts, and volcanic ash picked up during flood stages. Bog areas can cause high acidity, organic content, and color levels, the latter inhibiting light penetration.

The major interaction between wildlife and the salmon resource occurs where management of one or more species of wildlife produces limitations or impacts on the salmon resource.

The regional vegetation is of concern in planning the salmon resource primarily in the area where mature Sitka spruce can be harvested. When timber harvest occurs, habitat conditions change.

The relevance of other fish species to the planning effort is two-fold. Some species compete for habitat and food, while others are considered predatory. Some species provide a viable alternative harvest for fishermen, decreasing emphasis on utilization of the salmon resource.

2.3 OVERVIEW OF THE HUMAN ENVIRONMENT

Human activities can produce an effect on the salmon resource. These activities may be indirect to a greater extent than those of the natural environment. The action or results may appear to have nothing to do with the salmon resource, however, the results of the action may significantly affect the potential of an area to support salmon.

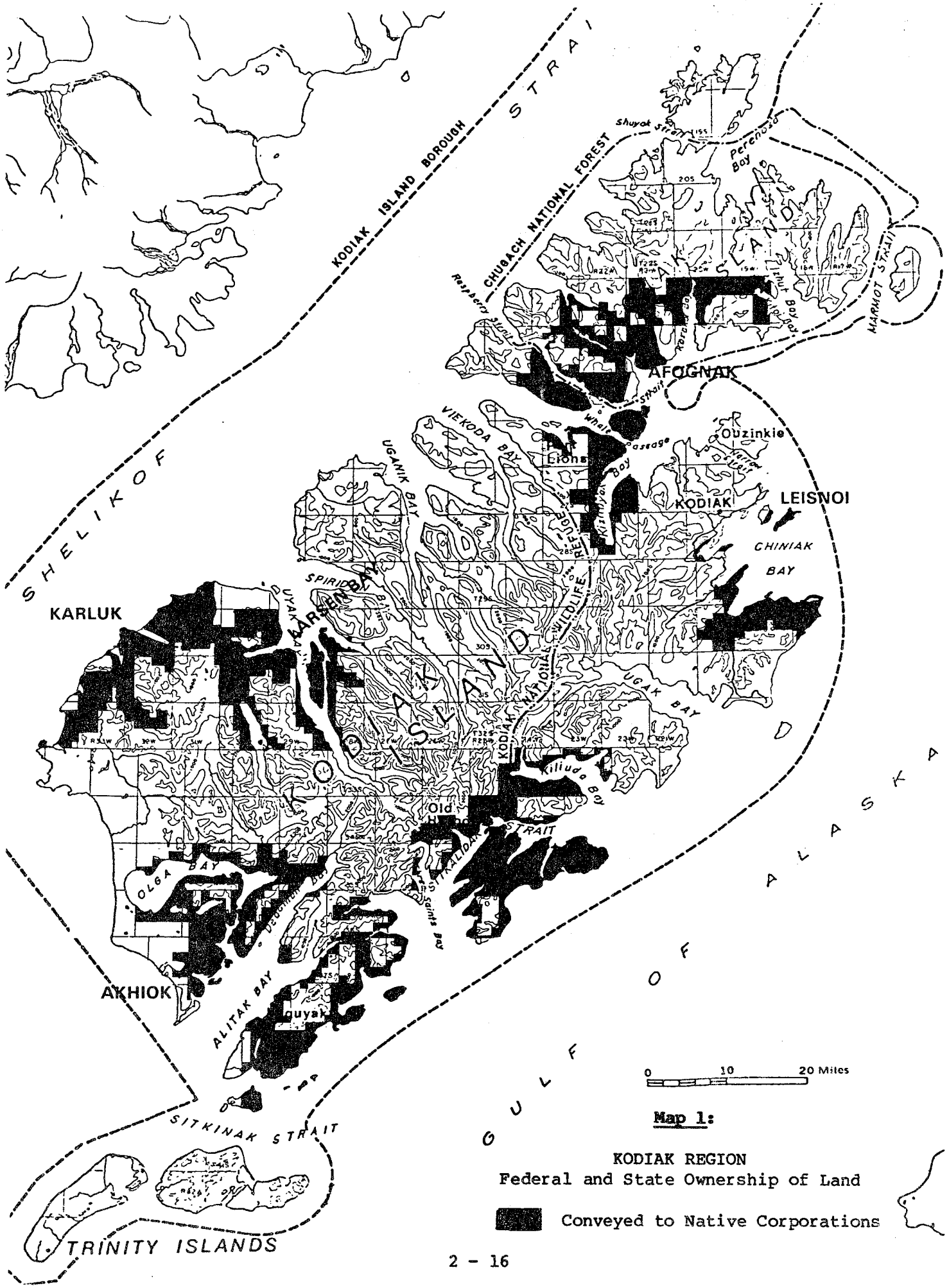
2.3.1 Land Status and Use

Much of the effectiveness of planning can be dependent upon who owns the property in question, what their actions are apt to be, and what uses may be implemented on the property.

2.3.1.1 Land Status

The land within the Kodiak Region is in federal, state, borough, municipal, Native village and regional corporation, and individual ownership. In addition, there are ongoing programs and legislative actions which continue to transfer parcels of land among these various owners. In some cases, to add to the complexity, there are two or more overlapping claims to the same property.

Much of the Kodiak Region is federally owned, with a great portion of Kodiak Island situated within these boundaries of the Kodiak Wildlife Refuge. Portions of the peninsula are in the Katmai National Monument. For lands with federal and state ownership, there is a stability of status and a known set of operational and management policies. Alteration of these policies is open to public input and should be in the public interest. Federal and state ownership of land is shown in on Map 1.



Map 1:

KODIAK REGION
Federal and State Ownership of Land

Conveyed to Native Corporations

Land which is held in some generalized status category by government or individual, has a much less certain future.

The coastal zone has been recognized because of its importance to coastal communities. Various state and federal programs have been instituted to assure its preservation. In Alaska much attention is given to this issue through the Coastal Zone Management Program, the U.S. Army Corps of Engineers' 404 Wetland Permit Program, and the Critical Habitat Designations. The Kodiak Island Borough has drafted a plan for much of its coastal zone.

2.3.1.2 Land Use

Direct impacts can be expected when there are projects to develop the land and/or to exploit the natural resources. It is generally true that the magnitudes of these impacts increase in proportion to the scale of the project. The location and character of the project play large roles in determining what these impacts will be.

Power projects may alter habitat significantly. Within the Kodiak Region the only power project is at Terror Lake on Kodiak Island. The area altered will be in the Terror and Kizhuyak River drainages. However, the indirect impacts may be greater and longer lasting.

Although there are known deposits of sub-surface minerals in the Kodiak Region, only minor production has occurred. Much of the production from the region was in the form of beach placers along the western shore. If large, commercial deposits of sub-surface

minerals are located, the actual disruption caused by the extraction and the effect of the exposed terrain can be significant.

Offshore from the Kodiak Archipelago, recoverable reserves of oil and gas are believed to exist. Leases to explore the Outer Continental Shelf in the Western Gulf of Alaska are scheduled within the time scope of the plan. A sale in Lower Cook Inlet and the northern part of Shelkikof Strait has been proposed, thus raising the possibility of gas and oil development on both sides of Kodiak Island. The impact on the coastal habitat by such exploration and possible production with onshore development has been the subject of numerous studies and several environmental impact statements.

There is a strong tendency to look for the damage, caused by major development, and to overlook potential benefits which could be derived from nominal modifications. Major projects should be reviewed as early as possible to consider what features could serve to maintain and enhance the salmon resource.

Indirect impacts are often overlooked and may involve less planning to minimize negative impacts. Development can result in increased residential and industrial growth. This growth, coupled with increased uses and number of users, can alter habitat and impact salmon.

2.3.2 Population

According to the 1980 census, only 3.0% of the state's population resides in the Kodiak Region. These people live within the Kodiak Island Borough. The Alaska Peninsula portion has been uninhabited for a number of years.

The Kodiak Island Borough has grown from 9,409 residents to 12,714 residents, a 26% population growth since 1970 (see Table 2.3-1). This gain was due to fishing, its largest industry, which has expanded significantly over the decade.

Six villages within the region represent 10% of the population, with the remainder residing in Kodiak and on the road system. During the last thirty years, the population of theses villages has increased at a much slower rate than the population of the City of Kodiak. All of the villages, with the exception of a few people who still live at the Afognak village site and the village of Ouzinkie on Spruce Island, are on Kodiak Island. None of the villages are on the current road system. Access to all is by boat or airplane.

To the year 2000, forecast is for steady population growth in the Kodiak urban area at a rate of about 2.7% annually and a cumulative increase of 100% over the forecast period.[3]

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3 Growth of the Alaskan Economy: Future Conditions Without the Proposal, ISER, 1979.

Table 2.3-1:

POPULATION DATA

	1970 (a)	1982 (b)
Kodiak Island Borough	9,409	12,714
Kodiak City	3,798	5,873
Kodiak Military Base	3,052	3,018
Outside Kodiak City Limits	-----	2,559
Akhiok	115	103
Larsen Bay	126	180
Old Harbor	290	355
Ouzinkie	160	233
Port Lions	227	291
Karluk	98	102

(a) 1970 Census

(b) Kodiak Island Borough data

2.3.3 Description of the Economic Sector

The Kodiak Region's primary industry is fishing and fish processing. As in most other parts of Alaska, the region's fishing industry has been traditionally reliant on salmon, supplemented by catches of halibut and herring. While salmon remains a very important fishery, the addition of large scale king crab, tanner crab, dungeness crab, and shrimp fisheries, and more recently, groundfish, have served to make this area's seafood processing industry a diversified year-around operation.

Most processing takes place in Kodiak, however, several salmon processing plants are located elsewhere on the island. None operate on the Alaska Peninsula portion of the region.

Tourism is currently a minor economic activity in the Kodiak Region, however, it is an industry with potential for expansion. Kodiak Archipelago and the Shelikof shore of the Alaska Peninsula are "off the beaten track" for tourists.

The military has been a factor in the region's economy since World War II, however, it plays a much less dominant role in the economy today. The U.S. Coast Guard, which has a major base on Kodiak, has an impact because it is a major civilian employer and acts as a support for fishing and fish processing, Kodiak's primary industry.

To date, the timber industry has not been a major economic factor in the region. In 1982, two lumber mills near the City of Kodiak cut 2,950,000 board feet of timber that is processed and sold locally as rough cut lumber. The demand for this lumber is increasing. Within the last five years, 110,000,000 board feet of timber has been cut on Afognak Island and shipped to

Japan. With much of the timber lands now in private hands, timber harvest may increase during the plan period.

A minor element in the economy is cattle ranching. Currently six or seven ranches support about 2,000 cattle. An approved slaughterhouse facility at Woman's Bay provides meat to Kodiak and occasionally to Anchorage.

2.3.4 Employment and Labor Force

Fish processing is the largest employer of the Kodiak labor force. The average annual employment for manufacturing, which is almost entirely fish processing, was 3,660. This represents almost 64% of the non-agricultural wage and salary employment in the region.

Fishing employment within the Borough of Kodiak peaks in July during the salmon harvest. While seasonal employment declines in the winter months, these declines are less pronounced than the statewide seasonal patterns. This is due to shellfish harvesting and processing activities during that period of the year.

While the volume of fish harvested fluctuates from year to year, the overall employment level has increased. This is due to exploitation of a wider variety of fish and a generally improved catch level. However, it is difficult to predict future employment levels in this industry. With generally improved management practices, fish enhancement, new technologies in the fish processing industry, and marketing efforts by the State, fish processing employment is expected to hold its own and perhaps even grow moderately in the future. While utilization of groundfish species may increase, it will be a number of years before this has any large impact on employment.

After fishing, government provides the largest employment. The federal government, including the U.S. Coast Guard, is a significant element in this employment. Government is the slowest growing economic sector and the Coast Guard Station, the chief public employer, is not expected to expand its operations. Thus, the public sector employment is expected to decline from 33% to 23% of total employment by the year 2,000.

The basic employment categories - timber, fishing, fish processing, and agriculture - are projected to grow by about 75%, accounting for about 40% of all employment growth to the year 2,000.[4] Trade and services exhibit the fastest growth rate, together generating about 36% of all new jobs. These categories provide 75% of the Kodiak area's growth.

The remaining sectors of construction, transportation, finance, insurance, real estate, and mining comprise a minor share (10%) of the employment and will probably maintain this share through the forecast period.

The petroleum industry will have only minor impacts in terms of employment. Most employment would be on site, and most of the secondary employment increases would go to current residents.

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4 Alaska Consultants, Inc. "Northern and Western Gulf of Alaska, Local Socioeconomic Baseline" prepared for BLM, Outer Continental Shelf Office, 1979.

2.3.5 Economic Outlook for the Region

The economic outlook for the Kodiak Region is dependent upon the influence of the fisheries industry and potential oil and gas development. Without such oil and gas development, the region is expected to continue its moderate growth, much as it has experienced over the last ten years. Several factors lead to this pattern. One of the most important is the availability of land on which to develop new projects. Another is the limited entry fisheries program. This system has been hotly contested in the Kodiak area, however, the limiting of salmon fishing gear is a fact. Kodiak currently has a single basic industry which is fishing and seafood processing. When problems develop in this area, it is felt within the attendant retail and wholesale trade, as well as the services industry.

Fisheries activities should gradually increase despite lower quotas on many of the more valuable shellfish species. It is anticipated that better scientific understanding and improved resource management practices will enhance and stabilize yields, allowing more efficient use of gear, plant and labor force. Efforts continue to establish a viable groundfish industry and as technology and markets improve, this could be a significant influence on the economy.

Tourism has only slight to moderate significance in relation to the total economy of the region and should continue to grow on a modest basis. Promoting the region's historical and recreational assets and improved visitor facilities should attract increased numbers of tourists, conventioneers, and vacationers. Sport fishing and hunting attract the most visitors, with hunting of brown bear with or without a guide, the main attraction. However, the majority of the hunting guides

allowed to work in this area are not residents of the region. As the population increases in other parts of Southcentral Alaska and favorite fishing and hunting spots become overused, a spill-over effect may occur to the lesser exploited areas of the Kodiak Region.

Major portions of the forests of the Kodiak Archipelago have been transferred from the Chugach National Forest to private owners through the Alaska Native Land Claims Settlement Act. It is expected that the forest products industry could become a significant element in the economy. Since the timber is Native owned, it is anticipated that new employment opportunities for Native corporation shareholders will become available and that service and support related activities in the region will benefit.

Another element in the economic future, cattle ranching and meat processing, has some potential for expansion, providing a greater portion of the meat market within the state.

The government sector of the economy is expected to experience some growth as a result of the general expansion of the community of Kodiak. The Kodiak Coast Guard base is anticipated to remain at or around current strength in the future, unless major new developments such as oil and gas exploration take place. A University of Alaska fisheries technology center is being developed and may provide additional employment.

The federal hiring freeze may affect federal government expansion in the region. However, as the economy grows, it is expected that local government will respond by providing increased education and general services.

The investment plans of the Native regional corporation, Koniag, Inc., and the various village corporations, could be an important role in the future economy.

The major economic factor on the horizon is the proposed Western Gulf OCS oil and gas leases. An unknown, but significant economic impact would occur in the region, either as direct salary and wages to local workers, or as dollar infusions throughout the economy through service and support related activity.

2.3.6 Summary

Human environment impacts on the salmon resource differ from impacts by the natural environment. Potential problems can be recognized and minimized through plan modification. In dramatic cases threats to the resource can be mitigated if not eliminated.

The ownership and status of much of the land within the region is in the public domain because it is either held by the state or federal government. The short and long-term policies governing these lands facilitate the planning for salmon enhancement by adding a degree of predictability. These lands are afforded some protection, can serve multiple resource functions, and are dedicated to serving public interest.

Land use development and alteration could have significant impact on the salmon resource that would affect planning of projects. Anticipated projects such as exploration and possible production of oil and gas, may lead to development of support and supply facilities, crude oil terminal sites, and onshore production treatment facilities. As progress toward OCS leasing and subsequent exploration begins, assessment of the impact on salmon habitat needs to start at the earliest possible time to determine the potential effects of

resource development on the habitat.

The total population growth of the region appears to have stabilized and a major influx can only be expected when oil and gas exploration and possible production begins. A large increase in the number of people in the area will cause loss of salmon habitat in some areas and pressure on the salmon resource, especially with reference to sport fish.

The Kodiak Region's growth and prosperity is tied to its primary industry, fishing and fish processing. Other sources of economic strength include the continued presence of the U.S. Coast Guard plus some probable expansion in forest products, tourism, and recreational activities. The investment plans of the Native regional and village corporations may also be a factor in the future growth of both Kodiak and other communities in the region.

It is expected that employment opportunities and the labor force will continue to have seasonal fluctuations. New opportunities for employment may arise from development of such industries as timber, oil and gas, and groundfish.

2.4 SALMON FISHERY

The story of the man/salmon relationship in the Kodiak Region has been one of increased participation, harvest, management, and regulation.

2.4.1 Overview

The salmon resource in the Kodiak Region is utilized by three user groups: subsistence and personal use fishery, sport fishery, and commercial fishery. Some aspects of the salmon fishery are important to all user groups or play a role in the relationship between these user groups.

2.4.1.1 Historical Perspective

The earliest use of salmon in the Kodiak Region came from Native harvest on a relatively small scale as a basic food for existence.

In the 18th century Russian explorers discovered and reported great runs of salmon at the Karluk River, which the Natives knew about and used long before Russian arrival. Undoubtedly the Russians utilized the salmon from an early date, although limited data exists to indicate the extent of their operations. However, in several seasons around 1827, 300,000 sockeye salmon were prepared as "yukola" (dried without salting or smoking).

No large commercial use seems to have been made of the region's salmon until Alaska was purchased by the United States in 1867. Commercial use of salmon centered on the Karluk River and Lagoon. For a 46 year span (1882 through 1927) a yearly average of 1,706,000 sockeye was harvested from this great salmon stream. Commercial fishing spread by the 1890s to other sockeye producing areas such as Alitak

and Olga Bays, Ayakulik (Red River), Uganik Bay, and Afognak Island streams.

Sockeye was the preferred species prior to 1900. Pink salmon were dried by natives for winter use and moderate numbers were salted for San Francisco markets. Chum salmon were also dried for subsistence use.

By the turn of the century, commercial use of chinook and coho salmon was established. It was not until 1908 that quantities of pink salmon were harvested commercially. Pink salmon harvests rapidly increased about 1919 and became dominant in the catch around 1924.

Traps were used as early as 1896, however, the major gear used were hand-hauled drag nets. Steam power was introduced in 1896, reducing manual labor by half. Gear restrictions began by the early 1920s, and it was not until the 1930s that the present structure of commercial gear users was in place: purse seine, set net and beach seine. Traps were legal and as many as 33 were used to commercially harvest salmon. With the coming of statehood in 1959, traps were eliminated in the region.

The sport fishery began to develop particularly with the increase in military personnel during and after World War II.

As more and more use of the salmon resource developed, increased efforts to manage the resource were made by the fishery managers: the U.S. Bureau of Fisheries until 1940 and the U.S. Fish and Wildlife Service from 1940 until 1960 when the State of Alaska began management of its fisheries. Programs such as

establishment of escapement goals and forecasts have become management tools which help to ensure the continuation of the resources in a viable condition.

2.4.1.2 The Salmon

All five species of salmon return to the Kodiak Region. The complexity of the fishery and its management comes from many factors. One is the difference in the life cycle of each species. There is considerable variation in the amount of time that will pass between the period when eggs are deposited and the time the product of these eggs will return as mature adults. Although the chinook salmon may have a seven-year return period, they and the sockeye salmon normally have a 4 to 6-year return pattern. The chum and coho salmon generally are considered to have a 4-year cycle. The pink salmon have the shortest cycle of 2 years. However, the 2-year cycle of pink salmon is further divided into the dominant and non-dominant year. The even-year cycle is dominant.

There are pronounced differences in the number of each species which occur in the region. The commercial species in greatest abundance is the pink salmon. Both chum and sockeye rank nearly the same in the recent 20-year period, 1963 through 1982. Fourth is the annual harvest of coho salmon, and chinook salmon experienced the smallest harvest.

The annual run of each species is different and the total annual return within species is made up of different distinct runs spread out over several weeks and months. General run timing for the Kodiak Region is shown on Table 2.4-1.

Table 2.4-1:

GENERAL SALMON RUN TIMING INFORMATION
KODIAK AREA

Species	Present Bays and Estuaries	Present Freshwater	Peak of Spawning
Chinook Salmon	3/15 - 7/01	6/01 - 9/15	8/10 - 9/01
Sockeye Salmon	5/01 - 9/15	5/15 - 12/15	8/01 - 10/15
Coho Salmon	7/01 - 11/15	8/15 - 1/15	10/15 - 12/15
Pink Salmon	7/01 - 9/01	7/15 - 10/01	8/01 - 9/15
Chum Salmon	6/15 - 9/01	7/15 - 10/01	8/01 - 10/01

2.4.1.3 User Group Definition and Development

Three groups of fishermen have been recognized, based on the reason why they fish. The subsistence fisherman represents the continuation of Man's earliest use of the salmon resource. Today's context of what constitutes subsistence fishing is the subject of discussion and definition. However, the concept is based on the premise that fish caught are consumed by those who catch the fish or are traded for some other life sustaining necessity. A personal use concept is being discussed and defined.

Sport fishing is an ever increasing factor in the salmon fishery. Although the salmon are captured for recreation, the fish which are caught are consumed by the fishermen representing a quasi-subsistence use.

The commercial fishery is the largest harvester and has the longest, clearly quantifiable record of active involvement with the salmon resource. There is a substantial range in the size of commercial fish operations. However, all of the commercial fishermen are harvesting the salmon resource for the primary purpose of sale to the processor, with the ultimate goal of serving a large national and international market. A small fraction of the individual commercial fisherman's catch is diverted to his own table to fill a quasi-subsistence function.

Commercial fishermen define themselves according to the type of gear used in fishing. The greatest number of permit holders are the purse seine fishermen. The second largest group are the set gillnet fishermen, and the third group is comprised of the beach seine fishermen.

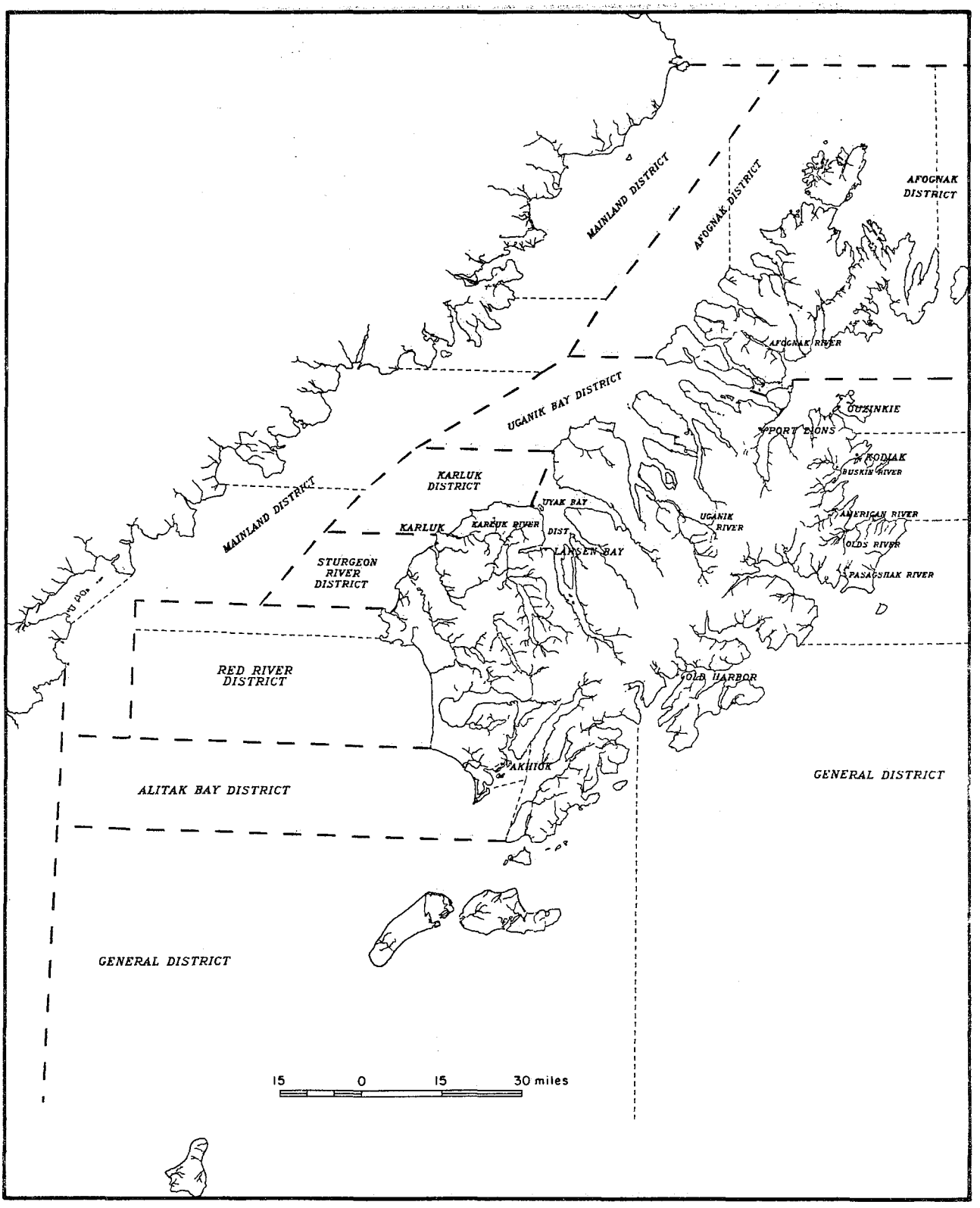
2.4.1.4 Fisheries Management

A management structure regulates how the needs of resource management and enhancement and resource harvest will be achieved. The agency with jurisdiction is the Alaska Department of Fish and Game, operating under the policies of the Alaska Board of Fisheries.

For purposes of administration and management, the ADF&G has created districts within the Kodiak Region shown on Map 2.

Map 2:

KODIAK REGION COMMERCIAL FISHING DISTRICTS



2.4.2 Subsistence Fishery

Subsistence fishing, the oldest category of salmon use, is the user group which is least defined. A permit system has been in effect since statehood. Recently the concept of subsistence fishing has come under scrutiny and has been subjected to new and generally expanded definition. It appears criteria will continue to be defined in years to come.

2.4.2.1 Regulations

The general trend for the past twenty years has been a general tightening in subsistence regulations. Participation has expanded because of public awareness.

All waters in the Kodiak Management Area are open to subsistence fishing except for a few areas. Subsistence fishing is open year around except that registered purse seine permit holders cannot take fish for subsistence purposes with commercial gear. Fish may be taken only by seines and gillnets.

The number of permits has dramatically increased in the 20-year period (1963 to 1982) from 74 in 1962 to a high of 1,277 in 1982. Not all permits are returned, consequently statistics for this document were calculated from data received from an average of 48% of the permit holders. In addition, there is undoubtedly subsistence fishing conducted without a permit which adds an unknown to the actual number of salmon taken for subsistence purposes.

2.4.2.2 Catch Analysis

The total catch reported by subsistence fishermen averaged 17,394 salmon a year, in the 5-year period from 1977 through 1981. *

Sockeye salmon is the most sought after species. The annual catch in the 5-year period has averaged 10,447, with a high of 13,746 in 1980. There has been a dramatic increase in the sockeye taken, with three times as many sockeye taken in 1980 as in 1976. Sockeye salmon contributed 66% of the total subsistence harvest in 1981.

Coho salmon is the second most harvested species, contributing an average of 20% to the total subsistence catch. There has been a steady increase in pressure on the coho runs.

The pink salmon harvest has remained fairly constant with an average of 2,786 fish taken in each of the years. Pink salmon contribution to total subsistence catch has steadily decreased during these years, from 21% in 1977 to 12% in 1981.

Chum and chinook salmon do not show a significant contribution to subsistence fishing. In 1981, chum contributed only 3% of the total subsistence take, and chinook salmon contributed less than 1%.

The average number of salmon caught per reported permit was 28 fish during the 5-year period. The trend has been stable within this period.

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* Data for 1982 are incomplete.

Salmon are taken for subsistence throughout the region. The Buskin and Afognak Rivers provide the most salmon for subsistence users. Other important locations for subsistence are the Uganik River, Chiniak Bay, Moser Bay, Karluk River, and Old Harbor. The Mainland District provides the fewest salmon for the subsistence fishery.

2.4.2.3 Economic Assessment

It is difficult to make an assessment of the economic impact of this fishery. Its main economic benefit is to the individual subsistence fisherman in the form of reduced household expenses.

2.4.3 Sport Fishery

2.4.3.1 Introduction

Sport fishing effort in the Kodiak Region has continued to increase since the first major pressure by military personnel in the 1940s.

Interest was sufficiently great by 1953, resulting in the organization of a sportsmen's club, the Kodiak Conservation Club, an unofficial volunteer project of the military. Its emphasis was on steelhead enhancement, however, it does show that sportsmen were concerned and dedicated to ensuring that a sport fishery would be available. Today, the Kodiak Island Sportsman Association and the Kodiak Rod and Gun Club are active sport fishermen's organizations.

After statehood, inventories and catalogues of lake and stream systems, used by fresh water and anadromous species, were conducted on the Kodiak Archipelago. Greater emphasis on this research in the last ten years has provided information for establishing priorities, formulating policies, and planning within the area.

2.4.3.2 Fishing Pressure

The sport fishing effort has increased annually since statehood, and it seems likely to do so for many years to come. A review of 1973-1978 sport fish license sales indicated a 73% increase in license sales over that 7-year period.

Starting in 1977, an annual angling survey has been conducted by a series of mail questionnaires which provides an estimate of state and regional angler use. This survey confirms the dramatic continuing upward trend in sport fish effort in the Kodiak Region. During the 5-year period, 1977-1981, the total number of anglers increased 44%, and the days they fished increased 35.5%.

Angling effort in Cook Inlet is the fastest growing in the state. As more and more pressure is placed on the salmon resource by sportsmen in that area, a spill-over effect may be felt in the Kodiak Region. Sport fishermen may choose to fly or take the state ferry to the Kodiak area, where the chances of catching more fish per angler-hour are greater.

2.4.3.3 Catch Analysis

The sport catch of salmon within the Kodiak Region has been assessed since 1977 by the postal survey (see Table 2.4-2).

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5 Murray, Pete, Area Sport Fish Biologist, letter dated December 23, 1982.

Table 2.4-2:

ESTIMATED SPORT FISH CATCH, 1977-1982

Year	Chinook	Coho	Land Locked Coho	Sockeye	Pink	Chum	Steel-head
1977	483	4,716	229	1,255	14,519	1,645	232
1978	350	4,927	90	1,776	17,739	1,287	162
1979	752	11,522	373	2,436	15,871	500	318
1980	327	12,692	628	2,178	18,669	525	671
1981	724	10,584	-	1,620	12,259	637	313
1982	1,120	13,329	712	3,055	18,850	1,324	258

Not included in the survey is the narrow coastal belt along Shelikof Strait on the Alaska Peninsula. Sport fishing is generally rated low because of remoteness, lack of easy access, and inclement weather. There are several species of sport fish present in many of the streams and lakes. However, the fishery has not been developed and sport fishing here is considered insignificant.

On the Kodiak Archipelago, sport fishing is primarily for freshwater salmon, char, and trout. The saltwater salmon troll fishery is minor. Most of the sport fishery centers along the 129 miles of road system. Of all remote rivers, the Karluk River receives the most sport fishing pressure.

The majority of the salmon are caught in fresh water. A 4-year average, 1977 through 1980, shows 90% of the chinook, 75% of the coho, 79% of the sockeye, 57% of the pink, and 40% of the chum are caught in fresh water. The Buskin and Pasagshak Rivers account for much of the freshwater sport fishing. In 1980, 50% of the total pink, 36% of the coho, and 28% of the sockeye catch came from the Buskin River. The Pasagshak River provided 34% of the total coho, 21% of the sockeye, 16% of the pink, and 14% of the chum salmon catch. Fishing pressure on these systems has increased rapidly. For example, the Buskin River salmon fishery has increased from 11,072 man-days of effort in 1978 to 19,403 man-days in 1981. On Pasagshak River, the increase was from 3,403 man-days in 1977 to 4,434 man-days in 1981.

A sport fishery occurs on land-locked coho salmon in freshwater lakes on the Kodiak road system. These lakes are stocked with coho fingerlings in an ongoing program. These salmon do not reproduce and are

placed in lakes for sport fishing effort. Table 2.4-2 shows the increased contribution these landlocked coho make to the sport fishery. The Karluk River is the scene of the majority of the chinook salmon fishery.

The saltwater salmon fishing generally takes place shoreside. Caught in salt water, from the shore, are 65% of the coho, 87% of the pink, and 90% of the chum salmon. Chinook and sockeye salmon are caught either by boat or from shoreside, however, fishermen showed no consistent preference.

2.4.3.4 Economic Assessment

Several small commercial enterprises function in support of the recreational fishery and thereby generate revenue, ultimately attributed to the presence of salmon. Since the majority of the fishery is reached by road, the economic impact is not great on aircraft and boat charters. In comparison to the commercial fisheries, the overall impact of the sport fishery is not large.

2.4.4 Commercial Fishery

2.4.4.1 Introduction

The commercial fishery in the region has been developed chronologically to show its progression over nearly one-hundred years.

Commercial use of salmon in the Kodiak Region began in Russian times, possibly as early as 1827 when sockeye salmon were dried for food. Commercial catch data for sockeye salmon were recorded beginning in the early 1880s. Data for coho and chinook salmon began in the late 1890s.

The high catch of sockeye salmon (4,826,000 fish) was made in 1901. Pink and chum salmon catch data begin around 1910.

The first closure of waters within the Kodiak Region was in 1918 when the Karluk River and Lagoon and all tributary waters were closed to commercial fishing. Fishing was permitted 100 yards outside the mouth of the Karluk River where it broke through the spit into Shelikof Straits. Although all commercial fishing was restricted to 500 yards beyond a stream mouth in 1921, the Karluk River remained an exception with the continuation of the 100 yards boundary.

Beginning in the 1920s commercial catches of pink salmon consistently were higher than sockeye salmon. Counting weirs were established at the Karluk River in 1921, Olga and Akalura Lakes in the Alitak District in 1923, and at Ayakulik (Red) River in 1929. Investigations of the Karluk River system began during this decade and have continued ever since.

The Executive Order of 1924, known as the White Act, began the era of more regulation of the salmon fishery. In the Kodiak Region counting weirs were used to be certain the take of salmon would not exceed 50% of the total run. Use of purse seine and floating traps for the capture of salmon were prohibited in the Kodiak Region. The act specified certain waters for the exclusive use of one gear type. For the first time several bays and waters along the shores of Kodiak Island were closed to commercial fishing. Closure times for commercial fishing were set and methods for emergency orders, openings, and closures were outlined.

From 1922 to 1933 beach seines, gillnets and stationary traps were the only legal gear types in the Kodiak Region. In 1933 purse seining was allowed. The record odd year pink catch was made in 1937 at 16,788,000.

In 1946 purse seining near the Karluk River was prohibited within 500 yards of the beach.

In 1958 fish traps were prohibited as a means of commercial fishing in the Kodiak Region's waters. In 1960 the management of the fisheries passed from the U.S. Fish and Wildlife Service to the State of Alaska's Department of Fish and Game.

During the 1970s, additional controls on commercial fishing came into existence. In 1971, the Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.) was established. That same year the Commercial Fisheries Entry Commission was formed to oversee the limited entry permit system, which came into effect in 1973. In 1971, the record chum salmon catch of 1,541,000 was established for the Kodiak Region.

In 1980, the even year pink salmon record catch for the Kodiak Region was established at 17,291,000. In 1983, the record catch of coho salmon was established at 344,000.

2.4.4.2 Regulations

Regulations govern who can fish, what gear can be used, and when and where fishing takes place.

Permits to commercially fish for salmon in the Kodiak Region must be secured through the Commercial Fisheries Entry Commission. The number of permanent

permits issued, since inception of the commission in 1972, is 595. These permits are distributed among the gear types with 376 purse seine permits, 34 beach seine permits, and 186 set net permits. This number is not likely to increase significantly.

Areas are reserved in certain districts for specific gear types. Although times of openings are generally set, special openings and closures can be invoked at short notice when warranted by run stengths.

2.4.4.3 Purse Seine Fishery

As of 1983, there are 376 permanent and 10 interim purse seine permits. An average of 92% of these permits have been fished over the recent 5-year period 1978 through 1982. However, there is no specific trend on how permits are used: 87% were used in 1981 and 96% in 1980, which was the highest for the 5-year period.

Pink salmon composed the majority of the purse seine catch, averaging 87% of their overall catch during the 5-year period from 1977-1981.* By coincidence, purse seiners took about 87% of the total pink salmon harvest for the same period of time. Chum salmon are second in number of fish harvested by purse seine, averaging about 8% of the harvest. However, sockeye salmon were the second most valuable fish, economically, to the purse seine fleet.

The areas open to purse seine fishing are shown on Map 3.

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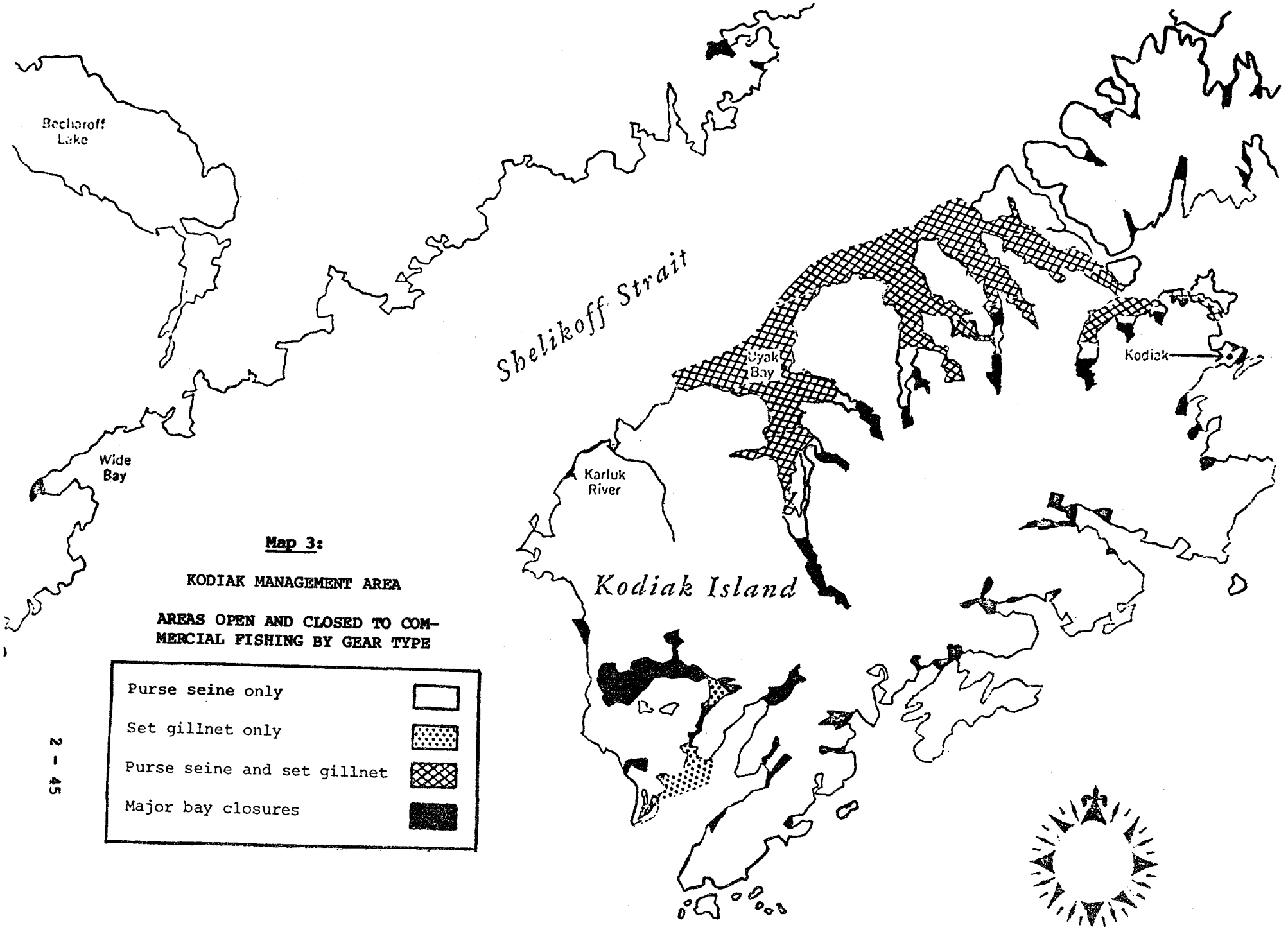
* Data not available for 1982. Therefore, the most recent 5-year period for which data are available was used.



Map 3:

KODIAK MANAGEMENT AREA

AREAS OPEN AND CLOSED TO COMMERCIAL FISHING BY GEAR TYPE

2.4.4.4 Beach Seine Fishery

As of 1983, there are 34 permanent and 1 interim beach seine permits. An average of 84% of the permits were used during the present 5-year period of 1978-1982. The trend is toward more utilization of existing permits. Pink salmon are the dominant species fished and provided the most income to beach seiners over the 5-year period of 1977-1981.* However, in 1979 the sockeye catch provided more income. Pink salmon provided 91% of the catch, but only 1% of the total pink harvest. In this 5-year period, coho and chum salmon were the other important species with coho catch averages a bit higher than chum salmon catches.

Economically, during the same period, the average income derived from coho and chum salmon was nearly the same. However, during 1979 and 1980, the value of the coho catch in dollars was nearly twice that of the chum value. Most beach seining is done from one specific site every year. Regulations do not require specific sites and exclude beach seining only from closed areas and restricted areas reserved for set gillnets.

2.4.4.5 The Set Gillnet Fishery

The number of permits for set gillnets is 186 permanent and 1 interim permit in 1983. An average of 86% of these have been used during the 5-year period from 1978-1982. The trend has been toward more utilization of permits.

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* Data not available for 1982. Therefore, the most recent 5-year period for which data are available was used.

The most important species is the pink salmon averaging 77% of the set net fishery catch during the 5-year period 1977-1981.* However, the set net fishery catch is only 11% of the total pink harvest. Sockeye salmon were the second most economically valuable fish and second in catch for this gear type.

Exclusive set gillnet areas have been designated in the Moser/Olga Bay area. Other areas which are open to the set gillnet fishery are shown on Map 3.

In most cases, tideland leases have been obtained from the State Division of Lands for areas where fish migrate. For sites in the Kodiak National Wildlife Refuge, a cabin site permit is secured from the U.S. Fish and Wildlife Service.

2.4.4.6 Harvest Summary

Table 2.4-3 depicts the high consecutive year averages for the history of the Kodiak Region commercial salmon fishery by species. Because of the 2-year period necessary to catch both the high and low years of the pink salmon cycle, increments of 2 years were selected. Calculated were the 32, 30, 28, 26, 24, 22 and 20-year averages.

The highest single year on record for each species in the total harvest is also shown on this figure. They are plotted to show the relationship to the long-term averages.

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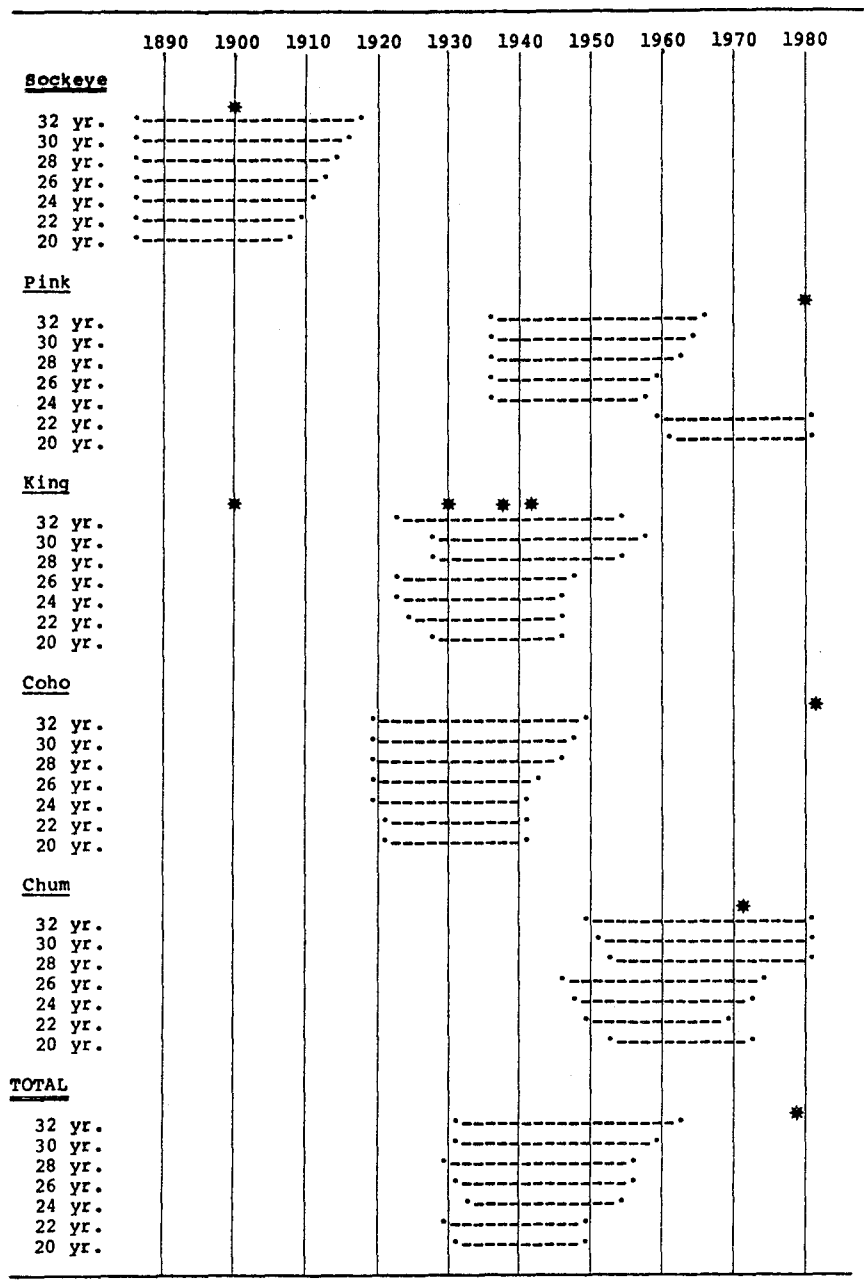
* Data not available for 1982. Therefore, the most recent 5-year period for which data are available was used.

The long-term high consecutive year averages for sockeye occurred near the turn of this century, when the Karluk River was in its most productive years. It should be noted that the 20 and 22-year highs for the pink salmon have occurred within the past 20 and 22 years. The highest consecutive 20-year averages for the catch of all species of salmon occurred between 1930 and 1949.

Table 2.4-3:

AVERAGE HIGH CONSECUTIVE YEAR COMMERCIAL CATCHES



* highest single year

2.4.4.7 Economic Catch Analysis

The price paid to fishermen for their catch (ex-vessel prices) varies by species and gear type from year to year (Table 2.4-4). The fluctuations are the result of a variety of causes. The trend of prices per pound of salmon was decidedly upward during the 1970s, but no trend has been established in the early 1980's.

Pink salmon, the most abundant species in the Kodiak Region, have provided the largest percentage of income to all gear types, although it is not the highest value per pound (Tables 2.4.-5 and 2.4-6). The ex-vessel values to the fishermen and the average gross earnings by gear type are not available for 1982.

Table 2.4-4:

AVERAGE GROSS EARNINGS BY GEAR TYPE
(Rounded to Nearest Dollar)

Year	Gear Type	Amt. of Gear	Chinook	Sockeye	Coho	Pink	Chum	Total
1971	Purse Seine	338	7	1,922	68	7,149	4,251	$13,397
	Beach Seine	16	1	113	9	2,434	362	$ 2,919
	Set Net	132	2	1,346	37	1,189	441	$ 3,015
1972	Purse Seine	385	9	884	56	4,052	4,232	$ 9,233
	Beach Seine	50	0	90	2	435	120	$ 647
	Set Net	219	0	376	17	586	472	$ 1,451
1973	Purse Seine	373	13	1,398	12	1,359	2,293	$ 5,075
	Beach Seine	54	0	33	2	165	51	$ 251
	Set Net	219	0	397	2	343	110	$ 852
1974	Purse Seine	268	12	3,558	101	10,147	2,175	$15,993
	Beach Seine	10	1	601	0	3,649	155	$ 4,406
	Set Net	99	5	1,941	23	2,544	315	$ 4,828
1975	Purse Seine	283	3	715	1,711	10,376	495	$13,300
	Beach Seine	10	1	177	1,290	4,081	51	$ 5,600
	Set Net	116	1	1,376	16	2,286	170	$ 3,849
1976	Purse Seine	341	19	5,967	140	32,092	4,799	$43,017
	Beach Seine	18	5	382	826	9,353	469	$11,035
	Set Net	145	3	4,382	64	9,569	463	$14,481
1977	Purse Seine	344	36	7,240	306	26,680	14,120	$48,382
	Beach Seine	25	2	232	1,482	8,765	1,953	$12,434
	Set Net	143	8	8,145	121	9,223	1,854	$19,351
1978	Purse Seine	375	86	13,923	661	46,681	10,807	$72,158
	Beach Seine	31	19	1,415	2,504	10,121	1,672	$15,731
	Set Net	158	40	10,131	179	13,514	1,631	$25,495
1979	Purse Seine	401	55	6,465	1,821	36,941	3,624	$48,906
	Beach Seine	31	8	1,541	3,164	13,476	650	$18,839
	Set Net	169	19	11,769	1,085	9,243	890	$23,006
1980	Purse Seine	372	9	4,668	1,597	53,652	9,191	$69,117
	Beach Seine	33	2	616	277	6,492	323	$ 7,710
	Set Net	169	14	7,299	409	12,606	1,250	$21,578
1981	Purse Seine	325	54	17,012	1,657	43,434	16,137	$78,294
	Beach Seine	30	6	1,358	2,447	21,320	1,579	$26,710
	Set Net	169	22	15,891	571	16,696	2,870	$36,049

Source: ADF&G Kodiak Management Area Finfish Annual Report

Table 2.4-5:

VALUE TO FISHERMEN - EX-VESSEL
(In 1,000 Dollars)

Year	Chinook	Sockeye	Coho	Pink	Chum	Total
1971	3.0	829	28	2,612	1,501	$ 4,973
1972	4.0	427	25	1,710	1,742	$ 3,909
1973	5.0	610	5	591	882	$ 2,094
1974	4.0	1,152	29	3,008	616	$ 4,808
1975	0.8	364	63	3,242	160	$ 3,831
1976	7.0	2,677	72	12,499	1,712	$ 16,967
1977	13.0	3,661	160	10,716	5,171	$ 19,721
1978	39.0	6,866	354	20,704	4,362	$ 32,325
1979	25.0	4,629	1,012	16,793	1,624	$ 24,083
1980	5.0	2,990	672	22,303	3,641	$ 29,613
1981	21.0	8,255	708	17,577	5,777	$ 32,339

Source: ADF&G Kodiak Management Area Finfish Annual Reports

Table 2.4-6:

EX-VESSEL PRICES PER POUND
(Average)

Year	Chinook	Sockeye	Coho	Pink	Chum
1971	0.22	0.27	0.18	0.15	0.13
1972	0.22	0.31	0.20	0.19	0.19
1973	0.50	0.57 * 0.50**	0.21 * 0.19**	0.29 * 0.26**	0.33 * 0.22**
1974	0.50	0.44	0.25	0.26	0.29
1975	0.52	0.44	0.31	0.26	0.25
1976	0.51	0.66	0.35	0.28	0.27
1977	1.09 * 1.15**	0.88 * 0.83**	0.65 * 0.74**	0.42 * 0.38**	0.52 * 0.78**
1978	1.00	1.00	0.85	0.37	0.60
1979	0.88	1.20	0.90	0.29	0.57
1980	0.62	0.85	0.70	0.40	0.45
1981	0.81	1.11	0.70	0.44	0.52
1982	0.50	.90	0.70 *** 0.25****	0.23	0.45

* Seine
** Set Net
*** Frozen
**** Canned

Source: ADF&G Kodiak Management Area Finfish Annual Report

Sockeye salmon, the highest value-per-pound species, are significantly more abundant than chinook and coho salmon which are also high value fish. The total value in dollars of the catch fluctuates more than the catch level in numbers of fish, because prices per pound and total weight differences affect the value to the fishermen.

The majority of the processors are located in Kodiak, with a few located in remote bays on Kodiak Island. No processors are located on the Alaska Peninsula at present. The bulk of the salmon are canned. There is an increase in freezing capacity by larger processors, as well as by small mobile units.

The salmon fishery contributes heavily to the fishing industry in the Kodiak Region. The ex-vessel price paid in the recent 5-year period of 1976 to 1980 totalled $122.7 million. However, in the preceding 5-year period, from 1971 to 1975, ex-vessel values were only $19.6 million (Table 2.4-7). For comparison, Table 2.4-8 shows the average earnings during the first year of statehood, 1960. These were direct payments to the fishermen and do not include the additional multiplier effect.

Table 2.4-7:

TOTAL CATCH AND ITS VALUE
AND THE AVERAGE EARNINGS BY GEAR TYPE
FOR 1971 TO 1981

Year	Catch	Total Value In Dollars	Average Earnings Purse Seine	Average Earnings Beach Seine	Average Earnings Set Net
1971	6,376,000	4,973,000	13,397	2,919	3,015
1972	3,890,000	3,909,000	9,233	647	1,451
1973	1,001,000	2,094,000	5,075	251	852
1974	3,323,000	4,808,000	15,993	4,406	4,828
1975	3,187,000	3,831,000	13,300	5,600	3,849
1976	12,484,000	16,976,000	43,017	11,035	14,481
1977	7,977,000	19,721,000	48,382	12,434	19,351
1978	16,942,000	32,325,000	72,158	15,731	25,495
1979	12,420,000	24,083,000	48,906	18,839	23,000
1980	19,157,000	29,613,000	69,117	7,710	21,578
1981	13,094,000	32,339,000	78,294	26,710	36,049

Table 2.4-8:

1960 (FIRST YEAR OF STATEHOOD)
AVERAGE EARNINGS BY GEAR TYPE
(Rounded to Nearest Dollar)

Gear Type	Chinook	Sockeye	Coho	Pink	Chum	Total
Purse Seine	8	611	126	7,577	1,670	$ 9,992
Beach Seine	20	797	67	3,710	700	$ 5,294
Set Net	1	845	20	1,768	247	$ 2,881

Ex-Vessel Value to Fishermen = $3,794,000 in actual 1960 dollars.

2.5 REGIONAL PROFILE SUMMARY

The plan must address a very valuable resource in the context of a complex natural and human environment. Careful consideration must be taken of both human and natural factors that contribute variables to the salmon fishery. All of these factors must be addressed because of the effects on the economy of the salmon resource.

SECTION 3.0

STOCK STATUS

TABLE OF CONTENTS

L I S T O F T A B L E S A N D M A P S

3.0 STOCK STATUS

3.1 INTRODUCTION

In the Kodiak Region, the present stock status concerns mainly wild stocks. However, on Afognak Island at Kitoi Bay, there are hatchery returns of pink salmon. The contribution of these pink salmon to the fishery in that area is significant, and it appears that it will continue to be a factor. Additionally, there is a small rehabilitation hatchery at Karluk Lake, and there are nine fishpasses supporting runs of pink, coho, and sockeye salmon. Chinook salmon have been successfully introduced into two systems.

Resource data available on the Kodiak Region are substantial. A synopsis of these data presents the stock status of each of the five species of Pacific salmon. Two different time periods have been used. To establish the high historic annual average, the consecutive 20-year high period was used to determine the annual average. The other time period used was the past 20 years, 1963 - 1982. These time periods give a consistent basis for forecasting for the life of this plan, a 21-year period, 1982 - 2002. These data present a perspective on the salmon resources which can be used for assessment of the goals and objectives of this plan.

3.2 STATUS OF WILD STOCKS

3.2.1 Methods for Determining Wild Stock Status

The Alaska Department of Fish and Game is the agency responsible for collecting data which contributes to assessment of the status of wild stocks in the Kodiak Region. Secondary sources may make interpretive manipulations of these data as is done in this plan. The primary source of information, however, is the Alaska Department of Fish and Game.

3.2.1.1 Commercial Harvest Reports

Because of the various federal agencies responsible for Alaska's fisheries since the first commercial exploitation in the 1880s, there has not been a consistent method of data collection. However, it is possible to gain a fair idea of the numbers of fish caught from the 1880s to 1927 for Shelikof Strait (Mainland), Alitak Bay, Red River district, Karluk River district, the northwest coast of Kodiak Island district (Cape Uyak to Whale Passage), Afognak Island district, Marmot Bay district, and the east coast of Kodiak Island district.[6] Federal area reports and ADF&G area management reports contain valuable harvest information from the mid-1930s through 1982. In recent years, particularly with the advent of fish tickets and limited entry, the count of commercially caught fish has become more accurate.

Catch data need to be modified with the various factors that influence them. Increases and decreases in runs are influenced by the number of participants in the fishery, the effectiveness of the gear being fished, the number of openings, the weather during open periods, and human factors such as price disputes.

The commercial fishery is regularly the largest part of the total catch. Data from this catch provide the best numbers with which to construct the strength of the stocks during a given period.

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6 Rich, Willis H. and Edward M. Ball, "Statistical Review of the Alaska Salmon Fisheries, Part II: Chignik to Resurrection Bay", Bulletin of the United States Bureau of Fisheries, Vol. XLVI, 1930, p. 643-712.

3.2.1.2 Sport Fish Harvest Reports

The second major user in the Kodiak Region is the sport fishermen. During the fishing season, a creel census is taken to help define the catch being taken by sport fishermen. These data are further defined by a mail questionnaire that solicits data on effort expended and the catch. The Sport Fish Division of ADF&G annually publishes a statewide harvest report which includes the Kodiak Region.

3.2.1.3 Subsistence Harvest Reports

Reports on subsistence fishing for the Kodiak area have been kept for the past twenty years. Because of the small portion of the catch clearly attributed to this group, it has relatively little impact on the stock status picture. As has been indicated, subsistence use has been the subject of much discussion and definition.

3.2.1.4 Escapement Monitoring

Escapement monitoring adds another valuable piece of information for estimating the overall stock strength. When coupled with harvest data, these data can bring the analysis another step closer to the assessment of the total run's strength. In addition, because it is system specific, it provides the best data on individual stocks and their relative strength.

3.2.1.5 Management Reports

An annual management report is prepared for the Kodiak Management Area by the Commercial Fisheries Division of ADF&G. This report contains a synthesis of salmon harvest and economic data. In addition to the current year's report, tables and figures present a brief historical context in which current information can be assessed.

3.2.1.6 Stock Status Reports

The ADF&G is preparing stock status reports dealing with the important Kodiak Region salmon stocks.

3.2.2 Historical Trends

Over the 100 years (1883-1982) that the salmon fishery has been documented in the Kodiak Region, annual harvests of salmon averaged 6.3 million fish per year. It should be noted that pink salmon catches were not consistently recorded until 1908, although small quantities were packed prior to that time.

Pink salmon dominate the 100-year commercial harvest with an annual average of 4.3 million fish (69%). The contribution of other species are: 1.5 million sockeye (24%); 373,000 chum (5.9%); 62,000 coho (1%); and 1,600 chinook salmon (less than one-hundredth of one percent).

In the past twenty years (1963-1982), salmon production in the Kodiak Region has increased from the 100-year average of 6.3 million to 9.2 million. The even-year average is 11.6 million; the odd-year average is 6.8 million. The annual average contributions of the species for the past twenty years has been: 7.8 million pink (84.8%); 597,000 sockeye (6.5%); 743,000 chum (8%); 64,000 coho (0.7%); and 1,200 chinook salmon (less than one-hundredth of one percent).

From a statewide perspective, Kodiak Region salmon average 18.6% of the annual Alaska production for the 20-year period of 1962-1981. On a species basis, pink salmon accounted for 25.3%, chum 11.4%, sockeye 4.3%, coho 2.4%, and chinook 0.2%.

3.2.3 Pink Salmon

3.2.3.1 Life History

Pink salmon have the shortest life cycle of the Pacific salmon, returning to spawn in their second year. Some streams on the average produce equally well on odd and even-year cycles while others on the average produce much stronger returns on only one cycle year, specifically the even-numbered years in the Kodiak Region.

The return rate for natural spawning pink salmon is generally three returning adults for each spawner. The returning adults which are harvested, averaged over the recent period, 3.8 pounds (3.6 pounds in even years and 3.9 pounds in odd years).

3.2.3.2 Historical Production

Through 1927, the records show that more pink salmon were harvested on the even years. This was undoubtedly because the commercial fishermen were targeting on sockeye destined primarily for Karluk, Red River, and Olga Bay systems. Pink salmon were taken incidentally to the sockeye fishery every year, but only the Red and Karluk Rivers produce large numbers of pink salmon on the even years, hence the larger incidental harvest on even years. Once sockeye were decimated to a large degree, pink salmon were actively sought in the 1930s, and it appears that through 1946 the odd-year cycle was actually stronger than the even-year cycle. From 1946 to the present, the even-year pink salmon run has been dominant with relatively strong returns on both cycles since 1976.

The highest commercial harvest on record for the Kodiak Region occurred in 1980 with 17,291,000 pink salmon. The highest long-term average catch of pink salmon has been in the 20-year period (1963-1982) with an average annual catch of 7,839,000 fish. The average even-year catch was 10,004,000 and the odd-year catch was 5,674,000. It is clear that the current pink salmon fishery in the Kodiak Region is stronger than it was in historic times.

3.2.3.3 Stock Status

Run strengths in the 5-year period 1977-1981 averaged 16,031,000 pink salmon. The escapement counts were estimated to be 4,001,000.

The majority of the pink salmon escapement is contained in 35 of the major river systems. They account for 60% to 85% of the total escapement.

Uganik and Uyak districts have produced pink salmon catches as high as 3.7 million since 1960. Terror, Uganik, and Uyak Rivers are the major producers. The Karluk, Sturgeon, and Red River districts produce large catches in even years and very few pink salmon in odd-year cycles. Major pink salmon systems are Karluk, Sturgeon, and Ayakulik (Red) Rivers. In the Alitak district, Humpy, Deadman, and Dog Salmon Rivers are major producers. In the Afognak district, Waterfall and Portage Rivers - with their fishpasses - and the Afognak River are the best producers. The Mainland district is not a major pink salmon producer. The variability of fishing effort in this district has contributed to fluctuating pink catches in the 1960s and 1970s. The General district is characterized by many smaller streams which produce pinks.

Optimum escapement figures for pink salmon systems in the Kodiak Region are not defined for each system. Desired escapement for many major producers has been determined from studying past escapement/return figures.

3.2.4 Sockeye Salmon

3.2.4.1 Life History

Sockeye salmon in Kodiak Region are generally considered five and six years old at spawning. This species is considered to be a lake-rearing fish, however, spawning sockeye have been observed in systems with no lakes. Generally they will spawn in the streams that are tributaries of a lake and upon emergence will move into the lake. They will spend one or more years in the lake before migrating to sea. In some instances, sockeye salmon may become land-locked, precluding the marine portion of their development. These are known as kokanee and are found in a few locations in the Kodiak Region. The IHN virus is common among wild stocks. Although it can be devastating in hatchery stocks, its toll on wild stocks is unknown.

The return rate for natural spawning sockeye is generally considered to be two or three adults to one spawner. In the recent 20-year period, the average weight of harvested sockeye has been 5.9 pounds.

3.2.4.2 Historical Production

The abundance of sockeye salmon, as measured by the size of the commercial fishery catch, has varied substantially. The single highest catch of record was 4,826,000 in 1901. The highest long-term average catch was for the 20-year period from 1888-1907, when the commercial catch annually averaged 3,185,000.

The average annual catch for the 20-year period 1963-1982 was 597,000. It is evident that the sockeye fishery in the Kodiak Region has an annual yield far below the historic long-term average.

3.2.4.3 Stock Status

Run strengths for the 5-year period 1977-1981 averaged 2,236,000 sockeye salmon. The escapement counts for sockeye are estimated to be 1,383,000.

There are more than thirty sockeye salmon systems in the Kodiak area. Four river systems are identified as the major producers of sockeye: Karluk River, Ayakulik (Red) River, Dog Salmon River (Frazer Lake), and Olga Creek (Upper Station). Approximately 80% of the sockeye, migrating along the west and southwest side of Kodiak Island in June, are bound for these systems.

Historically, the Afognak Island district produced sockeye catches in excess of 100,000 in some years prior to 1930. In the Uganik district, the Uganik River and Little River are sockeye producers. The Alitak district has historically been a sockeye producing district. The four systems, Upper Station, Akalura, Horse Marine, and Silver Salmon, reportedly produced average annual catches of over 400,000 up until 1927. Since the 1950s, the district averaged less than 100,000 fish. The former barren Frazer Lake is beginning to contribute good catches in this district. The Mainland district has no major sockeye systems. The vast majority of the sockeye catches in this district are fish destined for the Chignik River.

3.2.5 Chum Salmon

3.2.5.1 Life History

Chum salmon are generally considered to have a four-year life cycle, although some return in three years or in five years. This species spawns in the side channels of large systems, particularly where there are upwelling springs. Emerging chum fry move quickly into estuarine environments.

The adults return in a ratio estimated to be three adults to one spawner. In the recent 20-year period, the average weight of harvested chum salmon has been 8 pounds.

3.2.5.2 Historical Production

The single highest annual catch of chum salmon in the Kodiak Region was 1,541,000 fish in 1971. The highest long-term average annual catch was during the 20-year period from 1953-1972, when the average was 780,000 chum salmon. For the recent 20-year period, (1963-1982), the average annual catch is 743,000. These numbers make it evident that the chum salmon fishery over the past 20 years in the Kodiak Region has an annual yield near this historic long-term average. However, the past 5-year average is 917,000, above the historic highest long-term annual average.

3.2.5.3 Stock Status

The run strengths in the 5-year period 1977-1981 averaged 1,614,000 chum salmon. The escapement is estimated at 681,000 chum salmon.

The main runs of chum salmon occur on the east side of Kodiak Island where there are many small streams

which produce chum, especially in Kiliuda Bay. Other producers are the Sturgeon River and the Kukak river, the latter in the Mainland district.

3.2.6 Coho Salmon

3.2.6.1 Life History

Most coho salmon spend one or two years in fresh water and migrate to sea in the spring of the second or third year. One and one-half years are spent at sea before adults return in the summer or fall. In the recent 20-year period, the average weight of harvested coho salmon has been 7.8 pounds.

3.2.6.2 Historical Production

The highest commercial catch on record of coho salmon was 344,000 in 1982. This was due to increased effort on coho, combined with an excellent coho return. The highest long-term annual average was the 20-year period of 1922-1941 with an annual average harvest of 136,000 coho salmon. The average annual catch for the 20-year period (1963-1982) was 64,000. It is evident that the coho fishery is far below the historic high levels for this period. However, during the past 5-year period, the annual average is 159,000 fish which is above the historic high levels. This 5-year average includes the highest annual catch ever made.

3.2.6.3 Stock Status

Recent run strengths (1977-1981) averaged 151,000 coho salmon. Escapement estimates are at 49,000 coho salmon, but are known to be incomplete.

Many of the Kodiak systems have runs of coho. The largest consistent coho fishery in recent years

occurred at the Karluk River and in the Afognak Island and Shuyak Island areas. Fishing effort on coho has increased in recent years.

3.2.7 Chinook Salmon

3.2.7.1 Life History

Of the five Pacific salmon species, the chinook salmon has the longest life cycle, and it may be as long as seven years. However, returning adults that spawn are generally four to five or six years old. The fry typically spend one year in fresh water, and the remainder in salt water.

In the recent 20-year period, the average weight of harvested chinook salmon has been 22.5 pounds.

3.2.7.2 Historical Production

The highest annual commercial catches of chinook salmon occurred in 1900, 1930, 1936, and 1941, when 6,000 fish were harvested. The highest long-term average catch was in the 20-year period from 1927-1946 with an average of 3,000 fish. The average annual catch for the past 20 years (1963-1982) has been 1,200 fish. It is evident that the chinook salmon fishery in the Kodiak Region is far below the historic high levels due to closures. The chinook salmon fishery continued to be at a low level (1,600 fish) during the past 5-year period (1978-1982).

3.2.7.3 Stock Status

In the past 5-year period, the run strength has averaged 14,400 fish. Escapement levels are estimated to be at 12,800 chinook salmon. The Karluk and Ayakulik (Red) Rivers are the only natural chinook salmon runs in the Kodiak Region. The escapement

levels for chinook salmon are at record highs. Therefore, the total run strengths are considered excellent.

3.2.8 Summary

The status of wild stocks in the Kodiak Region has been examined in several different ways. Table 3.2-1 summarizes the various methods by which catch and escapement data have been examined. The historical high 20-year period, the recent 20-year period (1963-1982), and the past 5-year period (1977-1981 for escapement) have been calculated. It should be noted that the annual sport fish catch for all five species for the past five years would add an average of 28,000 salmon to these commercial catches. The subsistence catch has averaged 6,200 fish annually for the past 20 years. The average annual catch was 15,000 fish in the past 5-year period. When interpreting data as presented in this section, some qualifications must be kept in mind. The commercial fishery is stable as far as the number of participants. Gear has become noticeably more efficient in recent years. The gear efficiency may in part offset the decreasing amount of time available to the commercial fisherman.

Table 3.2-1:

HISTORICAL COMMERCIAL CATCH PERSPECTIVES
(number of fish)

	Pink	Sockeye	Chum	Coho	Chinook	Total
Highest Single Year	17,291,000 (1980)	4,826,000 (1901)	1,541,000 (1971)	344,000 (1982)	5,000 (1900, 1930, 1936, 1941)	19,152,000 (1980)
Highest Consecutive 20 Years (Annual Average)	7,839,000 (1963-1982)	3,185,000 (1888-1907)	780,000 (1953-1972)	136,000 (1922-1941)	3,000 (1927-1946)	10,075,000 (1930-1949)
Recent 20-Year Annual Average (1963-1982)	7,839,000	597,000	743,000	64,000	1,200	9,244,000
5-year Avg. Est. Run Strength (1977-1981)	16,031,000	2,236,000	1,614,000	151,000	14,000	20,046,000
5-year Avg. Est. Escapement (1977-1981)	4,003,000	1,383,000	681,000	55,000	13,000	6,135,000
1982 Commercial Catch	8,076,000	1,205,000	1,266,000	344,000	1,000	10,892,000

3.3 STATUS OF SUPPLEMENTAL PRODUCTION

3.3.1 Introduction

It has been clear for some time that demands on the salmon resource have been increasing, and that natural salmon fluctuations can result in economic instability for fishermen and individuals in support industries, loss of recreational opportunities, and subsistence hardship. This result was deemed to be undesirable, and several official actions were taken to give assistance to the resource. The most notable of these were the establishment of the F.R.E.D. Division of ADF&G and the regional aquaculture associations.

In the following sections, there will be a discussion of supplemental production techniques that are viewed as useful at one or more locations in the Kodiak Region (see Map 4) and descriptions of contributions to the overall stock strength that are now being made through supplemental production.

3.3.2 Methods of Supplemental Production

3.3.2.1 Hatchery

Hatcheries are used as a production base for salmon rehabilitation and enhancement programs because they are roughly eight times more efficient in converting eggs to fish than the natural environment.[7] The efficiency of hatchery production shortens the time required to rehabilitate depleted stocks. Because of initial investment, hatcheries may appear to be an expensive means of supplemental salmon production. However, there is generally a direct relationship

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7 ADF&G, "Annual Report, Division of Fisheries Rehabilitation, Enhancement and Development, 1981," p. 39.

between the cost of a hatchery fish and the life stage at which the hatchery releases the fish. More specifically, the longer the hatchery holds fish, the more dollars it invests in each individual fish. However, this fact is mitigated by the improved survival which is attained with fish that are more fully developed in a hatchery. Short term rearing can double marine survival and substantially increase hatchery benefit and feasibility.

There is currently one production hatchery in the Kodiak Region at Kitoi Bay. It is owned and operated by the state through its F.R.E.D. Division. It has been in pink salmon production since 1976, although it was a research facility prior to that and provided incubation facilities for sockeye eggs and fry for Frazer Lake and lakes on Afognak Island. Today, small numbers of chum salmon are being propagated to build a brood stock. Stocks of chinook, coho, and rainbow trout for the sport fishery are also being developed.

3.3.2.2 Lake Stocking

When rearing area is a limiting factor in salmon production, lakes can be used as natural nursery areas. Some lakes are under-utilized, while others have rearing habitat which is inaccessible due to a barrier. Chinook, coho, and sockeye are the species best adapted to this procedure.

A number of factors need to be considered before lake stocking is selected. The lake must be located where a harvest is feasible. An available and acceptable brood stock is needed. Pre-stocking studies are required to select suitable lakes, thus ensuring that stocked fry will grow and survive to migrate to sea in sufficient numbers. Careful determination of stocking density and timing is crucial to success.

Two lakes in the Kodiak Region have been stocked with chinook salmon fry. These are Lake Rose Tead and Frazer Lake. Sockeye fry and eggs were also planted in Frazer Lake and a number of lakes near Kitoi Bay. These runs are now self-sustaining.

3.3.2.3 Stream Planting

The technique of stream stocking may be advisable when there is a stream with too few salmon to make it probable that the stream will rehabilitate itself within an acceptable time frame. This assumes that the small numbers of salmon are due to overfishing or catastrophic weather conditions, not an absence of habitat. Streams may have areas of under-utilized habitat which could serve as a natural rearing area.

There are at least five different approaches, or a combination of these, to implement this technique. They are identified by the stage of life at which the fish are released. With artifical spawning and natural incubation, green eggs can be seeded in the stream. A second possibility with artificial spawning and partial natural incubation is to plant eyed eggs in the stream. The third choice is to depend on artificial spawning and incubation and natural rearing by releasing unfed fry into the stream. A fourth alternative depends on artificial spawning and incubation and partial natural rearing by releasing fed fry or fingerlings into the stream. The fifth choice is to depend entirely upon artificial spawning, incubation, rearing, and releasing of smolts into the stream.

The Karluk Lake system has been the site for planting eyed eggs for several years. The F.R.E.D. Division has been re-establishing sockeye in the Upper Thumb River portion of the Karluk Lake system. An incubation facility is now in place, and eggs are planted

at the eyed stage before winter conditions make it impossible to work in the creeks. Plants of eyed eggs have also been used in Frazer and Laura Lakes to establish sockeye runs. Pink salmon plants of eyed eggs were made in Izhut Bay streams.

3.3.2.4 Lake Fertilization

Addition of nutrients to lakes which serve as nurseries for rearing salmon, particularly sockeye, may increase the quality and quantity of phytoplankton and subsequently zooplankton, the major sources of food for rearing fish. Past studies have shown a clear and strong correlation between the availability of food to juvenile salmon, their size at out-migration, and their survival to adults.

Results of lake fertilization have varied. Some systems have shown a negative benefit, while others have experienced up to 20-fold increases in returning adults. The majority of cases do show some positive benefit.

The ADF&G has guidelines for lake fertilization. The first stage, pre-fertilization study, calls for a detailed study of the physical, biological, and chemical status of the lake. This study 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 contribution of the effort to the salmon fishery.

Pre-fertilization studies have been conducted on Karluk, Thumb, and O'Malley Lakes, all on the Karluk Lake system.

3.3.2.5 Spawning Channels

The construction of artificial spawning channels is an effort to both increase and enhance the spawning habitat. It permits some control of factors such as water flow, substrate, sedimentation, and predation so that egg-to-fry survival rates are improved. Past experience indicates that there is a strong incentive to explore application of this technique because the egg-to-fry survival in streams may be 10 to 15 percent, while it may increase to 35 to 80 percent with the introduction of spawning channels.

To implement this technique, there must be a controllable water source, the proper terrain, and sufficient salmon stock to utilize the completed project.

3.3.2.6 Habitat Modification - Stream Clearance

Stream clearance, as a means of rehabilitating salmon runs, is at the other end of the complex enhancement spectrum of hatcheries and artificial production. 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 a stream. Therefore, selective removal of a portion of the barrier, sufficient to allow passage of fish upstream without substantially altering the flow or downstream conditions, is the desirable level of effort.

The costs in terms of time and equipment vary from site to site. Therefore, if the cost is relatively small, the number of fish to benefit can be smaller and still have a good benefit/cost ratio. The cost of stream clearance is usually high in the Kodiak Region because of the remote locations of projects, usually accessible only by aircraft.

In the evaluation of a potential stream clearance 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.

Stream clearance has been conducted in the Kodiak Region as funds have permitted. An increase in beaver populations in recent years has created numerous small dams that block salmon migrations on Kodiak Island. Driftwood jams and beach deposits frequently block salmon streams in the Kodiak area.

3.3.2.7 Habitat Modification - Fishpass

The construction of a fishpass (fish ladder or steep pass) is a structured and permanent form of habitat modification. Much of the ultimate success of an individual fishpass will depend on a thorough pre-construction analysis, including estimation of high and low water flows. Thought must be given to the effects on fish species other than the salmon it is designed to benefit. Past experience over a broad range of conditions substantiates the fact that a well placed fishpass can yield a high benefit/cost ratio.

One of the most successful fishpasses provides access to Frazer Lake on Kodiak Island. There are eight other fishpasses in the region, all on Afognak

Island. The five lake and stream systems are Little Kitoi, Seal Bay, Waterfall (three fishpasses open up spawning grounds); Portage, and Pauls Lake (two passes between three lakes). Most of these open spawning area used by pink and coho salmon with some use by sockeye. All major salmon runs on north Afognak Island are served by fishpasses.

3.3.2.8 Habitat Modification - Predator/Competitor Control

This technique is more a modification of the biological habitat than the physical one. It is the process of trying to improve conditions for salmon stocks at any one or a number of different stages in their life cycle by taking direct action on species who prey upon young salmon or compete for food, spawning habitat, or rearing area.

Historically, the most common means was to eliminate Dolly Varden char from salmon streams.

No predator/competitor control is currently taking place in the Kodiak Region. However, plans are underway for controlling stickleback in the Karluk Lake area.

3.3.3 Summary of Supplemental Production

The overall enhancement and rehabilitation program in the Kodiak Region is still in a stage of growth where it is not producing what it is eventually expected to produce. The assignment of numbers of additional fish attributed to supplemental production can be made for the past three years at Kitoi Bay Hatchery. However, it is difficult to calculate numbers of fish produced by other techniques.

In 1982, 321,000 pink salmon returned to the hatchery. In 1981 at Kitoi Bay Hatchery, more than 797,000 pink salmon returned, and at least 663,000 were taken in a commercial fishery near the hatchery. In 1980, 360,000 pinks returned, and an estimated 125,000 were commercially harvested. The egg-take for 1982 at Kitoi Bay Hatchery was 85.7 million pink; 275,000 chinook; and 145,000 chum eggs. At Karluk Lake, 13.8 million sockeye eggs were taken. In 1983, 72 million pink salmon fry were released from the Kitoi hatchery.

Returns of salmon into the Frazer Lake system were recorded as 437,876 in 1982. An additional 54,000 salmon from Frazer Lake were estimated to have been caught in the commercial fisheries. Returns of chinook salmon to the Pasagshak River systems occurred in 1981 and 1982.

3.4 THE SUMMARY OF SALMON PRODUCTION STATUS

The history of the salmon resource in the Kodiak Region is a long one. Current data show the past 20-year status of the runs has fluctuated from a record high in 1980 to a record low in 1967. The past four years have shown a decided increase in the size of runs. This increase has come from efforts to obtain the proper escapements, to supplement the wild stocks, to implement the 200-mile limit, and weather conditions favorable to survival. The present status, outlined in the following chapters, is one that should offer encouragement about the progress which is possible.

The following chapters will develop goals, objectives, and strategies, to lead to a larger salmon resource, which is based on the full potential of the Kodiak Region, and which can be subjected to a greater harvest without jeopardizing its continuity.

Map 4: KODIAK MANAGEMENT AREA

CURRENT SUPLEMENTAL PRODUCTION SITES

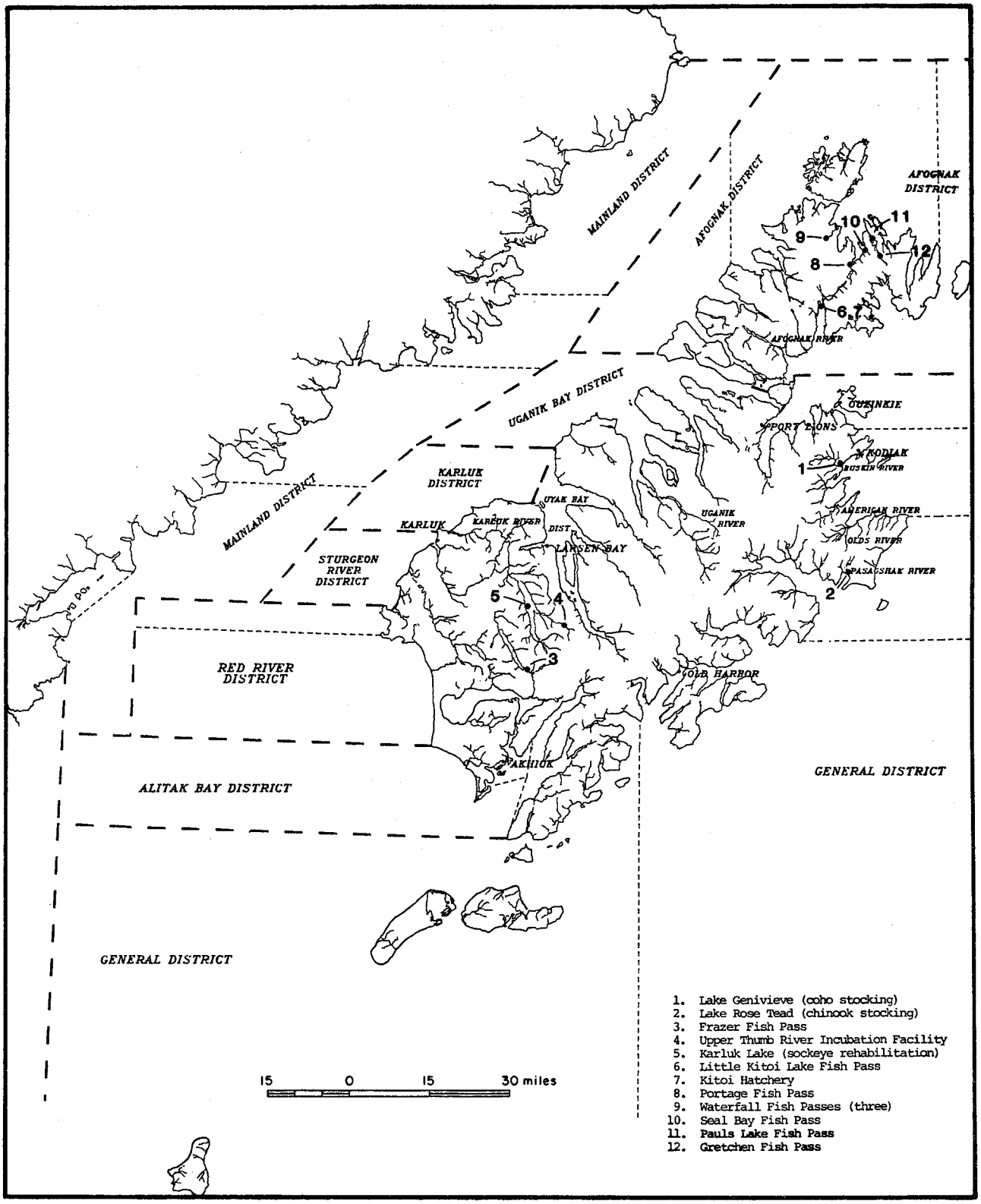

Table 3.4-1:

COMMERCIAL CATCH DATA

Historical Catch of the Kodiak Area Salmon
in Numbers of Fish by Species to the Nearest 1,000 Fish
1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1882		59,000				59,000
1883		189,000				189,000
1884		282,000				282,000
1885		469,000				469,000
1886		646,000				646,000
1887		1,004,000				1,004,000
1888		2,781,000				2,781,000
1889		3,755,000				3,755,000
1890		3,593,000				3,593,000
1891		3,846,000				3,846,000
1892		3,126,000				3,126,000
1893		3,245,000				3,245,000
1894		3,830,000				3,830,000
1895		2,247,000	8,000			2,255,000
1896		3,329,000				3,329,000
1897		2,786,000	2,000			2,788,000
1898		2,033,000	19,000			2,052,000
1899	1,000	1,935,000	32,000			1,968,000
1900	5,000	3,450,000	32,000			3,487,000
1901	4,000	4,826,000		2,000		4,832,000
1902	3,000	3,868,000	35,000			3,906,000
1903	1,000	1,826,000	120,000	10,000		1,957,000
1904	3,000	2,875,000	103,000	5,000		2,986,000
1905	2,000	2,142,000	87,000			2,231,000
1906	4,000	3,980,000	24,000			4,008,000
1907	4,000	4,232,000	38,000			4,274,000
1908	3,000	2,488,000	74,000	286,000		2,851,000
1909	4,000	1,915,000	52,000	154,000		2,125,000
1910	2,000	1,955,000	44,000	215,000		2,216,000
1911	1,000	2,686,000	28,000	230,000	6,000	2,945,000
1912	1,000	2,246,000	17,000	547,000	25,000	2,836,000
1913	1,000	1,663,000	28,000	590,000	4,000	2,286,000
1914	1,000	1,255,000	32,000	1,726,000	13,000	3,027,000
1915	1,000	1,664,000	51,000	252,000	20,000	1,988,000
1916	1,000	3,376,000	50,000	2,182,000	29,000	6,638,000
1917	1,000	3,646,000	30,000	225,000	16,000	3,918,000

continued on next page

Table 3.4-1: continued

COMMERCIAL CATCH DATA

Historical Catch of the Kodiak Area Salmon
in Numbers of Fish by Species to the Nearest 1,000 Fish
1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1918	2,000	1,894,000	78,000	2,467,000	82,000	4,523,000
1919	2,000	1,619,000	104,000	283,000	60,000	2,068,000
1920	2,000	1,958,000	89,000	1,977,000	55,000	4,081,000
1921	1,000	2,858,000	46,000	68,000	25,000	2,998,000
1922	1,000	1,097,000	120,000	2,766,000	224,000	4,208,000
1923	2,000	1,090,000	78,000	929,000	39,000	2,138,000
1924	1,000	1,408,000	121,000	5,435,000	118,000	7,083,000
1925	2,000	1,693,000	93,000	2,674,000	212,000	4,674,000
1926	1,000	3,015,000	174,000	4,607,000	325,000	8,122,000
1927	4,000	1,155,000	152,000	5,297,000	418,000	7,026,000
1928	3,000	1,592,000	291,000	1,535,000	726,000	4,147,000
1929	3,000	712,000	144,000	6,108,000	1,058,000	8,025,000
1930	5,000	466,000	229,000	1,651,000	419,000	2,770,000
1931	2,000	1,183,000	170,000	6,840,000	184,000	8,379,000
1932	2,000	1,058,000	52,000	4,710,000	237,000	6,069,000
1933	1,000	1,428,000	91,000	6,574,000	536,000	8,630,000
1934	3,000	1,829,000	86,000	7,642,000	662,000	10,222,000
1935	2,000	1,614,000	63,000	10,781,000	382,000	12,842,000
1936	5,000	2,658,000	163,000	5,648,000	329,000	8,803,000
1937	2,000	1,882,000	134,000	16,788,000	346,000	19,152,000
1938	3,000	1,966,000	133,000	8,398,000	640,000	11,140,000
1939	4,000	1,786,000	64,000	11,741,000	641,000	14,236,000
1940	3,000	1,318,000	163,000	9,997,000	674,000	12,155,000
1941	5,000	1,730,000	208,000	7,601,000	445,000	9,989,000
1942	3,000	1,281,000	106,000	6,093,000	565,000	8,048,000
1943	2,000	1,991,000	61,000	12,480,000	454,000	14,988,000
1944	2,000	1,818,000	45,000	4,956,000	507,000	7,328,000
1945	4,000	2,041,000	79,000	9,045,000	559,000	11,728,000
1946	1,000	839,000	71,000	9,546,000	298,000	10,754,000
1947	1,000	994,000	72,000	8,857,000	295,000	10,119,000
1948	1,000	1,260,000	32,000	5,958,000	331,000	7,582,000
1949	1,000	892,000	54,000	4,928,000	700,000	6,575,000
1950	2,000	921,000	41,000	5,305,000	685,000	6,954,000
1951	2,000	470,000	48,000	2,006,000	422,000	2,948,000
1952	1,000	631,000	36,000	4,554,000	984,000	6,206,000
1953	3,000	392,000	39,000	4,948,000	490,000	5,872,000

continued on next page

Table 3.4-1: continued

COMMERCIAL CATCH DATA

Historical Catch of the Kodiak Area Salmon
in Numbers of Fish by Species to the Nearest 1,000 Fish
1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1954	1,000	392,000	56,000	8,325,000	1,140,000	9,851,000
1955	2,000	164,000	35,000	10,794,000	482,000	11,477,000
1956	1,000	306,000	54,000	3,349,000	660,000	4,370,000
1957	1,000	234,000	35,000	4,691,000	1,152,000	6,113,000
1958	2,000	288,000	21,000	4,039,000	931,000	5,281,000
1959	2,000	330,000	15,000	1,800,000	734,000	2,881,000
1960	2,000	362,000	54,000	6,685,000	1,133,000	8,236,000
1961	1,000	408,000	59,000	3,926,000	519,000	4,883,000
1962	1,000	785,000	54,000	14,189,000	795,000	15,824,000
1963		407,000	57,000	5,480,000	305,000	6,249,000
1964	1,000	478,000	36,000	11,862,000	932,000	13,309,000
1965	1,000	346,000	27,000	2,887,000	431,000	3,692,000
1966	1,000	632,000	68,000	10,756,000	763,000	12,220,000
1967	1,000	284,000	10,000	188,000	221,000	704,000
1968	2,000	760,000	56,000	8,761,000	750,000	10,329,000
1969	2,000	604,000	35,000	12,493,000	537,000	13,671,000
1970	1,000	917,000	66,000	12,045,000	919,000	13,949,000
1971	1,000	478,000	23,000	4,333,000	1,541,000	6,376,000
1972	1,000	220,000	17,000	2,690,000	1,164,000	4,093,000
1973	1,000	167,000	4,000	512,000	318,000	1,002,000
1974	1,000	415,000	13,000	2,646,000	248,000	3,323,000
1975		136,000	24,000	2,943,000	84,000	3,187,000
1976	1,000	630,000	23,000	10,906,000	718,000	12,277,000
1977	1,000	624,000	25,000	6,274,000	1,071,000	7,994,000
1978	3,000	1,072,000	49,000	15,004,000	814,000	16,942,000
1979	2,000	632,000	141,000	11,288,000	358,000	12,420,000
1980	1,000	651,000	139,000	17,291,000	1,076,000	19,157,000
1981	1,000	1,289,000	122,000	10,337,000	1,345,000	13,094,000
1982	1,000	1,205,000	344,000	8,076,000	1,266,000	10,892,000

Sources:

Data prior to 1934: Historical Salmon Catches of Alaskan Commercial Fisheries, ADF&G, Juneau, 1980.

Data after 1934: Kodiak Management Area Annual Report, 1982.

SECTION 4.0

TARGET 2002 STATUS

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4.0 TARGET 2002 STATUS

4.1 BACKGROUND OF THE TARGET 2002 STATUS

After examination of projected natural run data, the RPT concluded that significant shortfalls would exist by the year 2002 between the needs of the fishermen, projected natural runs, and current supplemental production. Therefore, it was concluded that production of more fish in the Kodiak management area was required in order to provide the basis for continuing the economic viability for all participants in the salmon fishery in the region.

To reach a determination of what a future required harvest level might be, the RPT closely examined catch and ex-vessel price data for each user group and determined trends that were occurring in the fishery. One of the major assumptions of this plan is that there will be an increase in commercial catch due to better equipment, gear, and technological improvements during the plan period. Additionally, there will be increased harvest from sport fishermen along the Kodiak road system. The RPT found that the ex-vessel value to fishermen was generally increasing from the period 1972-1981. However, in 1982, there was a dramatic decrease in ex-vessel prices paid to fishermen. It does not appear that the same set of circumstances, which contributed to the low 1982 prices, will occur in 1983. However, the objectives set for each species in the plan take into account that there will be price fluctuations from year to year. Additionally, the RPT acknowledged the continued requirement for the fishery to support future harvests by subsistence users and users who are identified under the new category of personal use.

4.2 QUALIFICATION OF THE TARGET 2002 STATUS

The continued achievement of catch objectives in the salmon fishery in the Kodiak Region required that the RPT examine the relationship between what user groups seek from the resource and the ability of the resource to continue to respond to this pressure. The establishment of the target goals expressed what the RPT determined to be the user group needs. After these user group needs were determined, the RPT examined the ability of the natural resource plus current supplemental production to meet these needs in terms of a "projected status". The difference between the user group needs and the projected status was determined to be the "gap" that must be filled. The identification of supplemental production projects and the number of salmon they may produce, is the methodology recommended by the RPT to respond to harvest pressure.

The RPT also felt that the target goals could be sustained in the Kodiak Region with the addition of the supplemental production outlined in Section 6.

The projects outlined in Section 6 were felt by the RPT to provide for an orderly expansion of the resource, as well as provide for the continued gathering of additional data in order to better understand the resource base.

The RPT also felt that limited entry legislation will remain in force, and the number of limited entry permit holders will not significantly change during the plan period. However, the number of participants in the sport fishery will continue to increase. In spite of this increase, the RPT felt that due to the geographical location of Kodiak and the limited road system throughout the management area, it is not expected that this user group will present a major "pressure" on the total fishery during the plan period. Past data indicate that approximately 80% of the harvest and

effort in the sport fishery occurs on the Kodiak road system, primarily impacting coho salmon.

The future number of participants in the subsistence fishery will be determined by qualifications established by the Alaska Board of Fisheries. In 1982, 1,277 permits were issued for subsistence fishing. Approximately 30,000 salmon are taken annually in this fishery. This number excludes commercial fish taken for personal use which, based upon questionnaire data, the RPT estimates to be approximately 14,000 fish. This does not represent a major fishing pressure in the Kodiak Region during the plan period, however, strategies and specific projects will need to provide salmon in certain locations to support subsistence use.

4.3 QUESTIONNAIRE DATA

The final element examined prior to establishing target goals was public input data. In February, 1983, the RPT designed and sent questionnaires to commercial permit holders, commercial crew members, subsistence permit holders, and sport fish license holders in the Kodiak Region. The objective of this task was to obtain a representative sample of preferences for the type of fish these groups would like to catch in the future, problems they were currently experiencing, and preferred methods of rehabilitation and enhancement. The questionnaire was designed to provide the RPT with overall trends and a feel for the "general direction" in which each of these groups would like to proceed in the development of further rehabilitation and enhancement programs in the Kodiak Region.

The complete questionnaire data is contained under separate cover and available upon request at the Kodiak office of the Alaska Department of Fish and Game. The data is divided by commercial permit holders, commercial crew, sport fishermen, and subsistence fishermen. The summary of the data is as follows.

COMMERCIAL PERMIT HOLDERS

The RPT sent 607 questionnaires to commercial permit holders in the Kodiak Region. The breakdown was:

1. Purse seiners - 381
2. Set netters - 185
3. Beach seiners - 34

The RPT received 214 responses for a 35% return.

The general findings from the commercial permit holders were:

1. 85% of those surveyed commercially fished in the Kodiak Region in 1982.

2. In 1982, the majority (63%) of those sampled were not satisfied with their fishing income. This dissatisfaction primarily related to the prices received for salmon in the Kodiak Region in 1982. These prices were some of the lowest in recent years. However, 81% of those sampled were satisfied with their income during the period 1979-1981, when prices were higher. In neither case were they dissatisfied with the number of fish available for harvest.

3. The majority of those sampled need to gross between $30,000 and $150,000 from all sources to cover their fishing and living expenses. These data fell into two groupings. One group needed to gross between $30,000 and $70,000. A second group needed to gross between $80,000 and $150,000.

4. Most of those sampled have licensed commercial fishing boats, and 60% of those boats appeared to be paid for, because the respondents stated they were not financing their boats. Tying closely to this was the average total investment in their fishing gear. The majority of respondents have a total investment of between $100,000 and $200,000 in fishing gear. The RPT noted that the total investment figure ties closely to the financial requirements of between $30,000 and $150,000, which respondents say they need to make in any given year.

5. More than 25% of the respondents fish in multiple fisheries. These include salmon, crab, halibut, and herring.

6. The majority of respondents in terms of "species that they prefer to fish", responded in the following manner:

   (1) First choice was sockeye salmon.

   (2) Second choice was pink salmon.

   (3) Third choice was chum salmon.

7. In response to the question of which species they would like to see increased, there was a one-to-one tie to those which they prefer to fish. The order of preference was: (1) sockeye, (2) pink, and (3) chum. There was also a strong preference for coho salmon. The RPT concluded that the preference for coho salmon will vary depending upon the purse seiners' pink salmon season.

8. More than 50% of the respondents take fish home for personal use. In terms of the choice they like to take home for personal use and numbers of fish they take home, the data indicated: (1) sockeye and (2) coho.

   This is also the same preference for species that is reflected in the data obtained from the subsistence permit holders.

9. The majority of those sampled prefer to fish in the General District. This ties closely to the fact that the majority of responses were from purse seine permit holders. However, this is a minor conflict with the preference to fish for sockeye salmon and the respondents' first choice to see sockeye salmon runs increased. However, it ties closely to the respondents' second choice, which was pink salmon, as the species that the respondents preferred to see increased.

10. To the question: "in which districts do you wish to have salmon stocks increased?", commercial permit holders responded as follows:

    (1) Alitak District. This was the first choice and ties directly to the preference to see an increase in sockeye salmon.

    (2) General District. This was the second choice and ties closely to the second choice of species the respondents would like to see increased, which were pink salmon.

    (3) Karluk District. Again, this ties closely to the first choice of species that the respondents would like to see increased, which are sockeye salmon.

11. Problem areas identified in the commercial fishery were as follows:

    (1) Markets/prices.

    (2) Overcrowded fishing areas. (The strike in Kodiak, causing a short season, could be the reason for overcrowded fishing areas in 1982.)

    (3) Lack of enforcement.

12. In terms of increasing salmon runs and benefits from the resource, the commercial fishermen preferred that the following activities take place:

    (1) Stocking previously unproductive lakes.

    (2) Fertilizing lakes.

    (3) Clearing streams of logs and boulders.

    (4) Building hatcheries.

Items #1 and #2, stocking previously unproductive lakes and fertilizing lakes, relate directly to the preference that commercial fishermen indicated for fishing for sockeye salmon, as well as their choice for the the "number 1" species to be enhanced. Item #4, building hatcheries, relates directly to increasing pink salmon runs.

COMMERCIAL CREW MEMBERS

The RPT sent out 100 questionnaires (a 5% sample) to the commercial crew permit holders listed in the Kodiak Region. Sixteen responses were received for a 16% return. This was the lowest return of any of the groups sampled. The data from the returns were not sufficient in the RPT's mind to draw any major conclusions. However, certain statements can be made regarding desires of this group. They are as follows:

1. All commercial crew permit holders sampled fished in the Kodiak Region.

2. The majority were satisfied with their total earnings in 1982. However, more than 50% of them stated that they were not satisfied with their earnings from salmon fishing in 1982. The majority of those sampled were satisfied with their earnings from fishing for the period 1979-1981.

3. The majority of those sampled said they needed between $4,000 and $25,000 to cover their fishing and living expenses in any given year.

4. All stated that they must participate in multiple fisheries in order to cover fishing and living expenses.

5. The majority of those sampled prefer to fish for sockeye, coho, and chum salmon. This ties closely to the "number 1" preference (sockeye) of the commercial permit holders.

6. The majority of those sampled take some of their catch home, and they prefer to take home sockeye, coho, and chinook salmon. Most respondents stated they take sockeye home. This ties closely to the data contained in the commercial permit holder information.

7. Major problems seen by this group were:

   (1) Markets/prices.

   (2) Lack of enforcement.

8. As is the case with commercial permit holders, crew members would like to see the following rehabilitation and enhancement projects taking place in the Kodiak Region during the next twenty years:

   (1) Stocking previously unproductive lakes.

   (2) Building hatcheries.

   (3) Fertilizing lakes.

SUBSISTENCE PERMIT HOLDERS

The RPT sent out 150 questionnaires to subsistence permit holders in the Kodiak Region. This represents a 12% sample. There were 50 total responses for a 33% return. The general trends from the data are:

1. Set gillnets were utilized by 94% of the respondents in the Kodiak Region.

2. The preference in terms of the types of fish they like to eat are:

   (1) First choice is sockeye.

   (2) Second choice is coho or chinook. Inasmuch as they get very few chinook salmon, the RPT felt that the primary second choice was coho salmon.

3. The majority of subsistence salmon caught by the respondents were sockeye salmon. Sockeye had a better than a four-to-one ratio in terms of catch to the next closest species, which was coho salmon.

4. An adequate 1982 subsistence catch was reported by 65% of the respondents.

5. The Buskin beach area was fished with set gillnets by 72% of the respondents. The balance of the respondents fished primarily the Afognak/Litnik area. The remainder fished in 19 different locations throughout the Kodiak Region.

6. The preferred fish for subsistence is the sockeye salmon, followed by coho. It should be noted that these are also two of the top preferences for the sport fishermen, and the sockeye salmon is the "number 1" preference for the commercial fishermen.

7. Major problems listed by subsistence fishermen were:

   (1) Overcrowding. The feeling of the RPT is that this primarily takes place in the Buskin beach area.

   (2) Restrictive regulations.

   (3) Lack of access to fishing areas.

8. The rehabilitation and enhancement activities favored by the subsistence fishermen are as follows:

   (1) Stock previously unproductive lakes.

   (2) Construct spawning channels.

   (3) Build fish ladders.

   Based upon these priorities, the subsistence fishermen have indicated a strong preference for sockeye salmon enhancement. This ties closely to the "number 1" preference of fish in terms of what they like to eat, as well as the "number 1" fish they prefer to catch.

SPORT FISH LICENSE HOLDERS

Utilizing the mailing list developed by Mike Mills of the Sport Fish Division, the RPT sent out 266 sport fish questionnaires. There were 74 responses for a 36% return. A summary of the information contained in the data is:

1. The majority of those responding fished on the Kodiak road system. The primary areas were the Buskin River/Buskin beach; Pasagshak River; and American River.

2. Total days fished per year was 23 days. This corresponded closely to the data contained in a Statewide Postal Survey conducted by Mike Mills which showed an average of 21 days fished by sport fishermen in Alaska.

3. Most of the anglers (89%) fish from the shore in the Kodiak Region.

4. The "number 1" preference in terms of fish was coho salmon.

5. The majority of respondents release a substantial number of fish they catch.

6. The majority of respondents are satisfied with their catch and do not need to catch their limit in a single day to be satisfied. Furthermore, 79% of the respondents stated that they were satisfied with one or two fish, regardless of species, in a day's fishing.

7. Although the "number 1" preference for sport fishermen in terms of catch is coho salmon (primarily because this is what they can catch on the road system), their "number 1" preference for species to be enhanced is chinook salmon, followed by coho salmon and sockeye salmon.

8. The three most important problems seen by sport fishermen are:

   (1) Overcrowding of fishing areas.

   (2) Lack of enforcement.

   (3) Lack of boat slips.

9. In terms of rehabilitation and enhancement preferences by the sport fishing group, the first three choices were as follows:

   (1) Stock previously unproductive lakes.

   (2) Fertilize lakes.

   (3) Build hatcheries.

Stocking of previously unproductive lakes and fertilizing of lakes, primarily relate to the sport fishermen's choice for more coho salmon. Building hatcheries relates directly to their choices for increased coho salmon and chinook salmon, which would be available to them along the Kodiak road system.

SUMMARY

From general trends in the data contained in the questionnaires, the following points can be made:

1. All three gear groups prefer to have sockeye salmon enhanced.

2. The major rehabilitation and enhancement activities they would like to see are: (1) stocking previously unproductive lakes, (2) fertilizing lakes, and (3) building hatcheries. These activities relate directly to their desire to increase sockeye runs for all user groups, increase pink runs in the General District for commercial permit holders, and increase coho and chinook runs along the road system for sport fishermen.

3. The most important problems as seen by groups in the area are: (1) overcrowding of fishing areas, and (2) lack of enforcement.

4.4 TARGET 2002 STATUS

Based upon the assumption that a greater amount of salmon would be required to meet harvest demands, the RPT established a target towards which the efforts of the plan would be directed. After considerable review of historic and current trends and levels of harvest, a target goal of 22,950,000 salmon of all species available for harvest in the even years by the year 2002, and 17,950,000 in the odd years, was adopted. This mark was developed for harvestable fish by species as follows:

	Even Year	Odd Year
Pink Salmon -	18,500,000	13,500,000
Sockeye Salmon -	1,900,000	1,900,000 *
Chum Salmon -	2,000,000	2,000,000
Coho Salmon -	543,000	543,000
Chinook Salmon -	7,000	7,000
TOTAL:	22,950,000	17,950,000

These figures are based upon the following assumptions:

- The current natural runs will be maintained at the present levels.
- Expected fluctuations of ± 20% could occur.
- That necessary funds will be available from the "Fisheries Enhancement Loan Program" for the supplemental production projects required to achieve the target goals.
- Enough is known about the technical and biological limitations of salmon production to identify target goals for each species.

The next section, entitled "Gap Analysis" examines the "gap" between the projected status and target goals.

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* Potential exists to increase this number even further by lake enrichment projects.

SECTION 5.0

GAP ANALYSIS

TABLE OF CONTENTS

L I S T O F T A B L E S A N D M A P S

5.0 GAP ANALYSIS

5.1 INTRODUCTION

To conduct this analysis, the RPT felt it was necessary to define the "gap" with its qualifying elements. Based upon this analysis, it would then be possible to identify many of the variables which could affect the magnitude of such a "gap". Consideration could then be given to the means for closing that "gap" and the economic and biological implications of that closure.

5.1.1 Definition of Terms

The RPT developed a series of definitions to relate to terms used in projecting the number of salmon available to close the "gap" or to arrive at the Target 2002 goals and the "gap" figures. The terms are as follows:

(1) Recent 21-Year Average: This is the historical catch for the years 1962-1982. Historical commercial catch data is listed in Section 3 in Table 3.4-1, entitled "Commercial Catch Data - Historical Catch of the Kodiak Area Salmon in Numbers of Fish by Species to the Nearest 1,000 Fish 1882-1982."

(2) Present Condition: The average catch for the previous five years, 1978-1982.

(3) Projected Status (natural stocks only): The continuation of the present condition without additional supplemental production. This number is represented by a single figure (expected fluctuation of $\pm$ 20%) which the RPT felt takes into account the factors that could impact the natural runs during the plan period.

(4) Target 1992 Goal: The desired magnitude of the salmon resource by the year 1992, as a result of both natural and supplemental production.

(5) Target 2002 Goal: The desired magnitude of the salmon resource by the year 2002, as a result of natural and supplemental production.

(6) Gap: The required increase of salmon needed from the projected status to meet the Target 1992 and 2002 goals.

5.1.2 Perspective on "Gap"

The RPT felt that the number of fish required to fill the "gap" was achievable. This determination was made as a result of analyzing the goals established for each species for 1992 and 2002, as well as the validity of the assumptions made by the RPT. The RPT also felt that the efforts to close the gap will need to be carefully coordinated due to interrelationships of salmon stocks in the region and factors (such as increased commercial harvest) associated with any project aimed at increasing salmon production.

The potential of each of the five species of salmon to contribute to closing this gap will vary. Not only are the absolute levels of catch for the five species widely separated now, but their respective reproductive rates are markedly different. The perspective is complicated even more by the increase in survival and harvest rates of salmon produced by hatcheries as compared to natural stocks.

A final point is that the number of fish required to close the "gap" varies between the five species, and the increase of one species in total numbers may have an effect on the capability of another species to reach its potential.

Opportunities to increase salmon above present levels and to improve the management of the fishery exist. Each of these opportunities, which is part of a long-range strategy, will have to be assessed thoroughly before they are implemented. Phase II, which will look at specific projects, is anticipated to include a thorough project-by-project analysis which will take into account the previously listed interrelationships.

The RPT felt that the long-term strategies to close the "gap" would involve the entire range of rehabilitation and enhancement methods. The particular rehabilitation and enhancement method utilized during the plan period to enhance salmon stocks will be closely examined in the planning stage. This examination will include an evaluation of the benefit/cost of each project.

The "gap" represents not only an additional quantity of fish, but also the need for more data about the salmon resource.

In the last analysis, the RPT felt the reason for planning to close the "gap" is to increase wild stocks, while also developing the ability to produce more harvestable salmon on a sustained basis through artificial means. Both artificial and wild stocks will be managed on an optimum sustained yield basis. Although harvest policies applied to the increased resource are outside the jurisdiction of the RPT, it is clearly the intent of the plan that the resource benefit all user groups.

5.1.3 Structure of the Analysis

The structure of the "gap" analysis involves the following elements:

(1) The first element involves a review by the RPT of the recent 21-year average (1962-1982). From this review the RPT decided that it would be appropriate to develop a high mean and a low mean for this period, in order to take into account the environmental fluctuations that had affected the natural runs. Furthermore, this would also enable the RPT to project a "status" through 1992 and 2002 which would also take into account environmental fluctuations.

(2) Secondly, the RPT developed a present 5-year average (1978-1982). This present 5-year average was utilized by the RPT for the "high" projections of the natural stocks. It was felt that the present 5-year average was more representative than the last 21-year average.

(3) Table 5.2-1, entitled "Present Condition of Natural Runs", outlines the odd-year and even-year recent 20-year average and present average by species. The table also sets forth the odd-year and even-year escapements, as well as the odd-year and even-year total runs based upon the recent 20-year average and the present 5-year average.

(4) The RPT's analysis identified activities required to reach the 1992 goals.

(5) The RPT's analysis identified activities required to reach the Target 2002 goals.

(6) The final element of the overall analysis was a summary of the implications of the "gap" closure.

5.2 THE PRESENT CONDITION

The beginning of this analysis was to define a point against which future actions may be referenced. Table 5.2-1, entitled "Present Condition of Natural Runs", indicates what has been accepted as this starting point. The present condition table includes the recent 1962-1982 averages and the present condition. The present condition is defined as the average catch for the past five years (1978-1982), which the RPT felt was a more representative base period for the projections of natural stocks than the recent 1962-1982 averages. The table also shows recent 1962-1982 averages, illustrated with a low-mean and high mean-figure. Low-mean is defined as the average of the lowest eleven years between the years 1962 and 1982. High-mean is defined as the average of the highest eleven years between 1962 and 1982.

The general pattern that has been established during the previous years by state management will be continued during the life span of this plan, thereby lending the element of continuity to the harvest management practices.

The total run in Table 5.2-1, including commercial, sport, and subsistence catch during the present period (1978-1982) was 23,400,000 fish for the even years and 18,300,000 fish for the odd years. The total escapement averages for all species combined for the even years was 7,900,000 and for the odd years was 5,400,000. During the present period, it was assumed that all fish were a combination of natural stocks and production from the Kitoi Hatchery. The species composition of the present condition is also shown on Table 5.2-1.

TABLE 5.2-1:

PRESENT CONDITION OF NATURAL RUNS

Species	Recent 1962-1982 Averages Low-Mean	Recent 1962-1982 Averages High-Mean	Present 5-Yr. Average 1978-1982
CATCH:			
Pink - Odd Year	2,173,000	9,170,000	10,812,000
Pink - Even Year	8,758,000	14,078,000	13,457,000
Sockeye	353,000	837,000	970,000
Chum	399,000	1,063,000	972,000
Coho	20,000	103,000	159,000
Chinook	1,000	2,000	2,000
Total Catch:			
- Odd Year	2,946,000	11,175,000	12,915,000
- Even Year	9,531,000	16,083,000	15,560,000
ESCAPEMENT: (1)			
Pink - Odd Year	835,000	2,224,000	3,129,000
Pink - Even Year	2,250,000	3,898,000	5,623,000
Sockeye	585,000	1,222,000	1,448,000
Chum	136,000	564,000	737,000
Coho (2)	21,000	47,000	61,000
Chinook	2,000	6,000	8,000
Total Escapement:			
- Odd Year	1,579,000	4,063,000	5,383,000
- Even Year	2,994,000	5,737,000	7,877,000
TOTAL RUN:			
Pink - Odd Year	3,008,000	11,394,000	13,941,000
Pink - Even Year	11,008,000	17,976,000	19,080,000
Sockeye	938,000	2,059,000	2,418,000
Chum	535,000	1,627,000	1,709,000
Coho (2)	41,000	150,000	220,000
Chinook	3,000	8,000	10,000
Total Run All Species:			
- Odd Year	4,525,000	15,238,000	18,298,000
- Even Year	12,525,000	21,820,000	23,437,000

(1) Escapements are department estimates based upon a combination of aerial surveys, foot surveys, and weir counts.

(2) Does not represent total run. Only a portion of the coho escapement is counted.

Table 5.2-2:

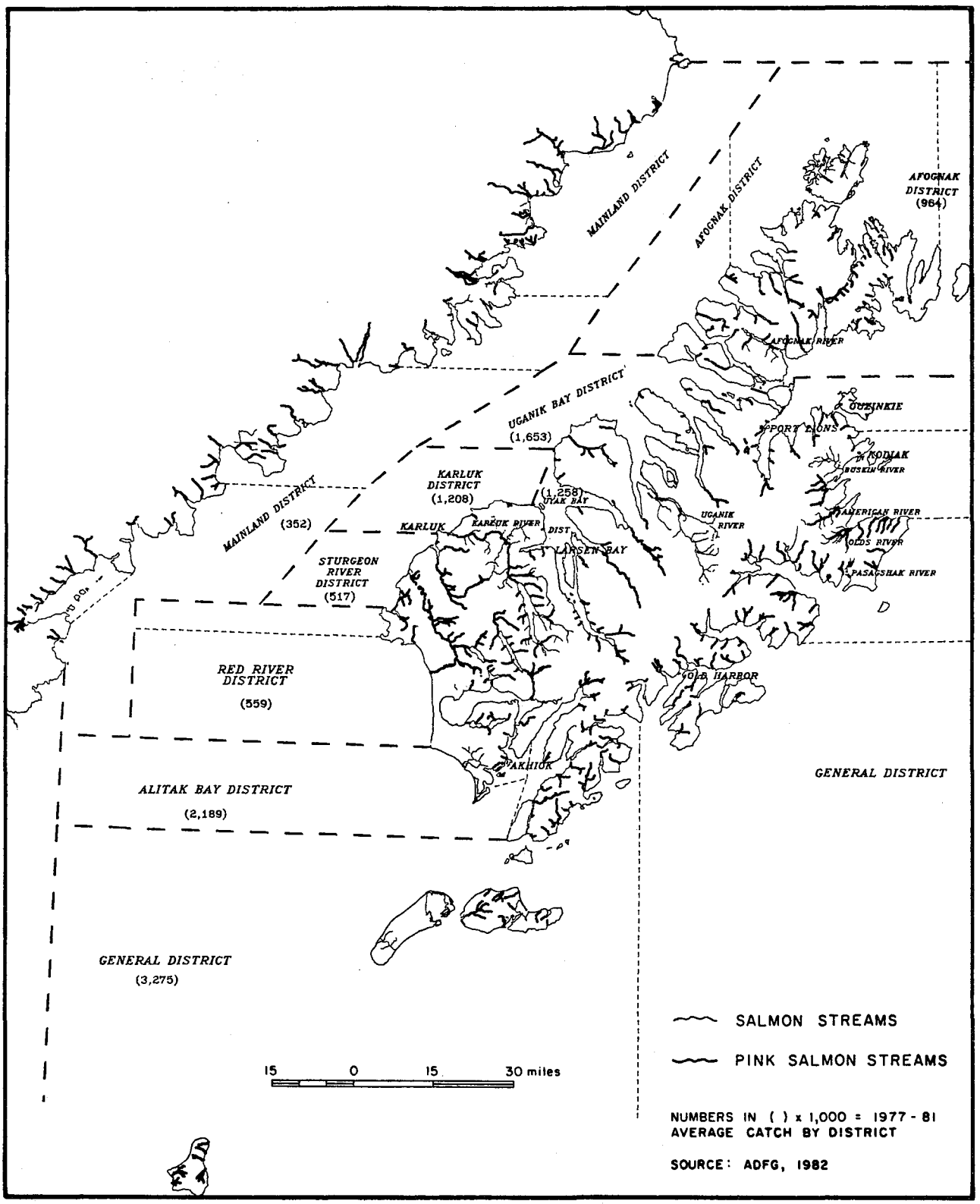
5-YEAR AVERAGE CATCH (1977-1981) PER DISTRICT PER SPECIES

(number of fish)

District	Chinook	Sockeye	Coho	Pink	Chum	Total
Alitak	200	232,000	10,000	2,189,000	59,000	2,490,200
Red River	300	155,000	2,000	559,000	3,000	719,300
Sturgeon	0	16,000	3,000	517,000	3,000	539,000
Karluk	0	37,000	7,000	1,208,000	6,000	1,258,000
Uyak	200	76,000	6,000	1,258,000	45,000	1,385,200
Uganik	200	83,000	9,000	1,653,000	75,000	1,820,200
Afognak	100	43,000	40,000	964,000	32,000	1,079,100
General	400	31,000	19,000	3,275,000	394,000	3,719,400
Mainland	100	181,000	2,000	352,000	301,000	836,100

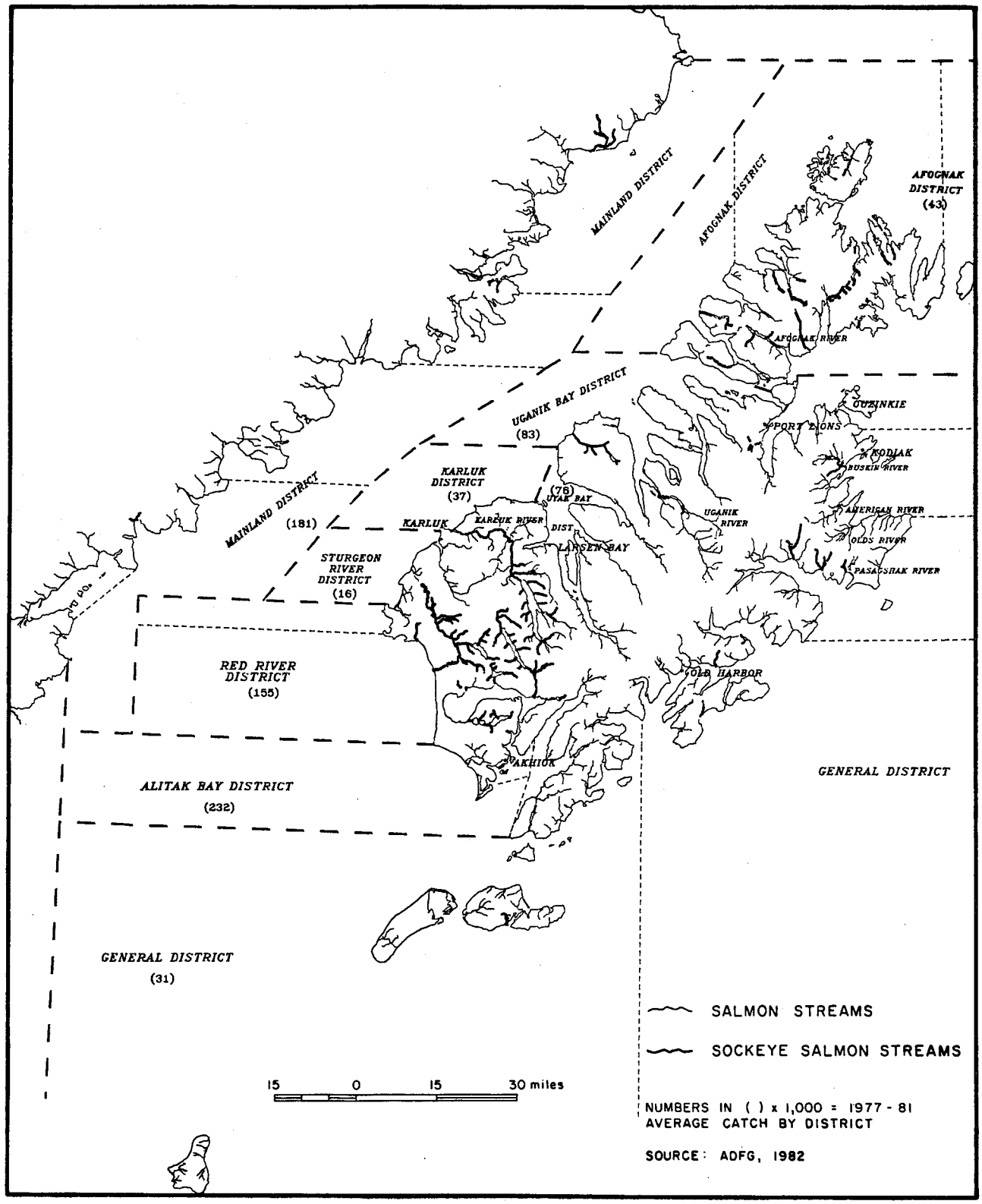
Map 5: KODIAK MANAGEMENT AREA

PINK SALMON DISTRIBUTION AND CATCH DATA



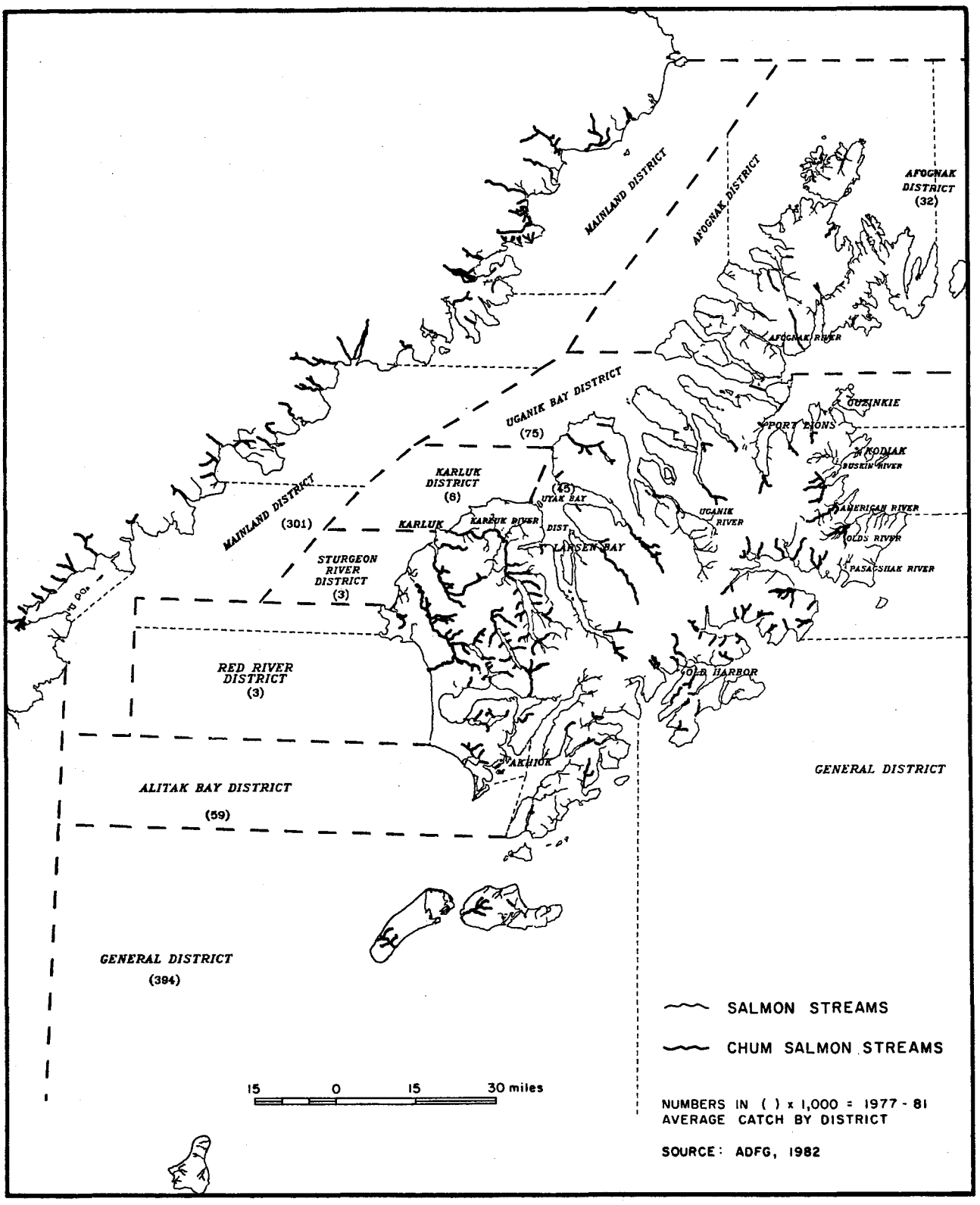
Map 6: KODIAK MANAGEMENT AREA

SOCKEYE SALMON DISTRIBUTION AND CATCH DATA



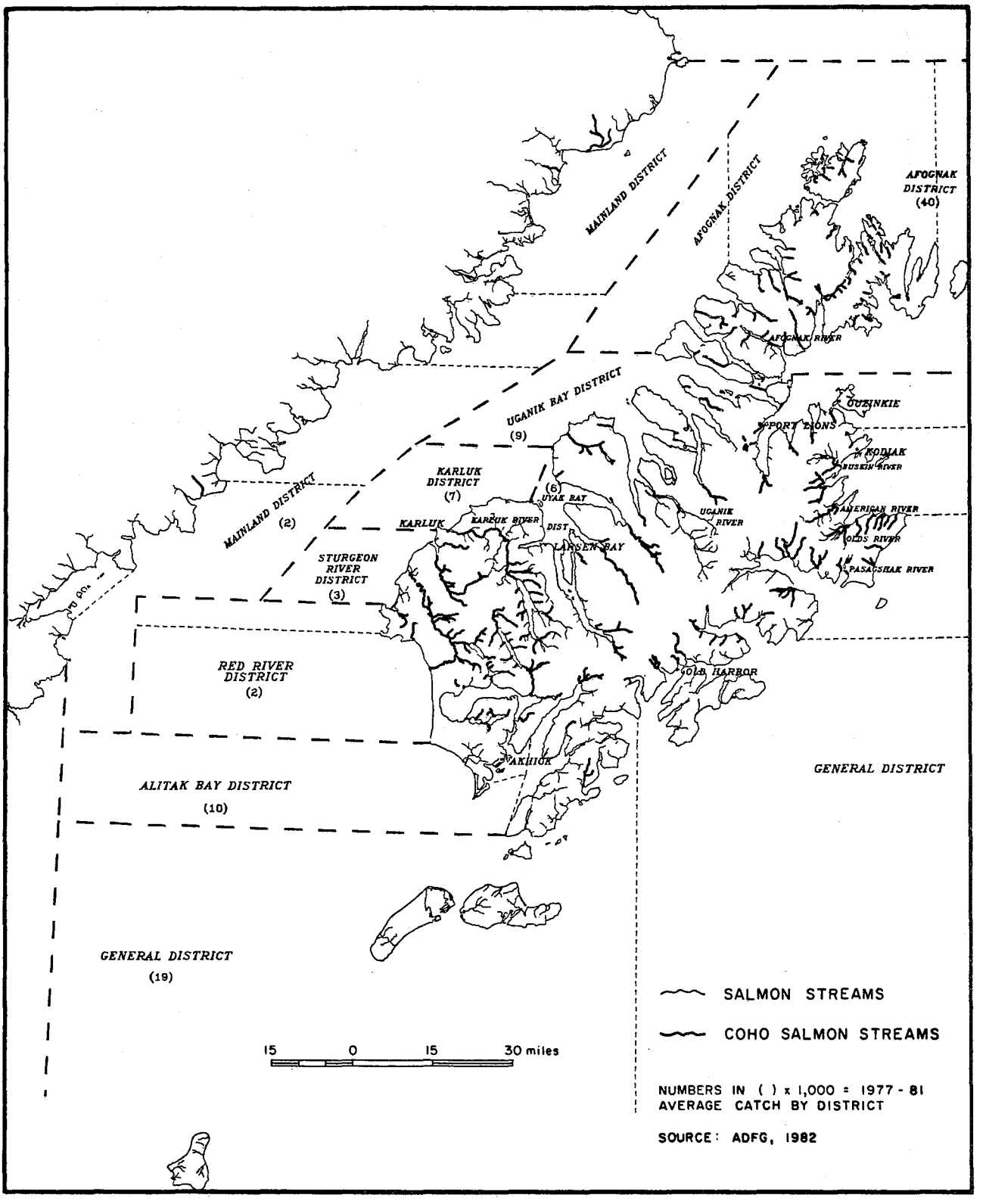
Map 7: KODIAK MANAGEMENT AREA

CHUM SALMON DISTRIBUTION AND CATCH DATA



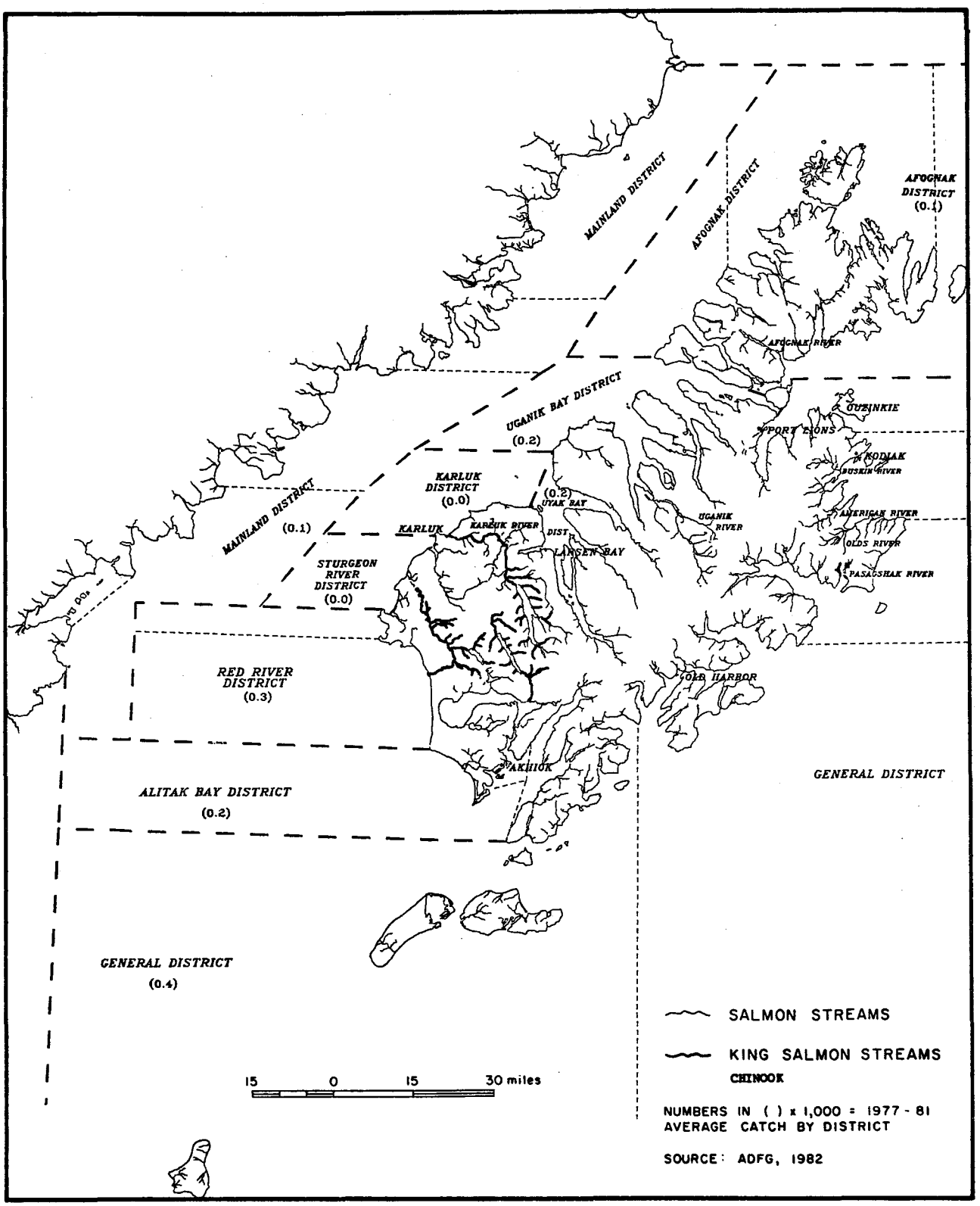
Map 8: KODIAK MANAGEMENT AREA

COHO SALMON DISTRIBUTION AND CATCH DATA



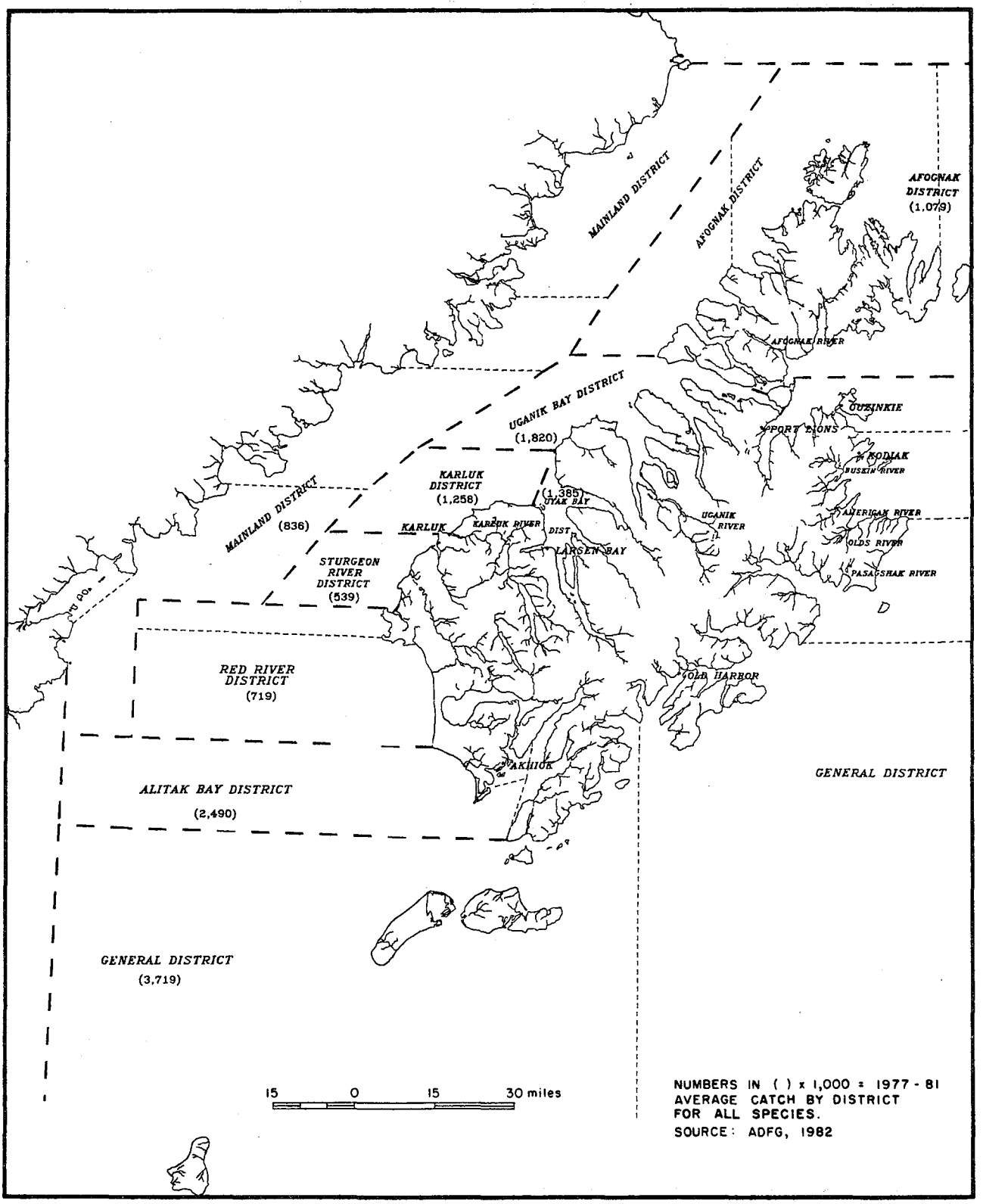
Map 9: KODIAK MANAGEMENT AREA

CHINOOK SALMON DISTRIBUTION AND CATCH DATA



Map 10: KODIAK MANAGEMENT AREA

5-YEAR AVERAGE CATCH BY DISTRICT FOR ALL SPECIES (1977-1981)



5.3 TARGET 1992 and 2002 GOALS

The RPT recognized 1992 as a half-way point in the plan and 2002 as the final point.

Tables 5.3-1 and 5.3-2, entitled "Projected 1992 Status" and "Projected 2002 Status", show the target goals established by the RPT for each species for the years 1992 and 2002. The tables also show the supplemental production required to achieve these target goals.

By 2002, the RPT anticipates that the continued maintenance of natural run strength and increased supplemental production will achieve the 2002 target goals as set forth in Table 5.3-2

5.3.1 Projected 1992 Status

The projected 1992 status assumes that Kitoi Bay Hatchery is phased into chum salmon production. By 1992, Kitoi Bay Hatchery would have the capability of producing for harvest 67,000 chum salmon, 1,301,000 pink salmon, 2,000 coho salmon, and 1,000 chinook salmon. In addition to Kitoi Bay Hatchery, a single new hatchery of 100 million egg capacity is expected to be in operation and producing 794,000 pink salmon for harvest by 1992. A private non-profit hatchery of 20 million egg capacity is also assumed to be in production. This hatchery would produce 298,000 pink salmon for harvest. The combined supplemental production of these facilities by 1992 would produce the following numbers of fish for harvest: 67,000 chum salmon, 2,393,000 pink salmon, 2,000 coho salmon, and 1,000 chinook salmon. (See Appendix V, Support Material for Supplemental Production.)

Table 5.3-1:

PROJECTED 1992 STATUS

Species	Natural Runs	Supplemental Production: Kitoi Hatchery(1)	Supplemental Production: New Hatcheries(2)	Target 1992 Goals
CATCH				
Pink - Odd Year	6,200,000	1,301,000	1,092,000	8,593,000
Pink - Even Year	11,200,000	1,301,000	1,092,000	13,593,000
Sockeye	1,000,000			1,000,000
Chum	900,000	67,000		967,000
Coho	120,000	2,000		122,000
Chinook	3,000	1,000		4,000
Total Catch:				
- Odd Year	8,223,000	1,371,000	1,092,000	10,686,000
- Even Year	13,223,000	1,371,000	1,092,000	15,686,000
ESCAPEMENT				
Pink - Odd Year	2,800,000	71,000	144,000	3,015,000
Pink - Even Year	5,800,000	71,000	144,000	6,015,000
Sockeye	1,900,000	0	0	1,900,000
Chum	732,000	52,000	0	784,000
Coho	56,000	— (3)	0	56,000
Chinook	8,000	-- (3)	0	8,000
Total Escapement:				
- Odd Year	5,496,000	123,000	144,000	5,763,000
- Even Year	8,496,000	123,000	144,000	8,763,000
TOTAL RUN				
Pink - Odd Year	9,000,000	1,372,000	1,236,000	11,608,000
Pink - Even Year	17,000,000	1,372,000	1,236,000	19,608,000
Sockeye	2,900,000	0	0	2,900,000
Chum	1,632,000	119,000	0	1,751,000
Coho	176,000	2,000	0	178,000
Chinook	11,000	1,000	0	12,000
Total Run All Species:				
- Odd Year	13,719,000	1,494,000	1,236,000	16,449,000
- Even Year	21,719,000	1,494,000	1,236,000	24,449,000

(1) Kitoi Hatchery only - Assuming a 50/50 split between pink and chum salmon.
(2) Two new hatchery facilities (100 and 20 million egg capacity.)
(3) Brood stock: Coho 299, Chinook 100.

Table 5.3-2:

PROJECTED 2002 STATUS

Species	Natural Runs	Supplemental Production		2002 Goals
		Kitoi Hatchery	New Hatcheries (1)	
CATCH				
Pink - Odd Year	6,200,000	739,000	6,561,000	13,500,000
Pink - Even Year	11,200,000	739,000	6,561,000	18,500,000
Sockeye	1,000,000	0	900,000	1,900,000
Chum	900,000	758,000	342,000	2,000,000
Coho	161,000	2,000	380,000	543,000
Chinook	4,000	1,000	2,000	7,000
Total Catch:				
- Odd Year	8,265,000	1,500,000	8,185,000	17,950,000
- Even Year	13,265,000	1,500,000	8,185,000	22,950,000
ESCAPEMENT				
Pink - Odd Year	2,800,000	71,000	576,000	3,447,000
Pink - Even Year	5,800,000	71,000	576,000	6,447,000
Sockeye	1,900,000	0	294,000	2,194,000
Chum	732,000	52,000	24,000	808,000
Coho	75,000	-- (2)	36,000	111,000
Chinook	8,000	-- (2)	-- (2)	8,000
Total Escapement:				
- Odd Year	5,515,000	123,000	930,000	6,568,000
- Even Year	8,515,000	123,000	930,000	9,568,000
TOTAL RUN				
Pink - Odd Year	9,000,000	810,000	7,137,000	16,947,000
Pink - Even Year	17,000,000	810,000	7,137,000	24,947,000
Sockeye	2,900,000	0	1,194,000	4,094,000
Chum	1,632,000	810,000	366,000	2,808,000
Coho	236,000	2,000	416,000	654,000
Chinook	12,000	1,000	2,000	15,000
Total Run All Species:				
- Odd Year	13,780,000	1,623,000	9,115,000	24,578,000
- Even Year	21,780,000	1,623,000	9,115,000	32,518,000

(1) Also includes projects such as stocking barren lakes and lake fertilization.
(2) Broodstock: Coho 200
Chinook - Kitoi 100
New hatcheries 135

5.4 "GAP" DEFINITION

The "gap" is defined as the difference between the target catch goals, minus the natural catch. The total "gap" in harvest by 2002 will be "closed" by supplemental production (six new hatcheries), as well as other rehabilitation and enhancement projects, producing a contribution to the total run of 9,685,000 fish.

Table 5.4-1, entitled "Total Gap", sets forth the total "gap" to be closed by the year 2002.

Table 5.4-1:

TOTAL GAP

Species	Natural Runs 2002	Target Goal 2002	Total Gap
CATCH:			
Pink - Odd Year	6,200,000	13,500,000	7,300,000
Pink - Even Year	11,200,000	18,500,000	7,300,000
Sockeye	1,000,000	1,900,000	900,000
Chum	900,000	2,000,000	1,100,000
Coho	161,000	543,000	382,000
Chinook	4,000	7,000	3,000
Total Catch:			
- Odd Year	8,265,000	17,950,000	9,685,000
- Even Year	13,265,000	22,950,000	9,685,000
ESCAPEMENT:			
Pink - Odd Year	2,800,000	3,447,000	
Pink - Even Year	5,800,000	6,447,000	
Sockeye	1,900,000	2,194,000	
Chum	732,000	808,000	
Coho	75,000	111,000	
Chinook	8,000	8,000	
Total Escapement:			
- Odd Year	5,515,000	6,568,000	
- Even Year	8,515,000	9,568,000	
TOTAL RUN:			
Pink - Odd Year	9,000,000	16,947,000	
Pink - Even Year	17,000,000	24,947,000	
Sockeye	2,900,000	4,094,000	
Chum	1,632,000	2,808,000	
Coho	236,000	654,000	
Chinook	12,000	15,000	
Total Run All Species:			
- Odd Year	13,780,000	24,518,000	
- Even Year	21,780,000	32,518,000	

5.5 IDENTIFIED ACTIVITIES

The management practices currently employed in the Kodiak Region are expected to remain the same during the plan period. Based upon these management practices, it is anticipated that the natural salmon stocks will remain relatively stable, with only modest increases in coho and sockeye salmon (see Tables 5.3-1 and 5.3-2 for increase by species).

The RPT anticipates that at least two hatcheries, in addition to Kitoi, and several site specific projects will contribute salmon to the harvest and therefore, to the run by 1992. These two facilities include one with an anticipated 100,000,000 egg capacity and one hatchery with a 20,000,000 egg capacity. Approximately 2,463,000 additional salmon may be anticipated to be added to the runs from these two facilities and the Kitoi hatchery (see Table 5.5-1).

Table 5.5-1:

PROPOSED SUPPLEMENTAL PRODUCTION FACILITIES
IN OPERATION BY 1992

	Salmon for Harvest by 1992					
Facility	Pink	Chum	Sockeye	Coho	Chinook	Total
Kitoi Hatchery	1,301,000	67,000	0	2,000	1,000	1,371,000
New Hatchery (1)	794,000	0	0	0	0	794,000
Private Hatchery (1)	298,000	0	0	0	0	298,000
Total	2,393,000	67,000	0	2,000	1,000	2,463,000

(1) Number of hatcheries.

Lake fertilization could also substantially increase sockeye and coho salmon. Throughout the period from 1982-1992, it is expected that research will identify more improvement opportunities which will have to be evaluated as they occur.

5.5.1 Projected 2002 Status

The major distinction of enhancement activities during the period 1992-2002, is the strong emphasis placed on a combination of state and private non-profit hatcheries, anticipated to be in operation and contributing approximately 9,685,000 fish to the total (see Table 5.5-2).

Table 5.5-2:

PROPOSED SUPPLEMENTAL PRODUCTION FACILITIES IN OPERATION BY 2002

	Salmon for Harvest by 2002					
Facility	Pink	Chum	Sockeye	Coho	Chinook	Total
Kitoi Hatchery	739,000	758,000	0	2,000	1,000	1,500,000
New Hatcheries (4)	6,561,000	0	0	0	0	6,561,000
New Hatchery (1)*	0	342,000	0	380,000	2,000	724,000
New Hatchery (1)**	0	0	900,000	0		900,000
Total	7,300,000	1,100,000	900,000	382,000	3,000	9,685,000

* Combined with rearing and lake stocking projects.

** Combined with sockeye enhancement and lake enrichment projects.

(1) Number of hatcheries.

(4) Number of hatcheries.

By 2002, Kitoi Hatchery production will be half chum and half pink salmon, resulting in annual expected harvests of 758,000 chum and 739,000 pink salmon. At least four hatcheries of 100 million egg capacity will need to be in operation to produce 6.5 million more pink salmon for harvest by 2002. Production of 342,000 additional chum, 380,000 more coho, and 2,000 chinook salmon will require a fifth hatchery with 75 million egg capacity in conjunction with an ambitious rearing, natural lake stocking, and evaluation program. Additional production of 900,000 sockeye for harvest requires at least one more hatchery of 100 million egg capacity in conjunction with sockeye enhancement and lake enrichment projects. The combined supplemental production of salmon for harvest from these facilities by 2002 is expected to be 7,300,000 pink, 1,100,000 chum, 900,000 sockeye, 382,000 coho, and 3,000 chinook salmon. (See Appendix V for simulated production schedules.)

Some of the major emphasis in the management of the fisheries, occuring during this period, will be to protect the hatchery brood stocks, managing to take pressure off the natural runs, and more refined management in the area of stock separation. The RPT felt that more research will have to be accomplished in the area of stock separation to respond to this fisheries management requirement. Additional emphasis will be placed on:

- Assessment of coho escapements
- Assessment of escapement goals
- Research and evaluation of lake stocking densities and salmon production
- Pre-stocking studies on lake and stream systems

In order to meet plan goals the RPT also recognized that additional protection activities will be required. Close coordination between Fish and Wildlife Protection and ADF&G is necessary. This activity was also recognized by the public as being of importance.

5.6 SUMMARY IMPLICATIONS OF "GAP" CLOSURE

Undertaking this ambitious program requires commitment, and its eventual success will have significant implications for the salmon fishery in the Kodiak Region. Some of these implications can only be assumed at this time. However, an awareness of their potential should properly temper the progress of work outlined in the plan. Assuming there is not a large scale increase in the number of fishermen, there should be more fish available to satisfactorily meet the anticipated increase in sport, subsistence, and commercial fishing pressure. This increase in fish will provide a good economic return for the fishermen, as well as the support industries in the Kodiak Region.

One of the results of this program would be to introduce more stability into the fishery, making it less subject to some of the fluctuations that have marked its history; thus helping it achieve a steady growth in the future.

A secondary effect of this stability would be a stronger position for the "support" industries and associated businesses which are an integral part of the commercial and sport fishery.

The Kodiak commercial salmon fishery is part of a large international market which is subject to supply-and-demand pressures. Should efforts locally and internationally create an excess supply, salmon prices and overall conditions of the industry locally would be adversely affected. Fluctuations in the market throughout the next twenty years will require that this plan be updated.

The RPT also recognizes that there must be a commitment to monitor and assess the effects of new fish on the existing salmon stocks. It is entirely possible that any new project may decrease the existing natural stock directly associated with it. The project may then represent some net gain which can only be measured against those specific "costs" that it exacts. This commitment also requires the funding and staffing of projects and programs at a level that allows them to function effectively. This commitment is important to understand at a time when public funds for rehabilitation and enhancement, as well as construction in the public and private sector, is expected to decrease during the plan period. Additionally, existing facilities may not continue to be operated by the State. However, an exception could be State loans made to viable private non-profit associations that can show a return on their investment.

The next two chapters discuss the goals, objectives, and the strategies that are required to support the gap analysis.

SECTION 6.0

GOALS AND OBJECTIVES

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6.0 GOALS AND OBJECTIVES

6.1 INTRODUCTION

The overall goal of the plan for the Kodiak Region is improved fisheries in the 20-year period. This is expressed in a series of goals and objectives. These goals are to increase the salmon available for harvest by the various user groups, the collection and evaluation of new data regarding the production of salmon in the Kodiak Region, and the potential revision and expansion of some management practices. Tying the goals together are three basic principles. These are:

1. The salmon resource needs to be maintained at an optimum sustainable yield.
2. The most effective management can only come with the attainment of the most complete information base.
3. The prudent harvest of salmon to the greatest extent possible is a positive benefit to the user groups and ultimately to the Kodiak Region and the state.

6.1.1 Production/Harvest Goals

These goals are expressed in numbers of salmon available to harvest by the user groups. Inasmuch as many specific projects have not yet been identified, the objectives are only identified in terms of being able to contribute to an increased harvest.

6.1.2 Research/Data Gathering Goals

There are a number of efforts that need to be expanded, but will not directly result in more salmon. However, the RPT feels that these will lead to a stronger and more precise harvester/manager/resource relationship so that the harvest will be as efficient as possible. Surveys of the habitat will help to clarify the manner

and extent to which the salmon resource of the region utilizes available habitat. Broadening the group of systems to which escapement monitoring is applied, and increasing the effort will further develop understanding of the resource. Expansion of stock separation studies (including use of coded-wire tagging techniques) should also provide a basis for refining the application of harvest pressure. Overall, additional knowledge is a prerequisite to the achievement of the greater harvests that are sought by all user groups.

6.1.3. Policy/Management Goals

One of the major goals of the plan is to support adequate funding of proposed research, data gathering, and production projects. Additionally, as a matter of policy, the plan will continuously be re-examined in the context of new information.

The RPT also supports all efforts to continue and improve the coordination between appropriate federal and state agencies and private non-profit associations actively involved in salmon enhancement.

6.1.4 Relationship of the Goals to the Target 2002 Status

The RPT established a harvest target for the year 2002 of 22,950,000 fish in an even year and 17,950,000 fish in an odd year. In Section 5 that target harvest was examined in the context of known projects and the production and harvest which might be expected from them. The results of that examination revealed a total gap of 9,685,000 salmon in an even and odd year. The projected catch composition by species for the even and odd years by the year 2002, are as follows:

TOTAL CATCH - 2002

	Even Year	Odd Year
Pink	18,500,000	13,500,000
Sockeye	1,900,000	1,900,000
Chum	2,000,000	2,000,000
Coho	543,000	543,000
Chinook	7,000	7,000
TOTAL	22,950,000	17,950,000

The catch composition in the years 1992 and 2002 were derived from calculations based upon the number of fish projected to be available for harvest from natural runs and supplemental production.

6.2 PRODUCTION/HARVEST GOALS AND OBJECTIVES

There are three broad goals relating to the harvest and production of salmon. The first two can be discussed in terms of specific numbers and objectives. The third cannot at this stage of the planning process be stated in terms of specific objectives.

GOAL: Maintaining the present condition as a base and increasing and stabilizing through identified projects, the runs of all salmon species to the point that they will support a catch of 15,686,000 fish in an even year and 10,686,000 fish in an odd year by 1992.

GOAL: Maintaining the present condition as a base and increasing and stabilizing through identified projects, the runs of all salmon species to the point that they will support a catch of 22,950,000 million fish in an even year and 17,950,000 fish in an odd year by 2002.

GOAL: Pursuing new enhancement opportunities considering habitat conservation measures and, through implementation of feasible projects, increase runs of all salmon species to the point that they will support an annual harvest of an additional 9,685,000 fish in even years and odd years.

The supporting objectives are detailed on the following pages.

6.2.1 PINK SALMON

In keeping with the character of pink salmon runs in the Kodiak Region, a distinction has been made between the even and odd-year runs.

OBJECTIVES 1992:

Objective: To maintain the natural stocks of pink salmon at a level that would allow a harvest from natural stocks of 11,200,000 fish in even years and 6,200,000 fish in odd years.

Objective: To produce, through supplemental production, an additional 2,393,000 returning pink salmon to be available for harvest.

Objective: To have 1,301,000 returning pink salmon produced for harvest by the Kitoi hatchery.

Objective: To have 1,092,000 returning pink salmon produced for harvest by new hatcheries.

OBJECTIVE 2002:

Objective: To have, in addition to the Kitoi hatchery, 6,561,000 pink salmon produced for harvest annually by new hatcheries.

6.2.2 COHO SALMON

OBJECTIVES 1992:

Objective: To increase the natural stocks of coho salmon to a level that would allow a harvest from natural stocks of 161,000 fish annually.

Objective: To have 2,000 returning coho salmon available for harvest from Kitoi hatchery production.

OBJECTIVE 2002:

Objective: To increase the natural stocks through supplemental production of coho salmon to a level that would allow a harvest of 543,000 fish annually.

6.2.3 CHUM SALMON

OBJECTIVES 1992:

Objective: To maintain the natural stocks of chum salmon at a level that would allow a harvest from natural stocks of 900,000 fish annually.

Objective: To have 67,000 returning chum salmon available for harvest from Kitoi hatchery production by 1992.

OBJECTIVES 2002:

Objective: To maintain the natural stocks of chum salmon to a level that would allow a harvest of 900,000 fish annually.

Objective: To have 1,100,000 chum salmon available for harvest annually by a combination of the Kitoi and new hatchery efforts.

6.2.4 SOCKEYE SALMON

OBJECTIVE 1992:

Objective: To Increase the natural stocks of sockeye salmon to a level that would allow a harvest of 1,000,000 fish annually.

OBJECTIVES 2002:

Objective: To maintain the natural stocks* of sockeye salmon at a level that allows a harvest from natural stocks of 1,000,000 fish annually.

Objective: To produce, through supplemental production techniques, an additional 900,000 sockeye salmon available for harvest annually.

Objective: To implement additional supplemental programs to enhance the sockeye salmon runs by the year 2002.

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* Natural stocks include production from the Frazer Lake Afognak fishpasses and the Karluk Rehabilitation Project.

6.2.5 CHINOOK SALMON

OBJECTIVES 1992:

Objective: To maintain the natural stocks of chinook salmon at a level that would allow a harvest from natural stocks of 3,000 fish.

Objective: To have 1,000 chinook salmon, produced by the Kitoi hatchery, available for harvest annually.

OBJECTIVES 2002:

Objective: To have 7,000 chinook salmon available for harvest annually from all sources by 2002.

Objective: To have 2,000 chinook salmon for harvest produced annually by new hatcheries by 2002.

6.3 RESEARCH/DATA GATHERING GOALS AND OBJECTIVES

The expression of goals and objectives in this section relates to research efforts that are important to the achievement of harvest objectives.

Objective: To initiate a comprehensive program to survey fish habitat (including stream surveys and inventories) throughout the Kodiak Region.

Objective: To increase the data base for improved fisheries management.

Objective: To further define salmon migratory routes within the Kodiak Region.

Objective: To improve forecasting techniques to determine salmon run strengths.

Objective: To continue efforts to increase the efficiency of hatchery facilities and the benefits associated with hatchery operation.

Objective: To initiate site investigation work for rehabilitation and enhancement efforts.

Objective: To evaluate and recommend feasible rehabilitation and enhancement projects for increasing salmon in the region.

6.4 POLICY/ISSUE GOALS

The RPT will assume an active role in the support, maintenance, and further development of salmon planning and project implementation in the region.

GOAL: Continuously review and evaluate progress in accomplishing goals and objectives identified in this plan.

GOAL: Maximize public participation in the salmon planning and project implementation process.

GOAL: Evaluate all projects in terms of user group benefits and economic feasibility.

GOAL: Monitor land uses effecting the salmon habitat and when necessary, through the Kodiak Regional Aquaculture Association, propose legislation and/or ordinances designed to protect the natural salmon production systems from incompatible land activities.

SECTION 7.0

STRATEGIES

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7.0 PROJECTS AND STRATEGIES

7.1 INTRODUCTION

This chapter will describe the strategies, and in some cases projects, which may be utilized to attain the goals and objectives set forth in Section 6. The basic strategies involved in improving salmon production are supplemental enhancement and rehabilitation strategies, research, and improved management strategies. The utilization of these strategies will vary according to species and natural conditions.

Inasmuch as they are easily identifiable at this stage of the planning process, a number of projects are included in the sport fishing area.

Planning in the Kodiak Region is in the beginning stages. Therefore, the strategies are necessarily broad in nature and will be finalized as the planning process continues.

As a final note, the planning team does not have the authority to allocate resources. It can only make recommendations to the Commissioner. The authority to allocate fisheries resources is vested in the Alaska Board of Fisheries by AS 16.251-255.

7.2 ENHANCEMENT AND REHABILITATION PROJECTS AND STRATEGIES

Enhancement and rehabilitation involves the building of stocks to production levels beyond their former capabilities and restoration of depressed stocks to higher levels of availability. Numerous projects fall into these categories. They include such things as construction of new hatcheries, hatchery expansion, lake and stream stocking, fishpass installation, stream improvement and clearance, and lake fertilization.

7.2.1 Projects

Project: To upgrade the Kitoi Hatchery by providing the following:

(1) A cold water pipeline for chum salmon production.

(2) Increasing rearing capacity.

(3) Construct brood stock holding facilities.

Project: Investigate sites for hatcheries, fishpasses, and lake stocking/fertilization projects.

Project: Contruct hatcheries and fishpasses in feasible locations during the 20-year period in order to meet the plan's goals and objectives.

Project: Conduct stream clearance and habitat improvement projects during the course of the plan in selected locations.

7.2.2 Strategies

Strategy: Increase production of coho, sockeye and chinook salmon through a combination of lake fertilization, predator-competitor control, and stocking of lakes and streams.

Strategy: Encourage private non-profit hatchery construction in order to expand the number of fish available for harvest.

Strategy: Protect the habitat for salmon while increasing utilization of existing habitat for salmon spawning and rearing.

Strategy: Develop plans and policies, in conjunction with the U.S. Fish and Wildlife Service, for the Kodiak National Wildlife Refuge, which will allow enhancement and rehabilitation projects on refuge lands.

7.3 RESEARCH AND IMPROVED MANAGEMENT STRATEGIES

Management strategies are generally developed in order to maintain and improve the salmon run, through the achievement of appropriate escapement for each stock and optimum utilization of salmon that are surplus to escapement needs. Harvest management strategies are required for both wild and supplementally-produced stocks.

Management strategies specifically work toward the attainment of more knowledge of run size, stock composition, timing, escapement rates, and optimum escapement levels. Increasing the knowledge in these areas will improve the harvest in the Kodiak Region.

7.3.1 Strategies

The following eight strategies are designed to maintain and improve salmon runs by providing additional knowledge on various aspects of the salmon stocks in the region:

Strategy: To establish a number of research project on specific stock and management problems in the region.

Strategy: To assess the habitat area and quality for optimizing salmon escapements, as well as for spawning and rearing capacities.

Strategy: To undertake a number of projects that will increase the assessment of salmon escapement for all species.

Strategy: To initiate catch sampling projects to determine sex, age, and size composition of salmon caught during specific time periods for the major salmon stocks of the region.

Strategy: To improve methods of recording salmon harvest data in order to get more specific information on actual catch by area.

Strategy: To continue studies on salmon stock separation within mixed stock fisheries by scale analysis and tag/recovery methods.

Strategy: To undertake projects that further define the time at which specific stocks of salmon pass through the fisheries.

Strategy: To manipulate the fishing effort to harvest hatchery fish instead of weak natural runs.

7.4 SPORT FISHING PROJECTS

The sport fishery on Kodiak Island has developed to the point where specific projects can be identified at this stage of the planning process.

The overall strategy is to increase the number of man-days of additional recreational fishing both near the City of Kodiak and on the Kodiak road system.

7.4.1 Projects

Project: Kodiak Road System Coho Enhancement

This project will provide a harvest of 2,500 coho salmon, which will result in an estimated 7,500 man-days of additional recreational fishing near the City of Kodiak. Eight roadside lakes would be stocked with coho fingerlings (weight equals 500/lb, Little Kitoi Lake origin) for natural rearing and volitional emigration. Adult coho would be harvested in the marine areas adjacent to the lakes.

Project: Smolt Plants

Smolt Plants are also a possible technique to increase the number of coho salmon to various user groups. Monashka Creek, Sargent Creek, and Russian Creek appear suitable for this type of coho production. However, further investigations will be required before smolt plants are conducted in these areas.

Project: Kodiak Road System Chinook Salmon Development

This project will provide a harvest of 1,000 chinook salmon, which will result in an estimated 5,000 man-days of additional fishing effort on the Kodiak road system. Buskin

River and Saltry River would be stocked with chinook fingerlings (weight equals 500/lb, Ayakulik River origin) for natural rearing and volitional emigration. Adult chinook would be harvested in the rivers and in adjacent marine areas.

Project: Lake Rose Tead Chinook Salmon Introduction

The objective of this experimental project is to produce a population of trophy size fish and 5,000 man-days of recreational effort on the Kodiak road system. The project is an existing project and involves stocking Lake Rose Tead with chinook fingerlings (weight equals 500/lb, Chignik origin) for natural rearing and volitional emigration.

SECTION 8.0

APPENDICES

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APPENDIX I

GLOSSARY

GLOSSARY

ADF&G - Alaska Department of Fish and Game

enhancement - Procedures applied to a salmon stock to supplement the numbers of harvestable fish to a level beyond what could be naturally produced. This can be accomplished by artificial or semi-artificial production systems. It can also be an increase of the amount of productive habitat in the natural environment through physical or chemical changes.

escapement - Salmon which pass through the fisheries to return upstream to a spawning ground or used as brood stock in a hatchery.

ex-vessel price - Price paid to the commercial fishermen for their catch.

fishpass - A fish ladder to enable salmon to get past a barrier to reach spawning grounds.

F.R.E.D. - The Division of Fisheries Rehabilitation, Enhancement, and Development, Alaska Department of Fish and Game.

goals - Broad statements of what the Planning Team, with input from the user groups, hopes to see accomplished within the 20-year life of the plan.

incidental catch - Fish of another species and/or stock caught during harvest of specific species/and or stock.

mixed stock fishery - Harvest of more than one stock at a given location and/or period.

natural production - Salmon which spawn, hatch, and rear without human intervention.

optimum sustained yield - Number of salmon that can be harvested and still sustain the population at a maximum level of production and vitality.

present condition - The average catch for the last five years, 1978-1982.

projected status - Continuation of the present condition without additional supplemental production.

recent 21-year average - The historical catch for the years 1962-1982.

rehabilitation - Procedures applied to a depressed natural stock which increase it to historical abundance.

residual gap - The required increase in salmon needed from the "projected status" to meet the "Target 1992" and "Target 2002" goals.

RPT - Regional Planning Team

run strength - Total run of salmon, including escapement, plus catch.

salmon:

chinook salmon - Oncorhynchus tshawytscha or king salmon.

chum salmon - Oncorhynchus keta or dog salmon.

coho salmon - Oncorhynchus kisutch or silver salmon.

pink salmon - Oncorhynchus gorbuscha, humpy or humpback salmon.

sockeye salmon - Oncorhynchus nerka or red salmon.

stock - Salmon of a single species that are produced from a single geographic location and are of the same genetic origin.

supplemental production - Salmon produced by other than natural spawning using enhancement and/or rehabilitation methods.

Target 1992 Goal - The desired magnitude of the salmon resource by 1992 as a result of natural and supplemental production.

Target 2002 Goal - The desired magnitude of the salmon resource by 2002 as a result of natural and supplemental production.

total run (run strength) - Number of salmon returning in a year for a stock or area (escapement plus harvest number).

user group - Identification by method and/or reason for the harvest of salmon (commercial, sport, or subsistence).

wild stock - Stocks which have not been rehabilitated or enhanced.

APPENDIX II

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BIBLIOGRAPHY

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APPENDIX III

COMMERCIAL CATCH DATA

COMMERCIAL CATCH DATA

Historical Catch of the Kodiak Area Salmon in Numbers of Fish by Species to the Nearest 1,000 Fish 1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1882		59,000				59,000
1883		189,000				189,000
1884		282,000				282,000
1885		469,000				469,000
1886		646,000				646,000
1887		1,004,000				1,004,000
1888		2,781,000				2,781,000
1889		3,755,000				3,755,000
1890		3,593,000				3,593,000
1891		3,846,000				3,846,000
1892		3,126,000				3,126,000
1893		3,245,000				3,245,000
1894		3,830,000				3,830,000
1895		2,247,000	8,000			2,255,000
1896		3,329,000				3,329,000
1897		2,786,000	2,000			2,788,000
1898		2,033,000	19,000			2,052,000
1899	1,000	1,935,000	32,000			1,968,000
1900	5,000	3,450,000	32,000			3,487,000
1901	4,000	4,826,000		2,000		4,832,000
1902	3,000	3,868,000	35,000			3,906,000
1903	1,000	1,826,000	120,000	10,000		1,957,000
1904	3,000	2,875,000	103,000	5,000		2,986,000
1905	2,000	2,142,000	87,000			2,231,000
1906	4,000	3,980,000	24,000			4,008,000
1907	4,000	4,232,000	38,000			4,274,000
1908	3,000	2,488,000	74,000	286,000		2,851,000
1909	4,000	1,915,000	52,000	154,000		2,125,000
1910	2,000	1,955,000	44,000	215,000		2,216,000
1911	1,000	2,686,000	28,000	230,000	6,000	2,945,000
1912	1,000	2,246,000	17,000	547,000	25,000	2,836,000
1913	1,000	1,663,000	28,000	590,000	4,000	2,286,000
1914	1,000	1,255,000	32,000	1,726,000	13,000	3,027,000
1915	1,000	1,664,000	51,000	252,000	20,000	1,988,000
1916	1,000	3,376,000	50,000	2,182,000	29,000	6,638,000
1917	1,000	3,646,000	30,000	225,000	16,000	3,918,000

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Historical Catch of the Kodiak Area Salmon
in Numbers of Fish by Species to the Nearest 1,000 Fish
1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1918	2,000	1,894,000	78,000	2,467,000	82,000	4,523,000
1919	2,000	1,619,000	104,000	283,000	60,000	2,068,000
1920	2,000	1,958,000	89,000	1,977,000	55,000	4,081,000
1921	1,000	2,858,000	46,000	68,000	25,000	2,998,000
1922	1,000	1,097,000	120,000	2,766,000	224,000	4,208,000
1923	2,000	1,090,000	78,000	929,000	39,000	2,138,000
1924	1,000	1,408,000	121,000	5,435,000	118,000	7,083,000
1925	2,000	1,693,000	93,000	2,674,000	212,000	4,674,000
1926	1,000	3,015,000	174,000	4,607,000	325,000	8,122,000
1927	4,000	1,155,000	152,000	5,297,000	418,000	7,026,000
1928	3,000	1,592,000	291,000	1,535,000	726,000	4,147,000
1929	3,000	712,000	144,000	6,108,000	1,058,000	8,025,000
1930	5,000	466,000	229,000	1,651,000	419,000	2,770,000
1931	2,000	1,183,000	170,000	6,840,000	184,000	8,379,000
1932	2,000	1,058,000	52,000	4,710,000	237,000	6,069,000
1933	1,000	1,428,000	91,000	6,574,000	536,000	8,630,000
1934	3,000	1,829,000	86,000	7,642,000	662,000	10,222,000
1935	2,000	1,614,000	63,000	10,781,000	382,000	12,842,000
1936	5,000	2,658,000	163,000	5,648,000	329,000	8,803,000
1937	2,000	1,882,000	134,000	16,788,000	346,000	19,152,000
1938	3,000	1,966,000	133,000	8,398,000	640,000	11,140,000
1939	4,000	1,786,000	64,000	11,741,000	641,000	14,236,000
1940	3,000	1,318,000	163,000	9,997,000	674,000	12,155,000
1941	5,000	1,730,000	208,000	7,601,000	445,000	9,989,000
1942	3,000	1,281,000	106,000	6,093,000	565,000	8,048,000
1943	2,000	1,991,000	61,000	12,480,000	454,000	14,988,000
1944	2,000	1,818,000	45,000	4,956,000	507,000	7,328,000
1945	4,000	2,041,000	79,000	9,045,000	559,000	11,728,000
1946	1,000	839,000	71,000	9,546,000	298,000	10,754,000
1947	1,000	994,000	72,000	8,857,000	295,000	10,119,000
1948	1,000	1,260,000	32,000	5,958,000	331,000	7,582,000
1949	1,000	892,000	54,000	4,928,000	700,000	6,575,000
1950	2,000	921,000	41,000	5,305,000	685,000	6,954,000
1951	2,000	470,000	48,000	2,006,000	422,000	2,948,000
1952	1,000	631,000	36,000	4,554,000	984,000	6,206,000
1953	3,000	392,000	39,000	4,948,000	490,000	5,872,000

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Historical Catch of the Kodiak Area Salmon
in Numbers of Fish by Species to the Nearest 1,000 Fish
1882 - 1982

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1954	1,000	392,000	56,000	8,325,000	1,140,000	9,851,000
1955	2,000	164,000	35,000	10,794,000	482,000	11,477,000
1956	1,000	306,000	54,000	3,349,000	660,000	4,370,000
1957	1,000	234,000	35,000	4,691,000	1,152,000	6,113,000
1958	2,000	288,000	21,000	4,039,000	931,000	5,281,000
1959	2,000	330,000	15,000	1,800,000	734,000	2,881,000
1960	2,000	362,000	54,000	6,685,000	1,133,000	8,236,000
1961	1,000	408,000	59,000	3,926,000	519,000	4,883,000
1962	1,000	785,000	54,000	14,189,000	795,000	15,824,000
1963		407,000	57,000	5,480,000	305,000	6,249,000
1964	1,000	478,000	36,000	11,862,000	932,000	13,309,000
1965	1,000	346,000	27,000	2,887,000	431,000	3,692,000
1966	1,000	632,000	68,000	10,756,000	763,000	12,220,000
1967	1,000	284,000	10,000	188,000	221,000	704,000
1968	2,000	760,000	56,000	8,761,000	750,000	10,329,000
1969	2,000	604,000	35,000	12,493,000	537,000	13,671,000
1970	1,000	917,000	66,000	12,045,000	919,000	13,949,000
1971	1,000	478,000	23,000	4,333,000	1,541,000	6,376,000
1972	1,000	220,000	17,000	2,690,000	1,164,000	4,093,000
1973	1,000	167,000	4,000	512,000	318,000	1,002,000
1974	1,000	415,000	13,000	2,646,000	248,000	3,323,000
1975		136,000	24,000	2,943,000	84,000	3,187,000
1976	1,000	630,000	23,000	10,906,000	718,000	12,277,000
1977	1,000	624,000	25,000	6,274,000	1,071,000	7,994,000
1978	3,000	1,072,000	49,000	15,004,000	814,000	16,942,000
1979	2,000	632,000	141,000	11,288,000	358,000	12,420,000
1980	1,000	651,000	139,000	17,291,000	1,076,000	19,157,000
1981	1,000	1,289,000	122,000	10,337,000	1,345,000	13,094,000
1982	1,000	1,205,000	344,000	8,076,000	1,266,000	10,892,000

Sources:

Data prior to 1934: Historical Salmon Catches of Alaskan Commercial Fisheries, ADF&G, Juneau, 1980.

Data after 1934: Kodiak Management Area Annual Report, 1982.

APPENDIX IV

SUPPORT MATERIAL
FOR SUPPLEMENTAL PRODUCTION

Supplemental Production Facilities

Facility	Salmon for Harvest					
	Pink	Chum	Sockeye	Coho	Chinook	Total
			BY 1992			
Kitoi Hatchery	1,301,000	67,000	0	2,000	1,000	1,371,000
New Hatchery (1)	794,000	0	0	0	0	794,000
Private Hatchery (1)	298,000	0	0	0	0	298,000
Total	2,393,000	67,000	0	2,000	1,000	2,463,000
			BY 2002			
Kitoi Hatchery	739,000	758,000	0	2,000	1,000	1,500,000
New Hatcheries (4)	6,561,000	0	0	0	0	6,561,000
New Hatchery (1)a/	0	342,000	0	380,000	2,000	724,000
New Hatchery (1)b/	0	0	900,000	0	0	900,000
Total	7,300,000	1,100,000	900,000	382,000	3,000	9,685,000

a/ combined with rearing and lake stocking projects.

b/ combined with sockeye enhancement and lake enrichment projects.

PROJECTED 1992 STATUS (1,000's)

Species	Natural Runs	Supplemental Production: Kitoi Hatchery	Supplemental Production: New Hatcheries	Target 1992 Goals
		HARVEST		
Pink - Odd yr	6,200	1,301	1,092	8,593
Pink - Even yr	11,200	1,301	1,092	13,593
Sockeye	1,000	0	0	1,000
Chum	900	67	0	967
Coho	120	2	0	122
Chinook	3	1	0	4
Total Odd:	8,223	1,371	1,092	10,686
Total Even:	13,223	1,371	1,092	15,686
		ESCAPEMENT		
Pink - Odd yr	2,800	71	144	3,015
Pink - Even yr	5,800	71	144	6,015
Sockeye	1,900	0	0	1,900
Chum	732	52	0	784
Coho	56	- a/	0	56
Chinook	8	- b/	0	8
Total Odd:	5,496	123	144	5,763
Total Even:	8,496	123	144	8,763
		TOTAL RUN		
Pink - Odd yr	9,000	1,372	1,236	11,608
Pink - Even yr	17,000	1,372	1,236	19,608
Sockeye	2,900	0	0	2,900
Chum	1,632	119	0	1,751
Coho	176	2 a/	0	178
Chinook	11	1 a/	0	12
Total All Species:				
Odd yr:	13,719	1,494	1,236	16,449
Even yr:	21,719	1,494	1,236	24,449

a/ 299 Coho Broodstock
100 Chinook Broodstock

PROJECTED 2002 STATUS (1,000's)

Species	Natural Runs	Supplemental Production: Kitoi Hatchery	Supplemental Production: New Hatcheries & Projects	Target 2002 Goals
		HARVEST		
Pink - Odd yr	6,200	739	6,561	13,500
Pink - Even yr	11,200	739	6,561	18,500
Sockeye	1,000	0	900	1,900
Chum	900	758	342	2,000
Coho	161	2	380	543
Chinook	4	1	2	7
Total Odd:	8,265	1,500	8,185	17,950
Total Even:	13,265	1,500	8,185	22,950
		ESCAPEMENT		
Pink - Odd yr	2,800	71	576	3,447
Pink - Even yr	5,800	71	576	6,447
Sockeye	1,900	0	294	2,194
Chum	732	52	24	808
Coho	75	- a/	36	111
Chinook	8	- a/	- b/	8
Total Odd:	5,515	123	930	6,568
Total Even:	8,515	123	930	9,568
		TOTAL RUN		
Pink - Odd yr	9,000	810	7,137	16,947
Pink - Even yr	17,000	810	7,137	24,947
Sockeye	2,900	0	1,194	4,094
Chum	1,632	810	366	2,808
Coho	236	2 a/	416	654
Chinook	12	1 a/	2 b/	15
Total All Species:				
Odd yr:	13,780	1,623	9,115	24,518
Even yr:	21,780	1,623	9,115	32,518

a/ 200 Coho Broodstock
100 Chinook Broodstock

b/ 135 Chinook Broodstock

NEW HATCHERIES
SUPPLEMENTAL PRODUCTION (2002)

Broodstock Requirements:

Pink Salmon

Harvest Goal: 6,561,000	
Broodstock	576,000
Holding Mortality (10%)	57,600
Stock For Eggs	518,400
Females (50%)	259,200
Females x 1,700 Eggs	440,640,000
Eyed Eggs (90%)	396,576,000
Fry (90%)	356,918,400
Adults (2%)	7,138,368
Harvest (92%)	6,562,368
Broodstock	576,000

Sockeye Salmon

Harvest Goal: 900,000	
Broodstock	294,000
Holding Mortality (10%)	29,400
Stock For Eggs	264,600
Females (50%)	132,300
Females x 2,500 Eggs	330,750,000
Eyed Eggs (85%)	281,137,500
Fry (85%)	238,966,875
Stream/Lake (25%)	59,741,719
Smolt (10%)	5,974,172
Adults (20%)	1,194,834
Harvest (75%)	900,834
Broodstock	294,000

Chum Salmon

Harvest Goal: 342,000	
Broodstock	24,000
Holding Mortality (10%)	2,400
Stock For Eggs	21,600
Females (50%)	10,800
Females x 2,100 Eggs	22,680,000
Eyed Eggs (90%)	20,412,000
Fry (90%)	18,370,800
Adults (2%)	367,416
Harvest (93.5%)	343,416
Broodstock	24,000

Coho Salmon

Harvest Goal: 380,000	
Broodstock	36,000
Holding Mortality (10%)	3,600
Stock For Eggs	32,400
Females (50%)	16,200
Females x 3,200 Eggs	51,840,000
Eyed Eggs (90%)	46,656,000
Fry (90%)	41,990,400
Smolts (10%)	4,199,040
Adults (10%)	419,904
Harvest (91.4%)	383,904
Broodstock	36,000

Chinook Salmon

Harvest Goal: 2,000	
Broodstock	135
Holding Mortality (10%)	13.5
Stock For Eggs	121.5
Females (50%)	61
Females x 7,200 Eggs	439,200
Eyed Eggs (90%)	395,280
Fry (90%)	355,752
Smolt (20%)	71,150
Adults (3%)	2,135
Harvest (93.7%)	2,000
Broodstock	135

POTENTIAL KITOI HATCHERY
PRODUCTION BY 1992 AND 2002 BY
PHASING CHUM INTO 50% CAPACITY a/

		Chum	Pinks
By 1992:			
	Return	119,000	1,372,000
	Broodstock b/	52,000	71,000
	Harvest	67,000	1,301,000
By 2002:			
	Return	810,000	810,000
	Broodstock b/	52,000	71,000
	Harvest	758,000	739,000

a/ Based upon assumptions and simulated production schedule.

b/ Broodstock includes 6,000 pink escapement for Kitoi Creek and assumed holding mortality of 10% for both pink and chum salmon.

KITOI HATCHERY PRODUCTION OF
50% EACH PINK AND CHUM SALMON

Assumptions:

1. Hatchery capacity 100 million eggs.

2. Survival rates:
   Egg-take to eyed-egg 90%
   Eyed-egg to fry 90%
   Fry to adult (partial rearing) 2.0%

3. Eggs/female:
   Pinks 1,700 and chum 2,100

4. Sturgeon chum broodstock egg-takes:
   1983-84 0.5 million
   1985-86 1.0 million

5. Chum salmon interception before broodstock established is 10% (10% of return to Kitoi harvested).

6. Broodstock holding mortality is 10% for both species.

7. Ocean age of returning chum salmon is 80% age .3 and 20% age .4.

8. New cold-water pipeline for chum incubation constructed in 1984 and completed in 1985.

9. Maximum use of chum returning to Kitoi for broodstock until 1991.

SIMULATED PRODUCTION SCHEDULE FOR 50% PINK/CHUM AT KITOI HATCHERY

Year of Operation	Activity	Species	Broodstock Total	No. Females	Egg Take (millions)	Fry Release (millions) Year	Fry Release (millions) No.	Adult Year	Adult Return No.	Adult Year	Harvested No.
1983	Existing Production	Pinks	135,000	58,800	100.0	1984	81.0	1985	1,600,000	1985	1,466,000
	Chum Development Sturgeon River	Chum	350	250	0.5	1984	0.40	1987	6,480	1987	648
								1988	1,620		
1984	New Pipe Construction	Pinks	135,000	58,800	100.0	1985	81.0	1986	1,600,000	1986	1,466,000
		Chum	350	250	0.5	1985	0.40	1988	6,480	1988	810
								1989	1,620		
1985	New Pipe Complete	Pinks	134,000	58,200	99.0	1986	80.2	1987	1,600,000	1987	1,472,000
		Chum	952	476	1.0	1986	0.81	1989	12,960	1989	1,458
								1990	3,240		
1986	Last Egg Take Sturgeon River	Pinks	134,000	58,200	99.0	1987	80.2	1988	1,600,000	1988	1,474,000
		Chum	952	476	1.0	1987	0.81	1990	12,960	1990	1,620
								1991	3,240		
1987	First Chum Egg Take Kitoi	Pinks	127,517	55,235	93.9	1988	76.1	1989	1,521,000	1989	1,403,000
		Chum	5,832	2,916	6.1	1988	4.9	1991	79,056	1991	30,238
								1992	19,764		

SIMULATED PRODUCTION SCHEDULE FOR 50% PINK/CHUM AT KITOI HATCHERY (cont'd)

Year of Operation	Activity	Species	Broodstock Total	No. Females	Egg Take (millions)	Fry Release (millions) Year	Fry Release (millions) No.	Adult Year	Adult Return No.	Harvested Year	Harvested No.
1988	Chum Brood Development Continues	Pinks	125,577	54,353	92.4	1989	74.8	1990	1,497,000	1990	1,381,000
		Chum	7,290	3,645	7.6	1989	6.2	1992	99,202	1992	66,584
								1993	24,801		
1989		Pinks	117,553	50,706	86.2	1990	69.8	1991	1,396,000	1991	1,325,000
		Chum	13,122	6,561	13.8	1990	11.2	1993	178,564	1993	150,983
								1994	44,641		
1990		Pinks	115,611	49,823	84.7	1991	68.6	1992	1,372,000	1992	1,301,000
		Chum	14,580	7,290	15.3	1991	12.4	1994	198,288	1994	190,547
								1995	49,572		
1991	First Year Chum at Capacity	Pinks	70,706	29,412	50.0	1992	40.5	1993	810,000	1993	739,294
		Chum	52,382	23,810	50.0	1992	40.5	1995	648,000	1995	645,190
								1996	162,000		
1992		Pinks	70,706	29,412	50.0	1993	40.5	1994	810,000	1994	739,294
		Chum	52,382	23,810	50.0	1993	40.5	1996	648,000	1996	757,618
								1997	162,000		
1993		Pinks	70,706	29,412	50.0	1994	40.5	1995	810,000	1995	739,294
		Chum	52,382	23,810	50.0	1994	40.5	1997	648,000	1997	757,618
								1998	162,000		

PRIVATE NON-PROFIT HATCHERY

BY 1992

Pink Salmon

20,000,000	Eggs Taken
18,000,000	Eggs Eyed (90%)
16,200,000	Fry Reared & Released (90%)
324,000	Adults Produced (2%)
26,000	Broodstock
298,000	Harvest

Broodstock Requirement:

11,765	Females x 1,700 eggs = 20,000,000
23,530	Males & Females at 50:50
2,353	Holding Mortality at 10%
25,883	Broodstock

ASSUMPTIONS FOR NEW PINK SALMON HATCHERY - KODIAK

1. 100 million egg capacity
   50 million fry rearing capacity

2. Female fecundity 1,700, 50% sex ratio

3. Survivals:

Broodstock	90%
Eyed Egg	90%
Fry	90%
Adult	2.2%

4. Harvest interception 50% of returning fish during broodstock development.

5. Initial broodstock 8,000 (4,500 females)

SIMULATED PRODUCTION SCHEDULE FOR A NEW PINK SALMON HATCHERY
WITH 100 MILLION EGG CAPACITY, KODIAK

Year of Operation	Activity	Broodstock No. Total	Broodstock No. Females	Egg Take (millions)	Fry Release (millions) Year	Fry Release (millions) No.	Adult Return Year	Adult Return No.	Adults Harvested
1986	Construction	-	-	-	-	-	-	-	-
1987	Operation Broodstock Development	8,000	4,500	7.65	1988	6.20	1989	136,323	68,162
1988	"	8,000	4,500	7.65	1989	6.20	1990	136,323	68,162
1989	"	76,161	30,081	51.14	1990	41.42	1991	911,274	763,626
1990	"	76,161	30,081	51.14	1991	41.42	1992	911,274	793,626
1991	Operation @ Capacity	117,648	58,824	100.00	1992	81.00	1993	1,782,000	1,664,352

Full capacity production by 1993 at 1,782,000 pinks.
Harvestable pinks 1,664,352 per year.
Average weight 3.8 lbs/fish.
Total weight harvestable fish/yr 6,324,538.
Average (1979-1982) ex-vessel price/lb 37¢.
6,324,538 lbs x $0.37 = $2,340,079 ex-vessel value (annual).

3 hatcheries x 1,664,352 = 4,993,056 pink salmon for harvest.
4 hatcheries x 1,664,352 = 6,657,408 pink salmon for harvest.

HYPOTHETICAL
COMPARISON OF HATCHERY AND
NATURAL SOCKEYE SALMON PRODUCTION

HATCHERY	NATURAL
1 Male:1 Female	1 Male:1 Female
2,500 Eggs	2,500 Eggs
2,125 Eyed Eggs (85%)	-
1,806 Fry (85%)	750 Fry (30%)
452 Fry Emerge to Lake (25%)	188 Fry Emerge to Lake (25%)
45 Smolt (10%)	19 Smolt (10%)
9 Adults (20%)	3.8 Adults (20%)
4.5 Adults Harvest (50%)	1.9 Adults Harvest (50%)
4.1 Adults Egg Take (90%)	1.7 Adults Spawn (90%)
4.1:2 Return/Spawner	1.7:2 Return/Spawner

( ) Survival Rate

In this comparison, the natural system cannot sustain a 50% harvest and maintain a viable population. A hatchery, releasing fry into the natural lake, could maintain the population and 50% harvest and still have surplus fish.

With a fishery harvesting 20% of the adults returning to the natural system, only 2.7 sockeye would be available to spawn (2.7 fish per parent pair) and would probably maintain the population.

To maintain viable natural sockeye stocks, harvest rates generally should not be expected to exceed 20% of the adult fish returning.

When escapement reaches the habitat capacity (spawning and rearing area), then the harvest can be increased on the surplus fish. For example, a 500,000 sockeye return to Frazer Lake can provide a 100,000 harvest (20%) and a 400,000 escapement. If the return is greater than this, then the harvest can be increased to maintain the escapement at 400,000 (system capacity estimate).