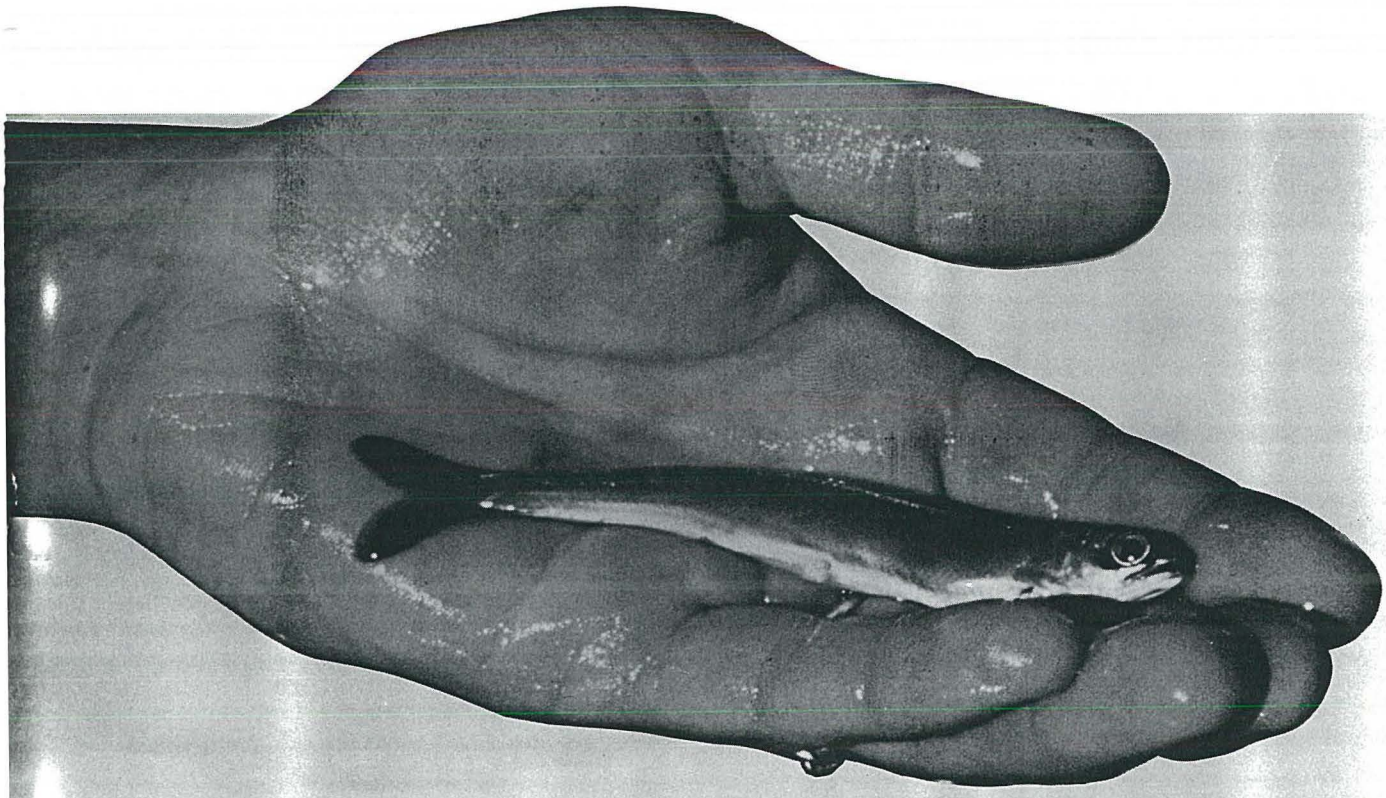
COOK INLET REGIONAL SALMON ENHANCEMENT PLAN



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I, Ronald O. Skoog, Commissioner of the Alaska Department of Fish and Game, formally give my approval to the Cook Inlet Regional Salmon Enhancement Plan 1981-2000 prepared by the Cook Inlet Regional Planning Team for the Cook Inlet area of Alaska per the provisions of Alaska Statute 16.10.375.

Ronald O. Skoog

Ronald O. Skoog, Commissioner

18 Feb 82

Date

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

JAY S. HAMMOND, GOVERNOR

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February 19, 1982

Sidney M. Logan, Chairman
Cook Inlet Regional Planning Team
P.O. Box 3150
Soldotna, Alaska 99669

Dear Mr. Logan:

This letter is to inform you, as chairman of the Cook Inlet Regional Planning Team (CIRPT), of my formal approval of the The Final Draft Cook Inlet Regional Salmon Enhancement Plan 1981-2000.

Since the submittal of the plan for my consideration, it has undergone a process of review and comment by the Directors of Alaska Department of Fish and Game (ADF&G) divisions responsible for managing, enhancing and protecting Alaska's fishery and its habitat. Previous to my review you conducted public meetings of the plan and distributed copies to provide opportunity for comment by ADF&G technical staff and the general public, with emphasis on those associated with the fishery in user and consumer capacities.

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

Based on the efforts of the CIRPT 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 me and the Department in producing a comprehensive salmon plan for the Cook Inlet area.

Sincerely,

Ronald O. Skoog
Commissioner

cc: Members, CIRPT
ADF&G Division Directors

COOK INLET REGIONAL SALMON ENHANCEMENT PLAN 1981 - 2000

Prepared By:

COOK INLET REGIONAL PLANNING TEAM

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OCTOBER, 1981

ACKNOWLEDGEMENTS

The Cook Inlet Regional Planning Team received much support during its work on this plan, and that support not only facilitated the effort but led directly to a better end product.

Several individuals had served on the Regional Planning Team in the past but were not members at the time of publication of the Plan. The Team acknowledges the time and thought given by Lottie Edelman, Emil "Beaver" Nelson, and Paul Jones who at various times represented the Cook Inlet Aquaculture Association and Dennis Haanpaa from the Department of Fish and Game. Additionally the alternate delegate from the Association, Dave Vanderbrink, served as an active and frequent contributor t the deliberations of the Team.

A number of people who were not officially a par of the Team made consistent and important contribu tions to the development of the Plan. Outstandin among those were Floyd Heimbuch, Tom Mears an Shirley Aleckson from the aquaculture staff and Ke Tarbox, Loren Flagg, Tom Schroeder, Nick Dudiak an Larry Engel from the Soldotna, Homer and Palme offices of the Department of Fish and Game. Valuabl overall perspective on the plan development wa given by Jerry Madden, ADF&G Private Non-profi Coordinator.

The Cook Inlet Regional Planning Team extend its thanks and gratitude for these efforts.

GUIDE TO THE READER

It will be helpful to understand what each of the chapters is intended to offer the reader so that the review of the Plan may be most efficient from each reader's perspective.

The **Executive Summary** presents selected highlights of the Plan. It addresses the broad perceptions of the Regional Planning Team concerning the appropriate direction for salmon enhancement efforts and the relationships that will be needed between the participants in those efforts.

Chapter 1 is an introduction to the Plan and a description of the process by which it was developed. It shows the working relationships of the Regional Planning Team (RPT) and its responsibilities. Efforts to involve the public in the development are set forth.

Chapter 2 gives the reader the background information that will be necessary to understand and assess the ideas set forth in later chapters. It describes both the natural and human environments of the Cook Inlet area and includes descriptions of the history and current status of the fishery by gear group and by species of salmon. It also covers the economics associated with the fishery. In all cases emphasis is given to those elements which have some recognizable influence on the salmon fishery.

Chapter 3 focuses on the life histories of the five species of salmon harvested in the Inlet and sets out an historical perspective on the strength and trends of the annual runs. It examines the data on the wild stocks, explores the condition of supplemental stocks, and describes the efforts of various groups to improve the condition of the fishery.

Chapter 4 deals with the projected aspirations of the various user groups and the total number of salmon required to support a satisfactory harvest level in the year 2000. It discusses the context in which this target status was developed and presents the qualifying assumptions that accompany the projection.

Chapter 5 examines the difference or "gap" between the existing situation described in Chapter 3 and the target 2000 status set out in Chapter 4. Included in this discussion is analysis of the limitations to filling the "gap", which range from lack of information to lack of technology and/or immediate funding.

Chapter 6 is the logical outgrowth of Chapters 3, 4, and 5 as it establishes the long-term goals of the Plan and describes the short-term objectives that will collectively lead to the attainment of those goals. It presents a schedule which outlines species-by-species the time framework within which these objectives, and subsequently goals, will be achieved.

Chapter 7 in its discussions of strategies and projects is the ultimate refinement of the concept of goals and objectives established in the prior chapter. Among the strategies considered are enhancement, harvest management, habitat protection, and research.

The plan concludes with an **Appendix** that provides the pertinent technical data used in the development of the Plan.

The first section of the Appendix is a **glossary** of terms which are used in the Plan and which may not be familiar to all. In addition some terms are used repeatedly and have very specific definitions, which were developed by the Cook Inlet Regional Planning Team (CIRPT). Finally, a number of organizations have been discussed by reference to their initials, and in each case the glossary contains those initials and the full name of the organization.

Many sources of information were reviewed during the preparation of the Plan. The second section of the Appendix is a **bibliography** of not only those sources which were specifically cited but also those which were used in developing context and background.

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EXECUTIVE SUMMARY

The Cook Inlet Regional Planning Team (CIRPT) made up of three fishermen from the Cook Inlet Aquaculture Association (CIAA) and three representatives of the Alaska Department of Fish and Game (ADF&G) met regularly over a two-year period to develop this twenty-year plan for salmon enhancement in Cook Inlet. The aquaculture association representing subsistence, sport and commercial fishermen, the Matanuska-Susitna and Kenai Peninsula Boroughs, the Municipality of Anchorage, fish processors, Cook Inlet Region, Inc. (the regional native association), the University of Alaska, and selected cities throughout the drainage area spoke for the user groups. The interests and positions of resource management were introduced by representatives from the Commercial Fish Division, the Sport Fish Division, and the Fisheries Rehabilitation, Enhancement, and Development Division.

The Plan attempts to capture the complexity of Cook Inlet and the diversity of conditions that exist within its 50,000 square mile drainage area. This region by general consensus contains the most intricate mixing of physical and social factors related to salmon resources of any area in the State for which this type of plan is being prepared. Examples of this complexity include the mixed stock nature of the fishery, the widespread persistence of seismic activity, and the presence of over one-half of the total State population.

With full recognition of the inherent "risks" the Regional Planning Team decided to take a basically optimistic approach to the Plan. Much is not known about the salmon resource in the Inlet, and many of the projects which have been identified have not been developed to the point that there is certainty that they can be realized. Nevertheless, the underlying tone of the Plan is that improvement is possible. The commitment of the Plan is for all involved to extend their maximum efforts toward that improvement.

The most promise for enhancement of the salmon resource of Cook Inlet rests in the coordinated and cooperative efforts of the Department of Fish and Game and other agencies and associations interested in salmon, particularly the Cook Inlet Aquaculture Association. Not only do the fishermen have a desire to participate in enhancement of the resource, but it is essential that there be mutual understanding between the user groups and the resource managers.

During the evolution of the Plan in the work of the Regional Planning Team several broad items emerged as the focal points for the work to be planned for the next twenty years.

- Enhancement of the salmon resource in any significant and lasting fashion will depend upon a careful balance of management for the wild stocks and the orderly introduction of supplemental production.
- Conditions in the Inlet are sufficiently diverse that any application of a supplemental production technique will have to be assessed on a site-by-site basis.
- Concentrated research efforts are necessary to build the type of information base that will support an increased salmon resource base and allow appropriate and effective management of it.
- Sustained long-term support of adequate staffing and project budgets on the part of the State and the fishermen will be required to realize the ambitious goals set out in the Plan.

It became necessary in the planning process to establish some target towards which the efforts of the Plan would be directed. There is no clear definition of the carrying capacity of the Inlet. Additionally, to all but the managers, the most meaningful number is the one that describes the harvest goal for the year 2000. After review of historic and current trends and levels of harvest a target of 12.000 million salmon of all species available to harvest in the year 2000 was adopted. This mark, which is about 50 percent higher than the best total harvest of salmon ever recorded in the Inlet, is both high enough to necessitate a more thorough understanding of the salmon and of the Inlet and modest enough to be within reach, if all identified projects proved both feasible and successful.

There are two major components to the planned increases in the number of salmon, those additional salmon that can be achieved through management of the natural stocks and those salmon that will arise from supplemental production techniques. The Commercial Fish Division projected that through management the harvest from wild stocks could be brought to a level of 6.030 million in the even years and 5.030 million in the odd years by 2000.

Through a number of projects designed to supplement the salmon resource the Regional Planning Team was able to envision a total of 4.061 million being added to the annual harvest by 2000. The table on page 3 identifies those projects and their possible contributions.

Combining the projected increases in natural stocks with the potential supplemental production that has been identified to this point, it is possible to project a total harvest of 10.091 million in the even years and 9.091 million in the odd years by 2000.

It is obvious that there will have to be a concomitant escapement, if this size harvest is to be achieved and maintained. The following tables show the projections up through the year 2000 and compare them to the target 12.000 million harvest status. It is apparent that there is a residual gap of between 1.909 and 2.909 million harvestable fish which cannot be accounted for by any identified projects.

There are, however, a number of projects which have been suggested but which are not sufficiently developed to attach any specific potential production to them at this time. It is to these projects and those which will emerge during the twenty years that the Regional Planning Team will look to eliminate as much of the residual gap as possible.

PROJECTED HARVEST COMPOSITION — 2000

	Even Years	Odd Years
Sockeye	3,163,000	3,163,000
Pink	4,235,000	3,235,000
Chum	1,906,000	1,906,000
Coho	695,000	695,000
King	92,000	92,000
	10,091,000	9,091,000

PROJECT ANALYSIS

EVEN YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	4,078,000	6,892,000	10,091,000	1,909,000	12,000,000
NON-HARVESTABLE FISH	1,770,000	2,984,000	4,113,000	955,000	5,068,000
RUN STRENGTH	5,848,000	9,876,000	14,204,000	2,864,000	17,068,000

PROJECT ANALYSIS

ODD YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	3,810,000	6,092,000	9,091,000	2,909,000	12,000,000
NON-HARVESTABLE FISH	1,720,000	2,584,000	3,613,000	1,455,000	5,068,000
RUN STRENGTH	5,530,000	8,676,000	12,704,000	4,364,000	17,068,000

The role of research projects in the process of developing this stronger resource base cannot be overlooked. The ultimate success in achieving a greater number of salmon and the ability to maintain that higher level once it is achieved will depend in large part on the ability to manage the resource and the harvest effectively. That ability will, in turn, come only from pronounced improvement of the data base relating to such diverse elements as run timing and routes, identification of productive habitat and measurement of its productivity, and identification of the various salmon stocks in the Inlet.

Although there have been some fluctuations, the general trend of ex-vessel prices paid for commercial salmon has been upward through the last decade. The number of processors in the Inlet has increased markedly during the same period as has the participation in the sport fishery. Each of these increases is accompanied by secondary and tertiary economic activity. The projected increased proportion of supplemental stock in the catch will lower the present benefit/cost ratio in the salmon fishery. However, the Team felt that there is sufficient room for growth to make expectation of individual and regional economic gain as a result of the work planned here well within the bounds of reason. The Team will undertake a more particular analysis of the economics of both specific projects and the overall program in its Phase I planning.

The Cook Inlet Regional Planning Team recognizes that any one of many different elements might alter the feasibility of what is proposed in the Plan in either a positive or negative way. However, it also understands that a frame of reference is necessary, if the work is to be orderly and systematic and progress is to be measured. The Plan has the specificity to make immediate action possible and the flexibility to adjust to changing circumstances. Additionally, as it reviews proposed projects for salmon enhancement it will assess them in the light of the goals and objectives of the Plan. The Regional Planning Team is committed to maintaining the usefulness and timeliness of the Plan through a formal review and revision in 1985, 1990, 1995, and 2000.

QUANTIFIED PROJECTS

PROJECT	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
KASILOF HATCHERY SEE SECTION 7.3.2.1	120,000 / 160,000					120,000 / 160,000
TRAIL LAKES HATCHERY SEE SECTION 7.3.2.2	182,000 / 243,000			61,000 / 92,000	12,000 / 18,000	255,000 / 353,000
BIG LAKE HATCHERY SEE SECTION 7.3.2.3	97,000 / 130,000			53,000 / 80,000		150,000 / 210,000
ANCHORAGE HATCHERY COMPLEX SEE SECTION 7.3.2.4				133,000 / 200,000	50,000 / 75,000	183,000 / 275,000
TUTKA HATCHERY SEE SECTION 7.3.2.5		342,000 / 360,000	190,000 / 200,000			532,000 / 560,000
EKLUTNA HATCHERY SEE SECTION 7.3.2.6			205,000 / 308,000			205,000 / 308,000
ENGLISH BAY LAKES HATCHERY SEE SECTION 7.3.2.7	80,000 / 100,000	600,000 / 750,000	74,000 / 92,000			754,000 / 942,000
PAINT RIVER SEE SECTION 7.3.2.8	74,000 / 100,000	600,000 / 900,000	400,000 / 600,000			1,074,000 / 1,600,000
SCURVY CREEK SEE SECTION 7.3.2.9		160,000 / 240,000	4,000 / 6,000			164,000 / 246,000
BIG RIVER LAKES SEE SECTION 7.3.2.10	33,000 / 44,000					33,000 / 44,000
PTARMIGAN LAKE SEE SECTION 7.3.2.11	14,000 / 19,000					14,000 / 19,000
CHENIK LAKE SEE SECTION 7.3.2.12	71,000 / 95,000					71,000 / 95,000
DELIGHT AND DESIRE LAKES SEE SECTION 7.3.2.13	96,000 / 129,000					96,000 / 129,000
CRESCENT RIVER SEE SECTION 7.3.2.14	127,000 / 170,000					127,000 / 170,000
LARSON LAKE SEE SECTION 7.3.2.15	48,000 / 64,000					48,000 / 64,000
BYERS LAKE SEE SECTION 7.3.2.16	24,000 / 32,000					24,000 / 32,000
SHELL LAKE SEE SECTION 7.3.2.17	60,000 / 80,000					60,000 / 80,000
BEAR LAKE SEE SECTION 7.3.2.18				7,000 / 10,000		7,000 / 10,000
FINGER, DELYNDIA, AND BUTTERFLY LAKES SEE SECTION 7.3.2.19				8,000 / 12,000		8,000 / 12,000
OTHERS-UNSPECIFIED SEE SECTION 7.3.2.20	37,000 / 50,000	33,000 / 50,000	33,000 / 50,000	33,000 / 50,000		136,000 / 200,000
TOTAL HARVEST / RUN	1,063,000 / 1,416,000	1,735,000 / 2,300,000	906,000 / 1,256,000	295,000 / 444,000	62,000 / 93,000	4,061,000 / 5,509,000

THE PLAN

CHAPTER 1

1.0 INTRODUCTION TO THE PLAN

1.1 INTRODUCTION

The Plan had certain prerequisites. There had to be a history of legislative mandates that supported the importance of the salmon fishery and the active interest of the State in the perpetuation and enhancement of that fishery. It was essential that the fishermen organize into a group with a clearly defined geographical area of influence and interest as a working partner with the State. Finally, it was necessary for these two major groups to jointly form a planning team with some general guidelines for the accomplishment of the planning process.

1.1.1 Legislative Background

The history of the salmon as a valuable, harvestable, and renewable resource dates back into the last century; and it was officially recognized when Alaskan statehood was achieved in 1959. The Constitution (Article VIII, Section 5) authorized the legislature to "Provide for facilities, improvements and services . . . to assure further utilization and development of the fisheries." The formation of the Department of Fish and Game with its Sport and Commercial Fish Divisions was further evidence of this intent.

A further refinement of this concept came in 1971 when the legislature passed Chapter 113 SLA 1971 creating the Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.). A portion of the responsibility of this new division of the Alaska Department of Fish and Game (ADF&G) was to "develop and continually maintain a comprehensive, coordinated long-range plan for the orderly present and long-range rehabilitation . . . of all aspects of the state's fishery."

In 1976 in a committee substitute for Senate Bill No. 688 the Commissioner of Fish and Game was authorized to ". . . designate regions of the state for the purpose of enhancing salmon production and shall develop and amend as necessary a comprehensive salmon enhancement plan for each region for both public and private nonprofit hatchery systems. Comprehensive salmon enhancement plans shall be developed in cooperation with appropriate qualified regional associations formed under sec. 380 of this chapter."

Subsequently in 1977 in committee substitute for House Bill 264 the same section (AS 16.10.375) was repealed and re-enacted so that "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 sec. 380 of this chapter."

1.1.2 Cook Inlet Aquaculture Association

Through a series of fishermen initiated public meetings that started early in 1976, there was discussion of and ultimately the formation of the Cook Inlet Aquaculture Association (CIAA). Formed under the Non-Profit Hatchery Act the Association was to have a membership that consisted of all recognized commercial fishermen's organizations and other user groups as defined in AS 16.10 (3). The corporation is administered by a Board of Directors made up of representatives of the following groups.

- City of Seward
- Commercial Fishermen of Cook's Inlet
- Cook Inlet Fishermen's Association
- Cook Inlet Fishermen's Fund
- Cook Inlet Region, Inc.
- Izaak Walton League
- Kachemak City
- Kenai Peninsula Borough
- Municipality of Anchorage
- Kenai Peninsula Fishermen's Cooperative Association
- Matanuska-Susitna Borough
- Ninilchik Village Council
- North Pacific Fisheries Association
- University of Alaska
- Matanuska Valley Sportsmen
- fish processors

1.1.3 Geographic Area of Interest

While the characteristics of Cook Inlet 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 diversity which makes the Inlet physically attractive and biologically productive also makes it a very complex area for which to plan.

Cook Inlet is the major marine intrusion into the southcentral coast of Alaska. It extends about 250 miles north and east between the Aleutian Range and the Kenai Peninsula and is as much as 100 miles wide in its lower reaches. The drainage area feeding the Inlet is over 38,000 square miles and reaches as far north as Mt. McKinley and east almost as far as Glennallen. It should be noted that for purposes of fisheries management the Cook Inlet area includes the coast of the Gulf of Alaska as far east as Cape Fairfield.

Both in terms of the impact of development on fish habitat and the accessibility of the fishery to large numbers of people, population of the area becomes a significant factor. Over 50 percent of the total state population lives within the drainage area of Cook Inlet. Along the eastern side of the Inlet, highways make the northernmost portion of the Inlet near Palmer only about five hours by car from the southernmost community of Homer.

1.1.4 The Regional Planning Team

The Cook Inlet Regional Planning Team is made up of six voting members, three representing the

Cook Inlet Aquaculture Association and three representing the State of Alaska Department of Fish and Game. In the case of the latter three there is one representative each from F.R.E.D. Division, Commercial Fish Division, and Sport Fish Division. In addition the non-voting position of chairman is currently held by a representative of ADF&G (Exhibit A).

Members were appointed to this team from the CIAA shortly after the official formation of the Association and have been active in the planning process since 1977.

In 1979 additional support was sought for the team's activities, and a consultant was retained to aid in putting the Plan together. Later that consulting function was supplanted by a planner attached to the team itself.

The team met on a reasonably regular basis, which in the latter stages of the effort was approximately monthly. These team meetings were regularly attended by additional representatives of involved state and federal agencies and staff and members of the CIAA. Additionally the CIAA RPT members interacted with the CIAA Board of Directors at the monthly meetings of the Board.

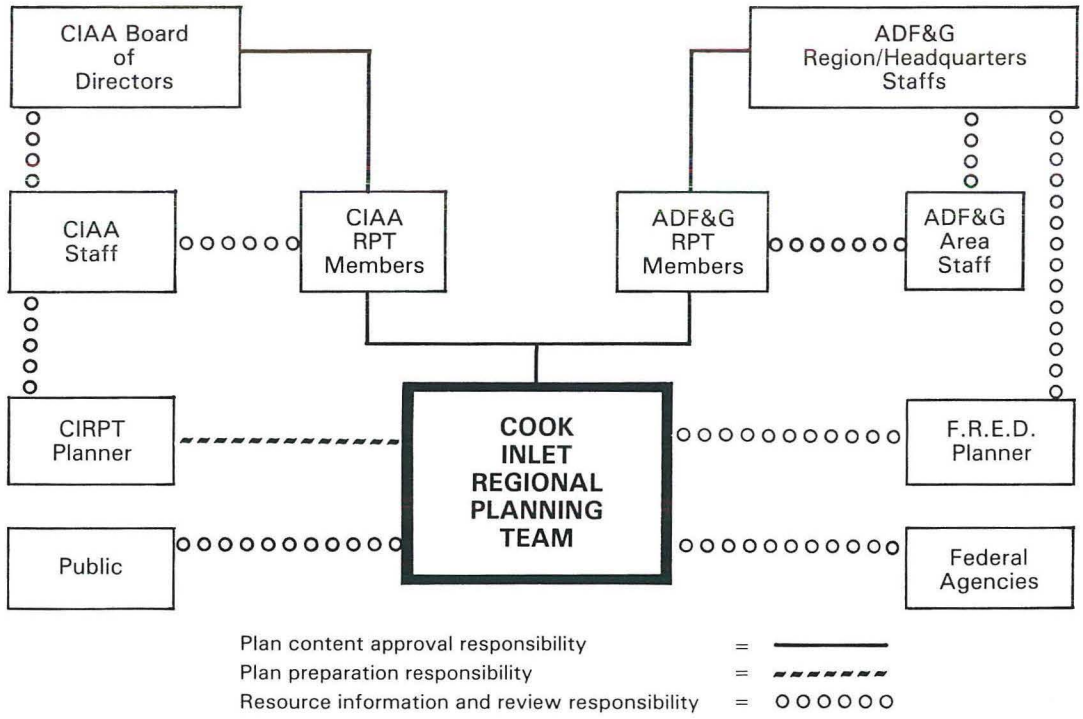
It should be noted that there can and will be overlap between the end of Phase I and the initiation of Phase II. The formal publication of this document concludes Phase I.

The approach to Phase I included review of the existing information about the salmon fishery in Cook Inlet. That information was contained in historical accounts and records and in the present and ongoing data development. The synthesis and analysis of those data were conducted to establish the status of the fishery. During this process a parallel field effort was underway to survey and log the existing and potential salmon habitat within the drainage of the Inlet.

Agreement was reached on the status of the fishery, the demands that would be placed on the resource during the life of the Plan, and the data gaps it would be necessary to fill to make periodic refinements of the Plan.

Finally a specific program was outlined to identify the sequence and significance of each project and to suggest the resources necessary to accomplish the project. In addition the potential benefits to be realized from the various projects were derived.

PLANNING TEAM INTERACTIONS **EXHIBIT-A**



1.2 APPROACH TO THE PLAN

The Plan recognizes the need for long-range planning as well as the desire for concrete accomplishments in the short-term. Thus, the planning process has two phases; Phase I which is the creation of the long-range plan, and Phase II which is composed of a number of specific projects consistent with the Plan. Phase I sets a framework in which Phase II projects of varying natures and dimensions can be implemented.

1.3 PUBLIC PARTICIPATION

Strong public participation in this planning process is implicit in the structure of the planning team. In a real sense the interest of the public is represented by the State and, in particular, the Department of Fish and Game. It is certainly one of the ways in which perceptions and opinions of the individual citizen can find their way into this type of planning.

The CIAA Board represents user group organiza-

tions and through these organizations the membership of each. Throughout the development of the Plan the CIAA Board received briefings and progress reports at its regular monthly meetings. During these same meetings Board perspectives and approvals were sought at critical planning stages.

The CIRPT representatives from the ADF&G and the CIAA also provided a personal level of public input in that in addition to representing their various organizations they are, as individuals, members of an interested public.

The CIRPT meetings were regularly attended by representatives of other state agencies as well as concerned federal agencies and individual citizens.

During the 53 day period in which the draft Plan was in wide circulation for review and comment, two public meetings were held. One meeting was held in Anchorage (August 20) to reach the inhabitants of the northern portion of the drainage area, and the other meeting was held in the Kenai-Soldotna area (August 19) to service the interested parties living on the Kenai Peninsula. Prior to these meetings copies of the document were placed with each Fish and Game Advisory Board in the area, all pertinent libraries, all pertinent offices of ADF&G and CIAA, all members of the Board of Directors of the CIAA, and selected organizations recognized by the RPT as having a special interest in the Plan (Appendix 3). Both the meetings and the availability of the documents for review were widely advertised.

1.4 APPROVAL AND AUTHORITY OF THE PLAN

It is clear that the responsibility for and authority to develop the Plan is vested by the Comissioner of Fish and Game in the RPT directly and, therefore, in the Department of Fish and Game and the CIAA indirectly.

When the RPT completed the draft document to its satisfaction, the Plan was widely circulated for review and comment. With due note taken of the comments which were received, the revised draft was forwarded to the Commissioner for review and approval. It was not until the document had received the approval of the Commissioner that the Plan was printed in final form and distributed.

The final Plan was then transmitted to the legislature by the Commissioner as the response to his charge to develop such regional plans, and the Plan became the official guideline for all salmon enhancement efforts in Cook Inlet.

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 the Plan should address a period of from 18 to 22 years. The CIRPT selected a period of twenty years covering the last two decades of this century, 1981 through 2000.

It is possible within this time framework to (1) complete a single action, (2) to complete a series of dependent actions, and/or (3) to initiate an action which may not be complete before the termination of the twenty-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, but rather 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 DEVELOPMENT OF STRATEGIES AND PROJECTS

Because of the nature of the existing data on the fisheries of Cook Inlet, it is necessary to develop two types of strategies for the Plan. The first strategy must cover the means of implementing projects which have already been identified as components of goal achievement. The second strategy must account for a three-step process whereby recognized data deficiencies can be filled; new data can be analyzed to determine what actions are warranted; and, finally, a means of implementation for those actions can be identified.

Additionally there must be a mechanism for regular evaluation of the progress of the Plan and determination of its consistency with changing conditions and new information. This evaluation component must also have the capacity to assess completed projects to determine their actual performance compared to earlier projections.

The projects related to these strategies take several forms. Specific projects known to be needed and approved include such efforts as the opening of Scurvy Creek through the use of a fish pass and the transplanting of stock into the Paint River. Projects designed to provide additional information for decision making are represented by studies now underway at Packers Creek to ascertain the size and timing of the spawning migration and habitat surveys to identify sites where additional work might be productive. The search for additional information about escapement on various streams is representative of the type of project designed to refine the perception of goals; improve concepts of management; and maximize the size, and therefore harvest potential, of this renewable resource.

1.7 ASSUMPTIONS

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

- The Plan makes use of the best data available and the most accepted interpretation of that information.
- The Plan does not purport to present the definitive understanding of the physical/biological interactions of the Cook Inlet system. In fact it recognizes the necessity of developing this understanding and seeks to initiate the orderly progress to that end.
- The Plan assumes a regular, if not constant, reassessment of information and requirements and the subsequent modification of Plan elements.

• The Plan assumes the continuation of close cooperation between the user groups and the State toward the end of providing the maximal sustainable harvest of salmon resources.

• The Plan assumes a sustained annual harvest of salmon within Cook Inlet greater than that experienced in the last two decades is possible, if appropriate effort, technology, and management are brought to bear toward that end.

With the context of the development of the Plan thus established Chapter 2 will explore the conditions which prevail in the Inlet as they relate to the present condition of the salmon resources and the potential of those resources.

CHAPTER 2

2.0 REGIONAL PROFILE

2.1 PROJECT LOCATION

Cook Inlet and its watershed are at the heart of the area known as southcentral Alaska. They form a rough rectangle that averages approximately 125 miles across and 310 miles long. The Municipality of Anchorage is at the center of the rectangle (Exhibit B).

Enclosed within the boundaries of this area is approximately 50,000 square miles of which approximately 12,000 square miles is taken up by the Inlet itself while the remaining 38,000 square miles is the landmass of the drainage basin[1].

In terms of political geography the drainage area boundaries are almost exactly coincidental with the boundaries of the Matanuska-Susitna Borough, the Municipality of Anchorage, and the Kenai Peninsula Borough. The southern Plan boundary is coincidental with the limits of the Outer and Eastern ADF&G management districts in the Gulf of Alaska.

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 Cook Inlet will be highlighted.

2.2.1 Cook Inlet

The entrance to the Inlet is occupied by the unpopulated Barren Islands (Exhibit C). Two large bays flank the entrance to the Inlet, Kamishak on the west and Kachemak on the east. On the west a series of smaller but significant bays are found north of Kamishak Bay. They are Iliamna, Iniskin, Chinitna, and Tuxedni Bays. Each of these is a narrow and fairly lengthy intrusion into the shore. Above these are two shallow bays on the west side, Redoubt and Trading Bays, respectively.

Between Redoubt Bay on the west and the mouth of the Kenai River on the east lies the largest island in the Inlet, Kalgin; and it is also the most significant from the perspective of the salmon fishery.

At its upper end the Inlet branches into two major arms with Fire Island and the Municipality of Anchorage in the fork. The Knik Arm to the north and east reaches to the mouths of the Knik and Matanuska Rivers near Eklutna. It is the lower portion of this arm that serves the commercial maritime traffic of Anchorage. The Turnagain Arm to the south and east penetrates the Chugach Mountains and ends at the mouth of the Placer River near Portage. The large but shallow Chickaloon Bay flanks the southern edge of the mouth of the Turnagain Arm.

Depths in the central portions of the Inlet range between 100 and 200 feet. The upper portion of the Inlet is bounded on the west side, particularly, by large tidal flats that are regularly exposed in the fluctuations of the 34 foot tidal range which the Inlet experiences.

The southeastern coast of the Kenai Peninsula faces on the Gulf of Alaska to the east of the entrance to Cook Inlet and is characterized by a series of north-south trending inlets. This area is included in the study area because it is administered as part of the Cook Inlet salmon fishery. The most prominent of these inlets is Resurrection Bay with the City of Seward at its northern end.

2.2.2 Major Mountain Systems

The mountain ranges which define the watershed of the Inlet are several and are located at varying distances from the Inlet (Exhibit D). Along the southwestern edge of the Inlet and close to the shore is the Aleutian Range. Further to the north on the western side is the Alaska Range which, near the northern edge of the watershed, is approximately 120 miles from the shore of the Inlet. The Alaska Range continues to form the northern edge of the watershed as it bends in an easterly direction north of the Denali Highway.

The first range on the eastern side of the Inlet is actually located inside the boundaries of the watershed. All drainage from the Talkeetna Range reaches Cook Inlet.

The Chugach and Kenai Ranges form the boundary between Cook Inlet and Prince William Sound and the Gulf of Alaska. The Kenai Range forms the eastern side of the Kenai Peninsula, and that portion of the drainage into the Gulf of Alaska west of Cape Fairfield is included in the Plan even though it does not reach Cook Inlet.

It is significant to note that each of these major ranges has one or more substantial ice fields which spawn glaciers at the heads of a number of the major river systems.

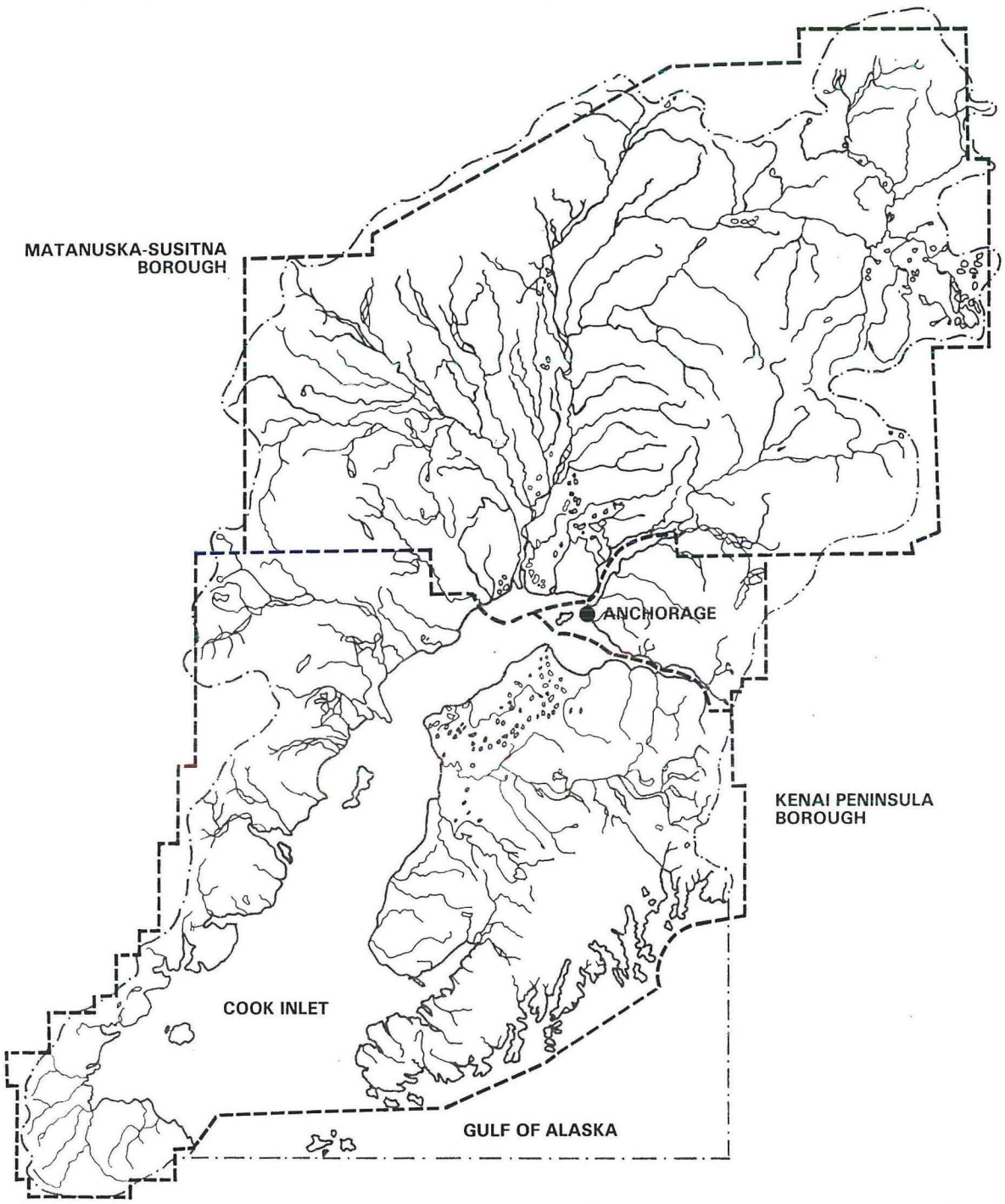
2.2.3 Surface Waters

Included in the discussion of surface waters are the major river systems, creeks, and lakes (Exhibit E). These features will be considered from two different perspectives, their individual roles in the hydrology of the Inlet drainage basin and their individual roles in the annual production of salmon. In this section only the physical aspects of these water bodies will be discussed, but in later sections these features will be examined again in terms of their salmon support capacity.

The Cook Inlet drainage contains at least 104 lakes, 322 creeks, and 80 rivers which have been named or otherwise identified[2]. The major lakes on the west side of the Inlet include Crescent, Kenibuna, Chakachamna, Beluga, and Lower Beluga. In the northern portion of the Inlet the larger lakes include Upper Lake George, Inner Lake George, and Eklutna. On the Kenai Peninsula are Kenai Lake, Ptarmigan

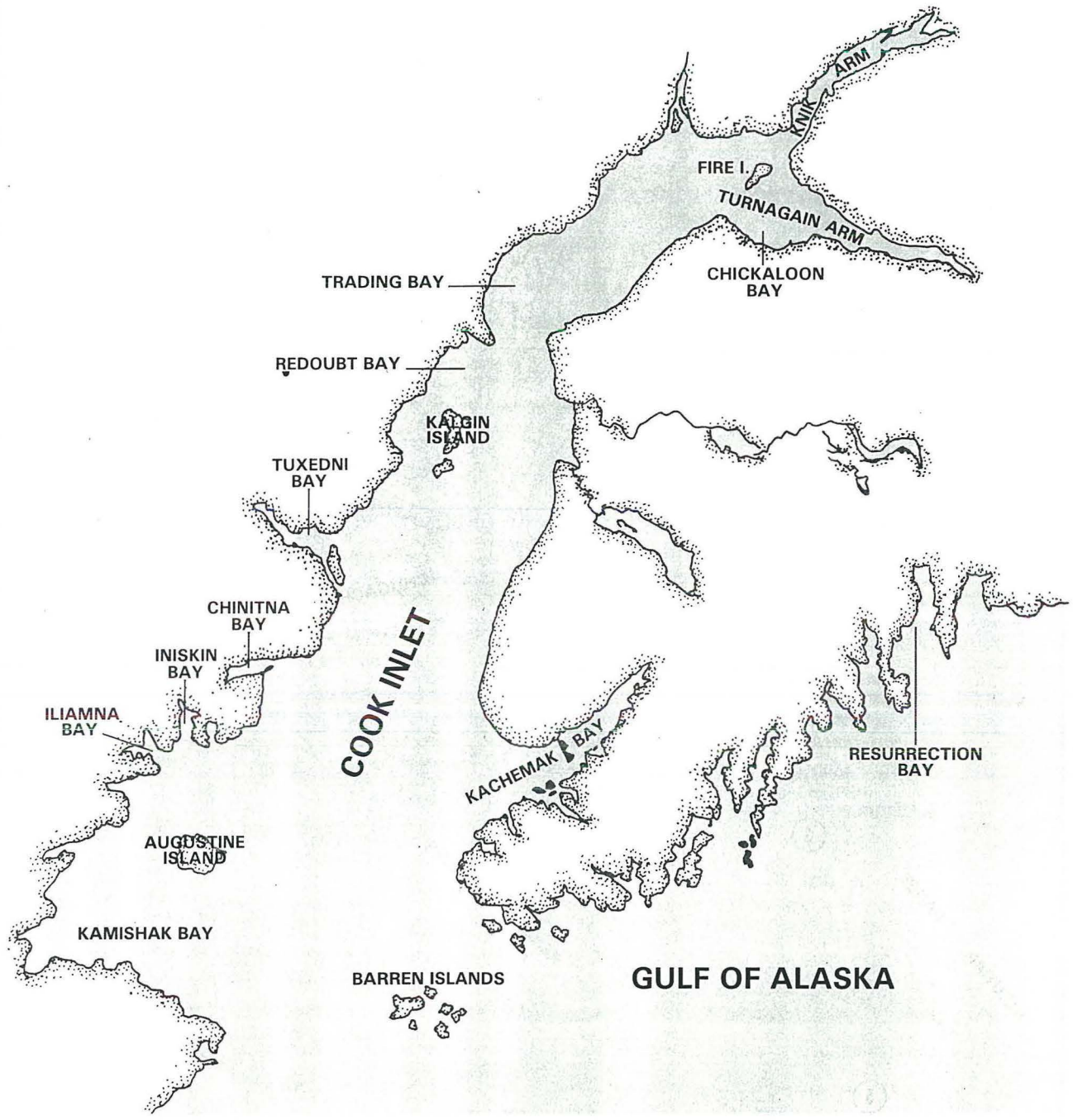
COOK INLET WATERSHED

EXHIBIT-B



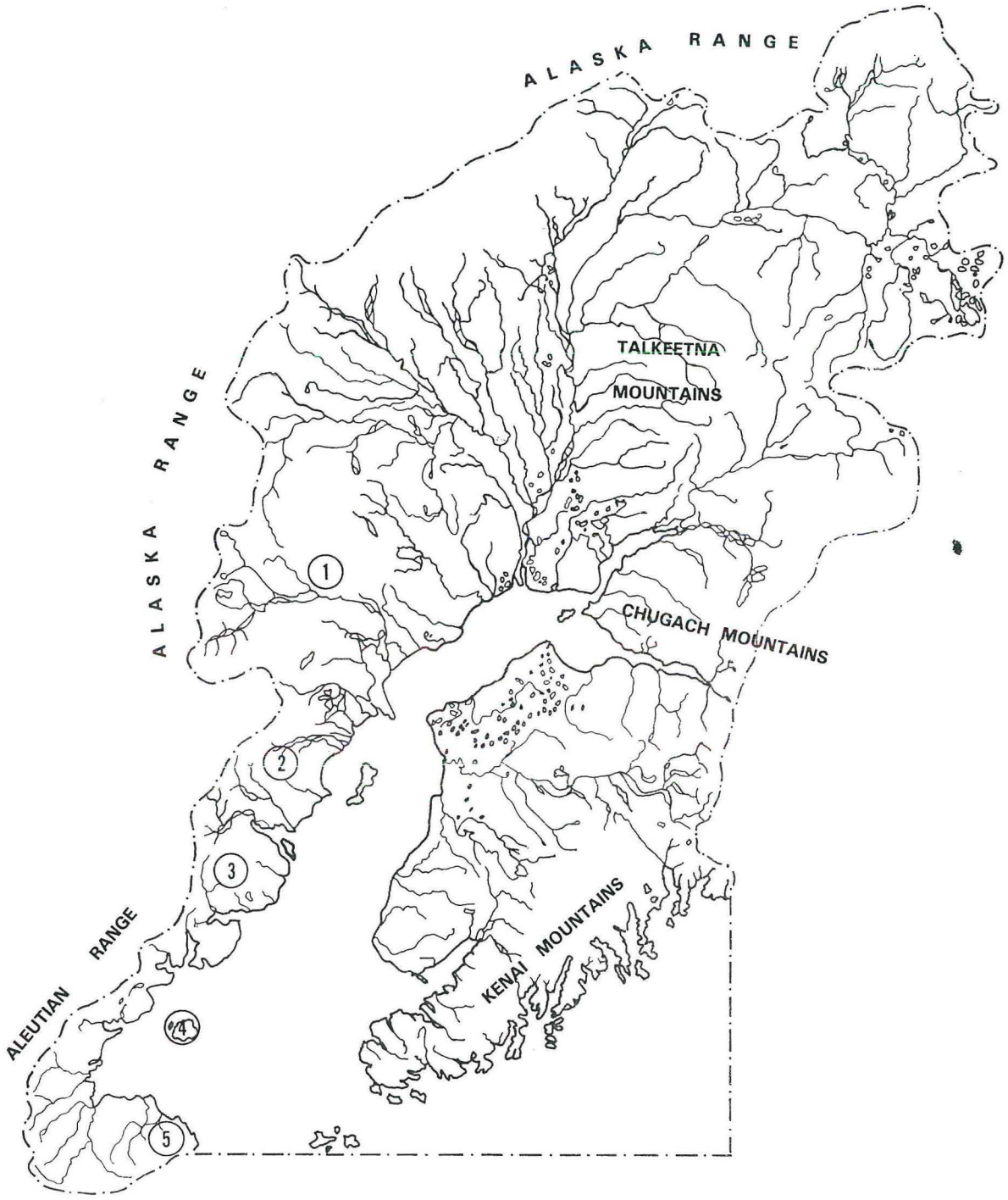
COOK INLET

EXHIBIT-C



MOUNTAIN RANGES AND VOLCANOES

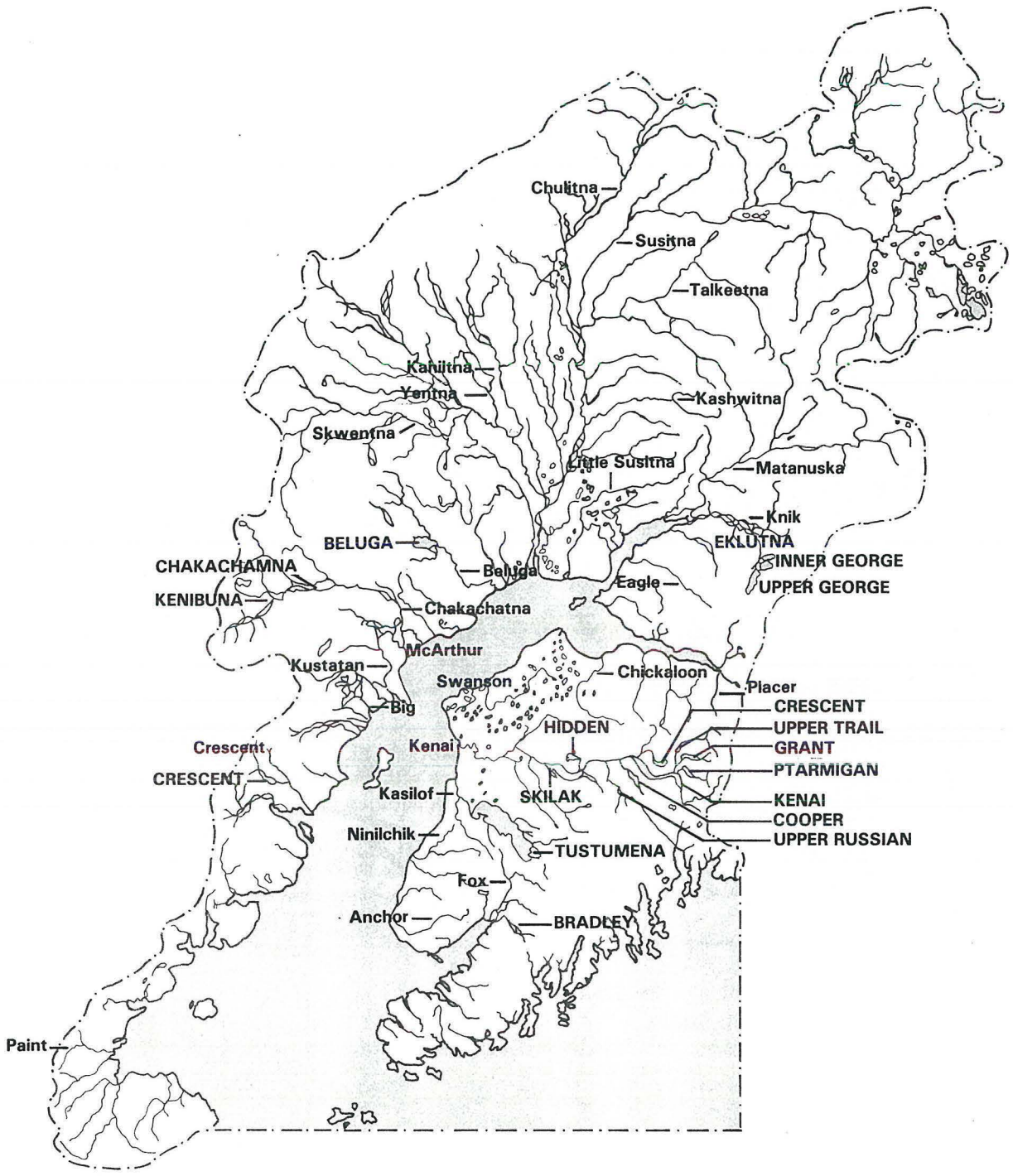
EXHIBIT-D



1. MT. SPURR
2. MT. REDOUBT
3. MT. ILIAMNA
4. MT. AUGUSTINE
5. MT. DOUGLAS

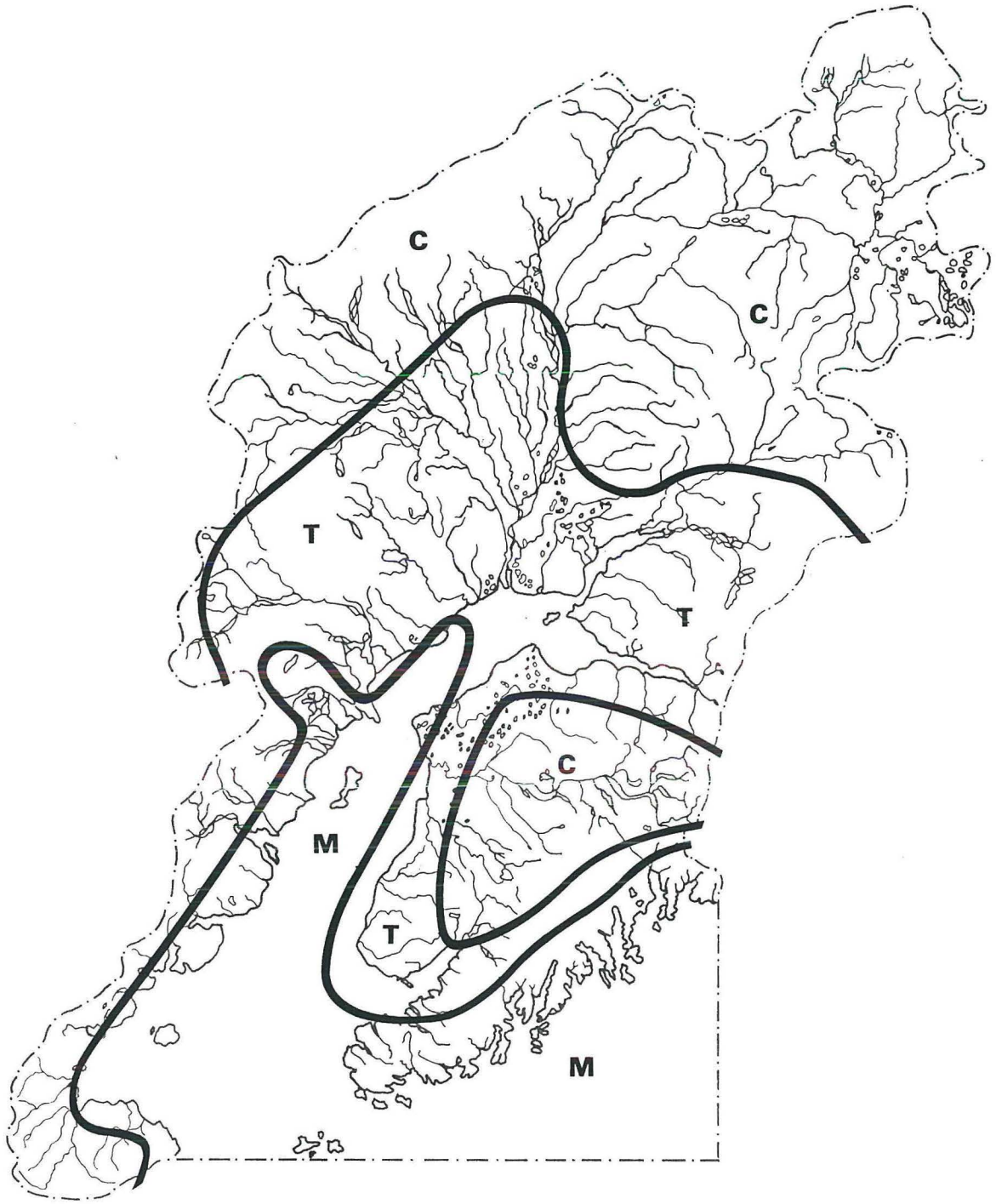
SURFACE WATERS

EXHIBIT-E



MAJOR CLIMATE ZONES

EXHIBIT-F



C CONTINENTAL

T TRANSITION

M MARITIME

Lake, Grant Lake, Upper Trail Lake, Crescent Lake, Cooper Lake, Skilak Lake, Hidden Lake, Upper Russian Lake, Bradley Lake, and the largest lake in the entire drainage system and the fifth largest in the state, Tustumena.

The identified creeks are quite evenly distributed throughout the entire drainage system.

In terms of watershed area and flow the Susitna River is the largest within the drainage area of the Inlet. To the west and south of the Susitna the following rivers are among the more notable; the Chulitna, Yentna, Kahiltna and the Skwentna (all tributaries of the Susitna), the Beluga, the Chakachatna, the McArthur, the Kustatan, the Big, the Crescent, and the Paint. To the east and south of the Susitna are the Talkeetna and Kashwitna (tributaries of the Susitna), the Little Susitna, the Matanuska, the Knik, the Eagle and the Placer Rivers. On the Kenai Peninsula are the Chickaloon, Swanson, Kenai, Kasilof, Ninilchik, Anchor, and Fox Rivers.

2.2.4 Climate

The climate within the Inlet drainage area is no less complex than any of the other natural elements. Of the four broad climatic zones described for the State, three occur within the study area (Exhibit F)[1].

The Maritime Zone, as the name implies, receives its major influence from the water. It has comparatively heavy precipitation, cool summers and warm winters. There are generally strong and persistent surface winds.

The Continental Zone exhibits summer and winter temperature extremes, but surface winds and precipitation are generally light.

The Transition Zone occurs between the other two and generally exhibits some of the characteristics of both.

It is very important to note that because of the extremely varied topography of Alaska and the south-central region many local variations, microclimates, occur.

Exhibit G provides weather information for selected sites within the drainage area and is structured to reflect a north to south progression from the area near Mt. McKinley to the mouth of the Inlet.

2.2.5 Seismicity and Volcanism

Southcentral Alaska and the Cook Inlet area, in particular, are situated on the edge of the North Pacific Plate. Therefore, they experience a significant amount of seismic activity which ranges in magnitude from those tremors perceived only by scientific instruments to the historic 1964 earthquake, the marks of which still exist the length of the Inlet. The subsidence and uplift which is associated with the more severe of these events can make dramatic and long-term changes in the landforms and, therefore, in the character of the related surface waters. While present technology does not allow for accurate predictions of where and when such events will occur, it is safe to assume that they will continue to happen with some regularity and that the results will be locally important.

Another facet of this very physically active region is the presence of volcanoes along the western side of the Inlet. Five prominent peaks have recorded volcanic activity historically; they are Mounts Augustine, Iliamna, Spurr, Redoubt, and Douglas (Exhibit D). It should be noted that Mount Augustine itself forms an island in Kamishak Bay, while the other four are part of the mainland. As with seismic activity, volcanic eruptions do not occur at regular periods; but the activity is recurring, and Mt. Redoubt was active as recently as 1966 while Mt. Augustine erupted last in January, 1976. Any eruption could have very significant impacts in, at least, a local sense. The ash from the 1976 eruption of Mt. Augustine still troubles the hatchery at Tutka Lagoon.

2.2.6 Geology and Soils

The geology and the soils are complexly interwoven and of great interest in the context of resource extraction and development, but they have little direct effect on the salmon resources. Where the relation-

SELECTED CLIMATE DATA — EXHIBIT-G

LOCATION	TEMPERATURE RANGE (F) SUMMER	WINTER	TEMPERATURE EXTREMES (F)	ANNUAL PRECIPITATION TOTAL/SNOW	WINDS (KNOTS) AVERAGE	EXTREME
SUMMIT	40 to 60	– 5 to 30	–45 to 89	20''/119''	NE 9.7	E 48.5
TALKEETNA	44 to 68	0 to 40	–48 to 91	29''/102''	N 4.3	NE 38.1
WILLOW	40 to 70	–10 to 33	–56 to 90	24''/unknown		
PALMER	44 to 67	6 to 42	–35 to 90	17''/64''	4.4	100.5
ANCHORAGE	46 to 66	4 to 42	–38 to 86	15''/66''		
PORTAGE	42 to 64	19 to 45	–37 to 85	58''/138''		
SEWARD	44 to 63	18 to 46	–20 to 88	67''/81''		
KENAI	42 to 62	4 to 43	–48 to 89	20''/69''	N 7.6	N 54.3
HOMER	42 to 59	17 to 42	–15 to 81	28''/101''	NE 6.6	N 57.7

ship is most evident is at the land interface with either glaciers or surface water features and in setting stream gradients.

Glacial flour results from glacial abrasion of the bedrock over which it is passing and is subsequently picked up by the runoff stream. Because the flour is extremely fine, it remains in suspension almost indefinitely contributing to the carrying stream's high turbidity levels. Of equal significance in causing turbidity and setting the character of spawning gravels are the sands, silts and clays picked up and transported by the stream.

In another type of situation the permeability of the soil and the absence of significant slopes combine to influence the quality of the surface water. In this situation a bog-type condition is formed producing water with high organic content, high acidity levels, and high color levels. The brown water which results can significantly inhibit light penetration.

2.2.7 Wildlife

The watershed of Cook Inlet contains essentially the full complement of terrestrial wildlife associated with Alaska with the major exception of the Polar bear. This fact is noteworthy in, at least, two contexts.

Because many of these species are considered game species and are, therefore, sought both in sport and subsistence hunting, they reinforce the concept of resource use. This condition also results in regular access to most areas of the watershed.

Some of the wildlife species which are present count the streams and lakes of the area as very 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. The interaction with the salmon resources may be as direct as the predatory character of the feeding Brown bears on the McNeil River or somewhat indirect as the habitat alteration created by beaver dams.

Included in these considerations must be the marine mammals in the Inlet. Among those that frequent the Inlet, the Beluga whales are those most commonly recognized as salmon predators.

2.2.8 Vegetation

The Alaska Regional Profile, South Central Region in its discussion of the vegetative communities of the Cook Inlet Subregion describes nine different types. These nine can be divided into two sub-categories, the forest communities and the non-forest communities[1].

The four forest types are widely distributed throughout the drainage area (Exhibit H). The Coastal Western Hemlock-Sitka Spruce Forest is found most notably in the vicinity of Kachemak Bay, Chinitna-Tuxedni Bays, and the Turnagain Arm. The Bottomland Spruce-Poplar Forest is found along the main channels of the Susitna River and the banks of the Kenai River. The Upland Spruce-Hardwood Forest is found in the vicinity of Tyonek and near Skilak Lake. The Lowland Spruce-Hardwood Forest is found north of Kenai and the Sterling Highway and in the floodplain of the Susitna River.

The five non-forest types include the High Brush community which within the watershed is found almost exclusively on the west side of the Inlet south of Tyonek. The Low Brush Bog and Muskeg commur ties dot the floodplain of the Susitna River and th western side of the Kenai Peninsula. The Moi Tundra is dominant in the upper reaches of the Si sitna River drainage north and east of the Talkeetr Mountains. The Wet Tundra occurs north of Kach mak Bay and near the mouth of the Susitna Rive Finally, the Alpine Tundra and Barren Ground is th dominant community in the elevations over 2,50 feet.

2.2.9 Fish

2.2.9.1 Salmon

Five species of salmon (sockeye, coho, kin pink, and chum) are harvested in the subsistenc sport, and commercial fisheries in Cook Inlet and it tributaries. Those five species are, in fact, the foc point of the Plan and will, therefore, receive the mos attention. The following chapters will develop th background and status of the salmon species in detai However, it is important to realize that this emphasi does not mean that there are no other fish resource of value in the region.

2.2.9.2 Non-Salmon Anadromous and Freshwater Species

Several non-salmon species are prominent in th waters of the Cook Inlet region, and four of those ar anadromous. Lake trout, arctic grayling, whitefish sculpin, lamprey, longnose sucker, and arctic char ar the most abundant exclusively freshwater species Rainbow trout, Dolly Varden, smelt and sticklebac may be anadromous or may be exclusively freshwate on a site-by-site basis. Northern pike have been intrc duced illegally into some Kenai Peninsula waters.

2.2.9.3 Non-Salmon Marine Species

Within the Cook Inlet region there are substantia harvests of herring (currently in a low cycle) an halibut on a commercial basis as well as a halibu sport fishery. In addition to the harvest of these tw species there is some effort extended to harves groundfish with the potential for an even larger re source harvest.

2.2.9.4 Shellfish

Shellfish play an important role in the biologica community within the Inlet waters and are also suf ficiently diverse and abundant to warrant harves efforts. Dominant in this harvest are king, dungenes and tanner crabs, razor and hardshell clams, an shrimp.

2.2.10 Summary

The natural environment of the Inlet has many features that have a direct influence on the salmor resources or are sufficiently inviting to human activity to have an indirect effect.

Cook Inlet is very elongated, and this length pro vides a wide variety of habitats for the salmon re sources. The sizeable tidal range has a direct bearing on land oriented harvest techniques. Because th salmon move into the Inlet at the south and progres in some cases all the way into the Susitna River drain age at the north, they are the subjects of a sequentia harvest pressure that is as diverse as the seine boats operating south of Homer and the sport fisherman or Byers Creek high in the Susitna drainage. Additionally the dimensions of the Inlet are great enough to pro vide a situation in which, because of their migratory

MAJOR FORESTS

EXHIBIT-H

FORESTED AREAS

characteristics, not all runs of fish are exposed to harvest at the same locations.

Essentially all of the **major mountain systems** that bound the drainage of Cook Inlet contain major icefields and glaciers, which means that many of the watercourses that feed the Inlet are not dependent exclusively on annual precipitation to maintain their flow regimes.

The varying character of the **surface waters** makes their investigation, assessment and understanding variable on a situation-by-situation basis. Generally the rivers on the east and west sides of the Inlet are shorter and have a more clearly defined channel which makes understanding of the individual system somewhat easier. However, the same characteristics make the system more vulnerable to a single altering factor. The rivers in the northern part of the drainage have much longer and much more braided courses making them more difficult to inventory, but less susceptible to any single alteration.

The largest lakes in the system are located to the east and west of the Inlet within fifty miles of the Inlet shore. Three dense clusters of smaller lakes occur in the northwest corner of the Kenai Peninsula, just north of the Knik Arm, and east of the Talkeetna Mountains in the upper reaches of the Susitna River system.

The **climate** plays a very active role in the Cook Inlet salmon fishery. The intensive periods of rain which can occur may result in flooding that scours the stream channels of the eggs which are buried there. With low flow and an extremely cold period anchor ice may appear in the smaller streams causing high egg mortality. Strong winds during the fishing season may cause changes in the timing and pattern of fish movement in the Inlet.

Seismic activity has and may very well again cause the interruption of an existing stream channel or the opening of a channel previously blocked. Full scale **volcanic activity** can cause widespread stream blockage, high turbidity, and excessive sedimentation of streams.

Some less spectacular forms of **geologic activity** will also influence the salmon resources. Glacial flour and the other soil material that is carried by the streams may inhibit stream productivity and substantially hinder the accurate counting of salmon escapement. Where soils produce a bog-type situation, the water may also be colored limiting counting effectiveness and increasing the levels of organics and acidity in the water.

The major interaction between the **wildlife** and the salmon resources occurs in situations where management for one or more species of wildlife produces limitations on measures considered significant to the maintenance of the salmon resources. It can be assumed that beaver activity and the resulting dam removal projects will be an ongoing situation.

The regional **vegetation** is of concern in the planning of salmon resources primarily in areas where mature spruce, hemlock, or hardwood invite timber harvest. In this type of situation it is possible for there to be substantial local change in the habitat conditions and generally in a negative fashion.

The relevance of other **fish** species to this planning effort derives primarily from the situations which those species function in either a predatory competitive role with respect to the salmon.

It is clear that many aspects of the natural en ronment exert an influence on the salmon resourc of Cook Inlet, and that in many instances the sepa ation between the elements of the natural enviro ment and those of the human environment is neith easy nor practical.

2.3 OVERVIEW OF THE HUMAN ENVIRONMENT

In this section those elements which are primar related to or arise from human activity and which c and do produce an effect on the salmon resources w be examined. To a greater extent than with th natural environment these actions may be indirec That is the action may appear to have nothing to d with the salmon resource, but the results of the actio may significantly affect the potential of an area t support salmon.

2.3.1 Land Status and Use

Much of the effectiveness of this type of plannin can be dependent upon who owns the property i question, what their actions are apt to be, and there fore what uses may be implemented on that property

2.3.1.1 Land Status

Land status and ownership with the Cook Inle region is, if anything, even more complex than man of the other human and natural elements that make u the region. In a very simplified system there is federa state, borough, municipality, native village and re gional associations, and individual ownership. I addition there are ongoing programs and legislativ actions that continue to transfer parcels of land be tween these various owners. Adding further com plexity to this picture are the situations where ther are two or more overlapping claims to the same property.

It is certainly true that precise definition of owner ship and status of very specific parcels of land may be critical to some facet of the management of the salmon resources. However, for the purposes of the Plan the primary distinction that will be made is be tween land which is owned by either the federal or state government and is designated to a particular status category (park, recreation area, forest, refuge or monument) and all other lands (Exhibits I and J)[3]. Under those public ownership conditions there is a stability of status and a known set of operational or management policies; and alteration of those policies is open to public input and should be in the public interest. Land which is held by individuals or by government in some generalized status category has a much less certain future.

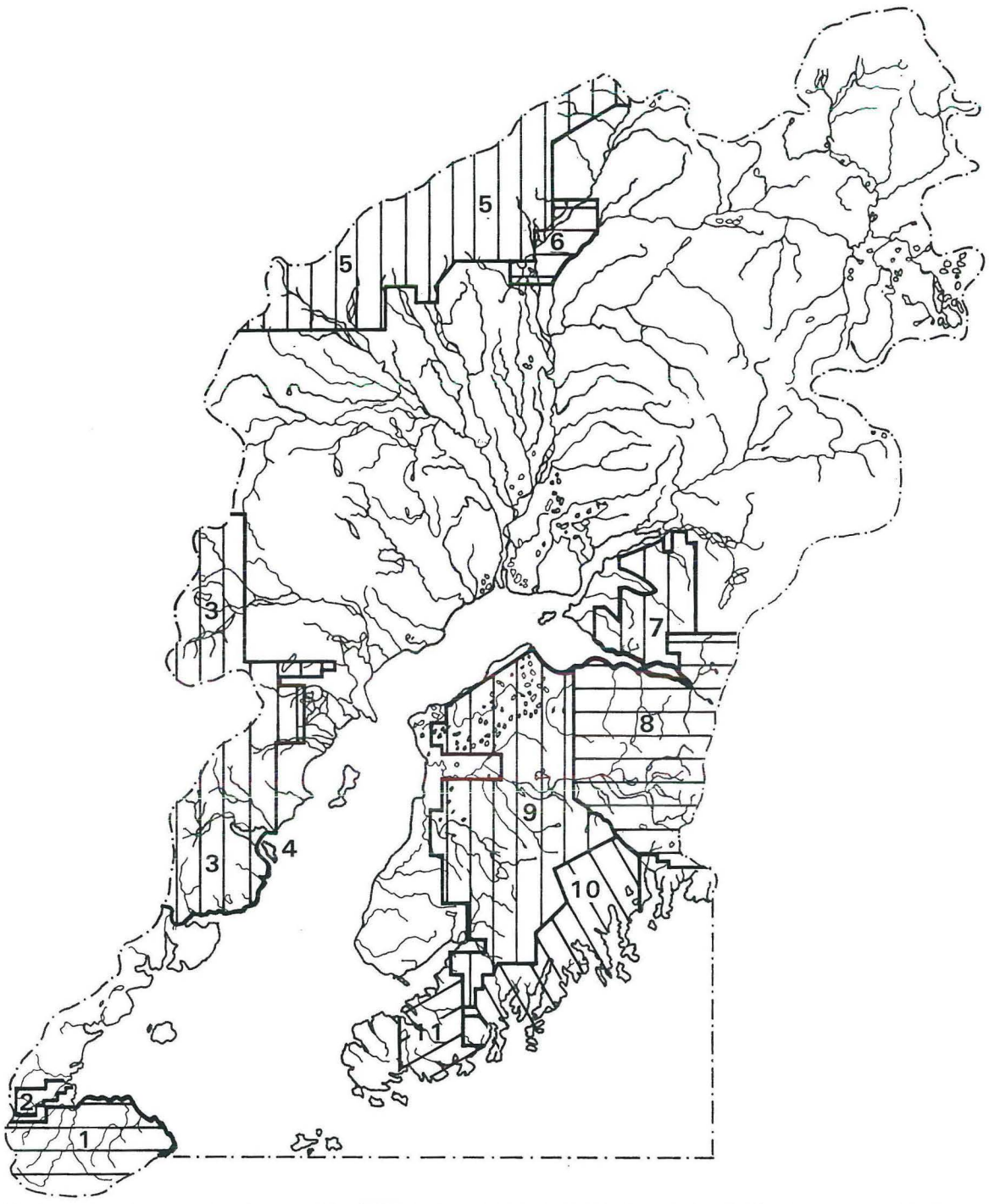
There is another category of land status which is not defined by ownership but rather by the character of the site environment and which is subject to a specific set of use guidelines and regulations. A notable situation within this category is that of the coastal zone. The importance of the biological communities in this type of area has been widely recognized and accepted, and various state and federal programs have been instituted to assure its preservation. In

SPECIAL STATUS LAND AREA — EXHIBIT-I

OWNERSHIP AND NAME	AREA IN INLET REGION (SQ. MI.) *Estimated
FEDERAL	
Katmai National Park and Preserve	810.00*
Tuxedni National Wildlife Refuge	10.00*
Lake Clark National Park and Preserve	1800.00*
Denali National Park and Preserve	3260.00*
Chugach National Forest	2130.00*
Kenai National Wildlife Refuge	3269.00*
Kenai Fjords National Park	886.00*
STATE	
Denali State Park	440.63
Matanuska Glacier Wayside	.36
Long Lake Wayside	.58
Bonnie Lake Wayside	.05
King Mountain Wayside	.03
Moose Creek Wayside	.06
Finger Lake Wayside	.07
Big Lake (South) Wayside	.03
Big Lake (East) Wayside	.03
Rocky Lake Wayside	.08
Nancy Lake Wayside	.05
Willow Creek Wayside	.14
Nancy Lake Recreation Area	35.45
Chugach State Park	773.76
Mirror Lake Wayside	.14
Peters Creek Wayside	.09
Kachemak Bay State Park	187.45
Kachemak Wilderness Park	325.50
Bernice Lake Wayside	.01
Kasilof River Wayside	.07
Johnson Lake Wayside	.09
Clam Gulch Picnic Wayside	.05
Ninilchik Wayside	.02
Deep Creek Wayside	.07
Stariski Wayside	.05
Silver King Wayside	.27
Anchor River Wayside	.09
Captain Cook Recreation Area	5.66
Independence Mine State Historic Park	.42
Sheep Creek Wayside	.01
Izaak Walton Wayside	.01
Funny River Wayside	.31
Upper Kenai River Wayside	.50
Kenai River Islands Wayside	.60
Morgan's Landing State Recreation Area	.40
Bing's Landing Wayside	.02
Slikok Creek Wayside	.03
Lower Kenai River Wayside	.15
McNeil River Game Sanctuary	149.63
Total	14,087.96

MAJOR PARK LAND

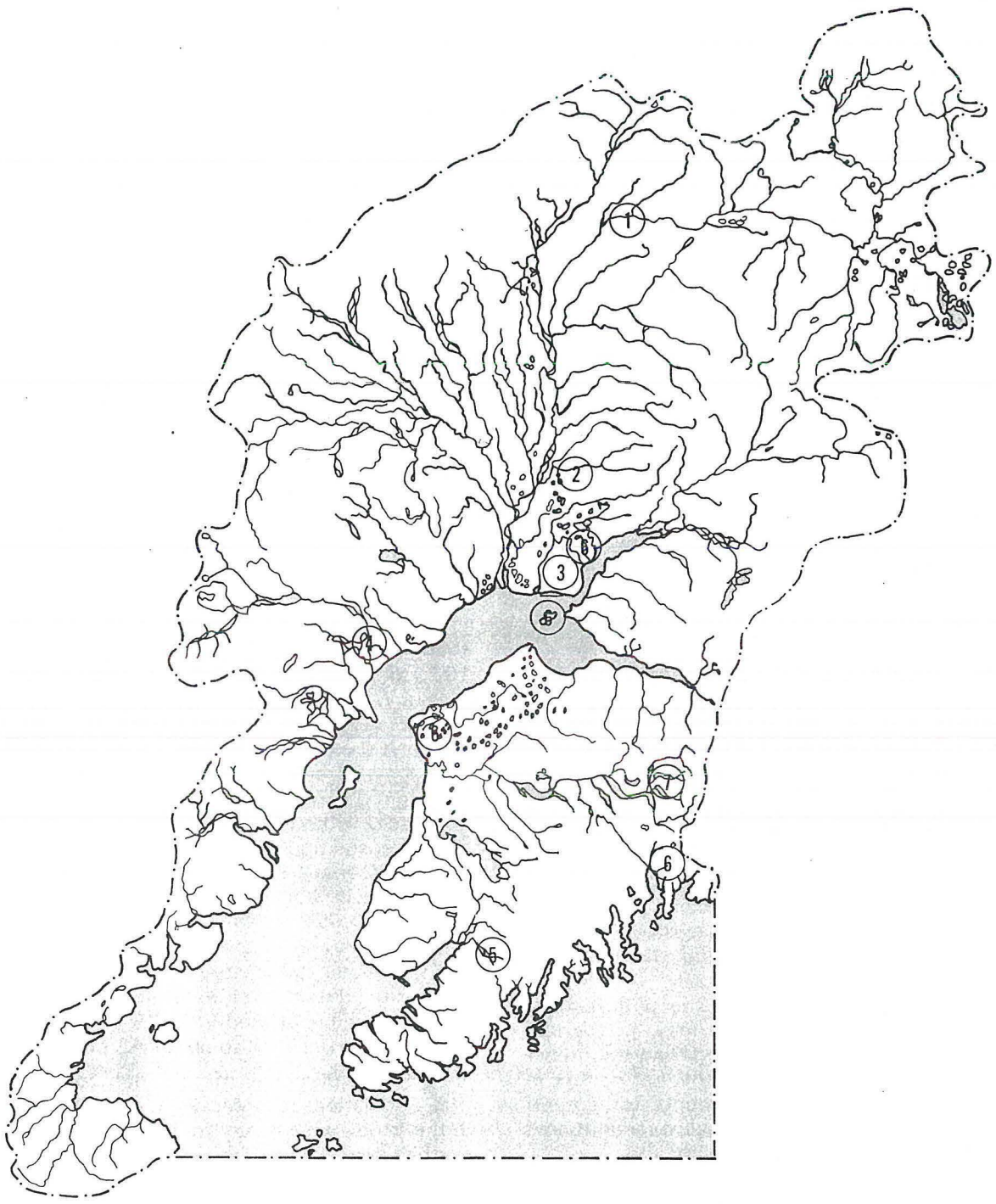
EXHIBIT-J



1 KATMAI NAT'L. PARK AND PRESERVE
2 MC NEIL RIVER STATE GAME SANCTUARY
3 LAKE CLARK NAT'L. PARK AND PRESERVE
4 TUXEDNI NATIONAL WILDLIFE REFUGE
5 DENALI NAT'L. PARK AND PRESERVE
6 DENALI STATE PARK
7 CHUGACH STATE PARK
8 CHUGACH NATIONAL FOREST
9 KENAI NATIONAL WILDLIFE REFUGE
10 KENAI FJORDS NATIONAL PARK
11 KACHEMAK BAY STATE AND WILDERNESS PARKS

MAJOR DEVELOPMENT PROJECTS

EXHIBIT-K



1. SUSITNA HYDROELECTRIC
2. WILLOW CAPITAL SITE
3. POINT MACKENZIE AGRICULTURE
4. BELUGA COAL
5. BRADLEY LAKE HYDROELECTRIC
6. ALTERNATIVE PETROCHEMICAL SITES
7. GRANT LAKE HYDROELECTRIC

N

Alaska there is much attention being 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.

Finally land status may be effectively permanently changed by the installation of a single large project. The proposed Susitna Hydroelectric Project in the upper reaches of the Susitna River is an example. While the actual acreage covered by the project structures is relatively small, the acreage which will automatically come under the use controls dictated by the requirements of the power project is dramatically larger.

2.3.1.2 Land Use

Direct impacts can be expected when there is any change in the use of land. It is generally true that the magnitude of the impacts increases in proportion to the scale of the project. The location of the project and its character play large roles in establishing what the potential impacts may be (Exhibit K). There are, at least, three examples of this type of change in land use that are currently viewed as probable within the Inlet area. They are the Bradley Lake Hydroelectric Project, the Susitna Hydroelectric Project, and the development of the Beluga coal fields.

In the instance of the two power projects the area actually altered by project elements is comparatively small, but the area that then comes under control of the policies governing the operation of the project is quite large.

The extraction of minerals in instances such as that that can be expected in the Beluga coal fields has potential impacts that are considerably greater than in the hydroelectric projects. The actual disruption caused by the extraction and the effect of the exposed terrain can be significant.

There is a strong tendency to look for the damage that can accrue from major development and to overlook potential benefits that can derive from nominal modifications of projects apparently unrelated to salmon resources. The review of each major project should include at the earliest possible opportunity consideration of project features that might serve a dual purpose by additionally favoring the enhancement of salmon resources.

With all such projects there is the potential for less obvious **indirect** impacts which may, in the last analysis, be greater and longer lasting than the immediate impacts. Secondary development that occurs in support of the projects usually accounts for greater area of disturbance and involves less oversight and planning for minimization of negative impacts.

The availability of additional electrical power ma result in increased residential and industrial growt The move of the capital from Juneau to Willow wou also create increased residential and commerci development. This type of development proliferatic may pose real threats to habitat.

The secondary development associated with r source extraction projects such as that at Beluga most often in the nature of transportation and pr cessing facilities, and these also pose concerns f salmon habitat.

2.3.2 Population Characteristics

The population of the Cook Inlet region ha increased rather continuously since prior to Worl War II until very recently, and the rate of that increas in any given period has reflected the "boom-bust' character of Alaskan development. The 1980 censu indicates that over 52 percent of the state's popula tion resides in the Cook Inlet region. Of the 217,00(persons residing in the region nearly 80 percent (ap proximately 174,000) live within the Municipality o Anchorage.

In addition to being at the physical center of th region, Anchorage has been and continues to be th dominant population center of the region and th state. Of the remaining 43,000 people in the area about 58 percent (25,000) live in the Kenai Peninsul Borough, and the balance of 42 percent live in the Matanuska-Susitna Borough.

The trends in population growth seem to be changing within the region (Exhibit L). In February o 1979 the Economics Task Force of the Southcentra Alaska Water Resources Study (Level B) issued **Southcentral Alaska's Economy and Population, 1965-2025: A Base Study and Projection.** In that document they drew three possible scenarios for the growth of the region; a high case, an intermediate case, and a low case. Although it is too early to be certain, the 1980 census figures make it appear that even the low growth scenario was considerably optimistic. The population in Anchorage appears to have peaked at about 180,000 in 1978 and has now declined slightly[4]. Growth in the region outside of Anchorage has continued rather steadily[5]. The population of the region in relation to the total state population also appears to have peaked in 1978 at about 54 percent, and has now declined to about 52 percent.

For the purposes of this Plan the distribution of that population becomes very significant (Exhibit M). If the study area were to be divided in half with a northeast-southwest line, the overwhelming prepon-

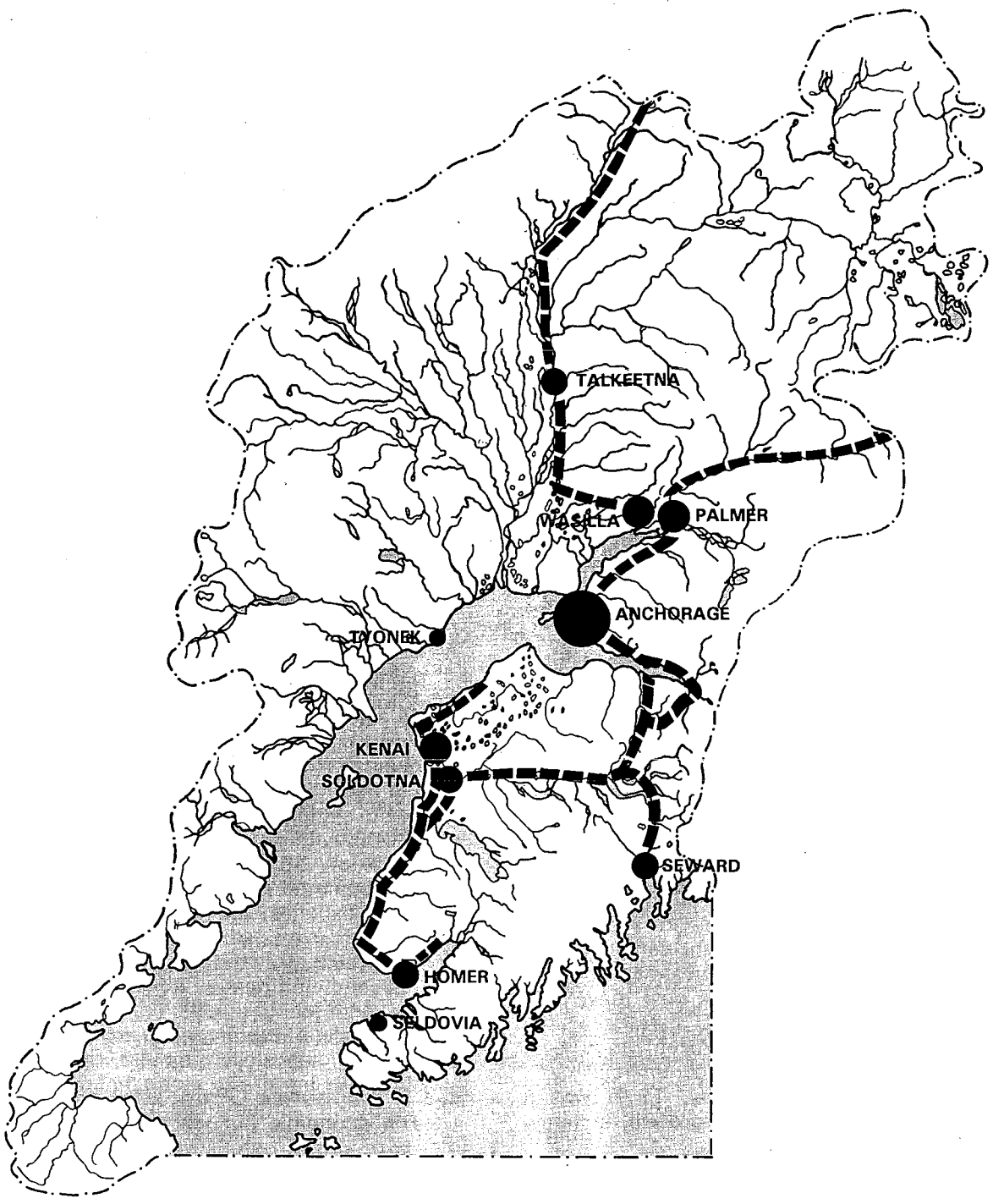
POPULATION **EXHIBIT-L**

	1970	1977	1978	1980
Anchorage	126,385	182,000	179,800	174,000*
Kenai-Cook Inlet	14,250	21,300	22,300	25,000
Mat-Su Borough	6,509	14,800	16,100	18,000
Total	**147,144**	**218,100**	**218,200**	**217,000**

*Low growth projections for Anchorage, which is the key to the area, were 205,000 for 1980 and 375,200 for 2000.

POPULATION DISTRIBUTION

EXHIBIT-M



POPULATION CENTERS

MAJOR HIGHWAY CORRIDOR

derance of the population would be found in the eastern half of the area. It is only in this half that there is a highway system, and the population has and will continue to focus along the major roadways. Access to the western half of the area is achieved exclusively by air or by water. About the only organized population center in the west is the village of Tyonek with a population of approximately 300 people.

2.3.3 Description of Economic Sectors

Two broad economic sectors are involved in this analysis of the Cook Inlet region, the basic sector and the support sector[6]. The basic industries are mining, manufacturing, construction, agriculture-forestry-fisheries, and federal government. Support sector industries are transportation, communications, financial-insurance-real estate, services, and state and local government.

2.3.3.1 Basic Sector

Oil production, as part of mining, and construction related to that production dominated the economics of the area from 1965 to 1975. As Cook Inlet oil production decreased after 1970 and fishing production and value increased 1976-1978, there was a large change in the contribution of each to the basic economy of Cook Inlet excluding Anchorage.

Gas production, on the other hand, continues relatively strong, and recent discoveries near Kenai may indicate another major gas field in the Cook Inlet region. In 1978 the Cook Inlet region yielded 42 percent of Alaska's total gas production.

Some portion of the monies generated by, or in association with, the Prudhoe Bay oil and gas field and Trans-Alaskan Pipeline eventually filters into the Cook Inlet economy. Secondary impact to regional manufacturing, construction and services is certainly significant; and since the completion of the oil pipeline, construction has declined by up to 66 percent compared to pipeline construction days.

International demand for what was previously a domestic canned product has rapidly changed the nature of the entire **salmon** processing industry. The addition of conversion to freezer plants in order to meet the demand of the fresh frozen market has required millions of dollars of capital investment by local processors. Cook Inlet processors now have the ability to process approximately 30 percent of the state salmon production as fresh frozen product. In terms of numbers of fish harvested commercially and value of the catch to the economy, 1978 was a record year in Cook Inlet. Fisheries growth, in terms of real dollars, has been quite strong.

2.3.3.2 Support Sector

The contribution of recreational fishing is very significant to the economy of specific localities in the region. It is not as significant to the basic sectors as the other portions of the fisheries which are, in turn, overshadowed by the influence Anchorage has on the economy. Anchorage growth is affected by activity in basic sectors of other areas in the state. Of the 321,000 visitors to Alaska in 1977 approximately 16 percent, or 51,360, indicated they engaged in sport fishing according to the State Department of Commerce and Economic Development. There is no refinement of the data to separate fresh water from salt water fishing, boat from bank fishing or fishing in t Cook Inlet region from other areas of the state.

Cook Inlet region tourism increased at about t state-wide rate in 1978 (10.5 percent), and w steady or experienced some growth in 1979. If gc ernment growth figures for the state are applicable the Cook Inlet as a region, then the trend towa growth in government (5 percent increase in 197 may continue. The statewide growth in state a local government amounted to a 62 percent increa between 1972 and 1977.

2.3.4 Employment and Labor Force

The Cook Inlet region has been divided into fo statistical units. The divisions are Anchorage, Ken Cook Inlet, Seward and Matanuska-Susitna. The four are added together to provide data in this secti representative of the Cook Inlet area. Fairly reliat estimates can be generated for projections on lab and employment by integrating present data wi population projections.

In 1977 the State labor force was 174,000. (these, 99,496 were in the Cook Inlet area. The pr jections for the five year period 1978-1983 sho that job openings resulting from industry expansic plus death and retirement separations will be greate for clerical occupations.

The service worker category is expected to ir crease nearly as much. A decline is projected for th craft, operative and laborer occupations.

While the Anchorage area shows a significant d versification of labor force other areas in the Coc Inlet depend almost exclusively on fisheries, oil an gas production, agricultural production and tourism Unless significant oil and gas sources are discovere in lower Cook Inlet, it appears likely that productio and revenue from Cook Inlet petroleum fields will cor tinue to decline significantly.

Basic sector employment in Cook Inlet by th year 2000 with low development is projected to b slightly below 35,000. Present basic sector employ ment is estimated at 32,000 in Cook Inlet.

Most fisheries activities which provide employ ment are labor intensive and rate high in percentag of jobs provided in the Cook Inlet region compare with its commodity value. A value of commodity com parison and job provided comparison would yiel different ordinal placement for fisheries on economi tables.

2.3.5 Economic Outlook for the Region

The economic outlook for the region is divide into two areas: non-fishery oriented activities an fishery related activity. The former category include oil and gas production, tourism, construction, govern ment and service related industries.

The major non-fishery related activity potential or the horizon is the proposed Alaska Natural Gas Pipe line. This project, which would affect most of Alaska is projected to cost upwards of 20 billion dollars. Ar unknown, but significant portion of the total woulc accrue to the Cook Inlet region either as direct salary and wages to local workers hired to work on the pro ject, or as a multitude of infiltrations throughout the regional economy through service and support relatec activity.

Additional regional economic benefit would be derived from oil and gas or energy related projects such as the proposed Pacific Alaska LNG plant at Kenai, the discovery and production of oil and gas from the lower Cook Inlet OCS region, the Dow-Shell petrochemical facility located at any one of several locations within the Inlet drainage or the development of major coal deposits on the west side of Cook Inlet. It should be pointed out, however, that none of the above projects has received all the necessary Federal and State permits and approval, and in some cases, financial arrangements are still lacking.

Tourism in 1979 increased about 10 percent over 1978 and as long as fuel supplies remain available, tourism is expected to increase. The long term impact of highway construction just south of Anchorage on tourist travel to the Kenai Peninsula is unknown, but with construction expected to continue until 1987, some decrease in Kenai Peninsula tourist travel might be expected.

Non-government construction activity in 1978 in the wake of Trans-Alaska Pipeline completion, has dropped by up to 66 percent. Future construction activity, especially in the Cook Inlet region, will probably be closely related to developments in related sectors such as oil and gas projects and potential for increased governmental spending on construction related activities.

With regard to growth by the government sector, current indicators predict a slight to moderate increase in government growth in terms of real dollars. For instance, the federal government's overall employment was 4.7 percent lower in 1978 than 1977, while state government increased about 2 percent in 1978 and local government increased about 5 percent for the same time period.

Fishery related activity through the turn of the century (for the purpose of this plan limited to salmon fishing) is predicted to increase for recreational fishing, fish processing and commercial fishing.

2.3.6 Summary

Most of the impacts that the human environment may have on the salmon resources differ in at least a couple of categoric ways from those considered in the natural environment. First, they are largely avoidable. If the potential problems are recognized they can be minimized through plan modifications. Second, in the most dramatic case the project could be eliminated if the threat were deemed to be sufficient.

The **ownership and status of a great deal of land** within the region is in the public domain because it is held by either the state or federal government. The short and long-term policies that govern such situations greatly facilitate the planning for the enhancement of salmon resources by adding predictability. Secondly, there is most often a single entity, the agency with jurisdiction, with whom cooperative efforts may be undertaken. Analysis of problem situations and proposals for enhancement projects can benefit substantially from recognition of salmon resources. These types of lands as a group are afforded some protection, can serve multiple resource functions, and are dedicated to serving the public interest.

Land use in the active sense of alteration and some form of development can and will have significant impact on salmon resources and the planning that is done for them. Anticipated projects such as the Susitna Hydroelectric Project and the Beluga coal field development need to be assessed at the earliest possible time to determine their potential effects and to search out opportunities for ancillary development of resource potential.

At least two aspects of the **population** of the region are significant, absolute numbers of people and the distribution of those people. During the period between 1975 and 1980 the total population of the region peaked and seemed to stabilize, so that immediate large scale increases in the numbers of people potentially available to harvest the salmon resources is not expected. However, distribution of that population along the major highways continues to occur and to that extent additional loss of habitat may be expected. Additionally, redistribution of the population may tend to change the locations of fishing pressure particularly with reference to sport fishing.

It is expected that **employment opportunities** and the **labor force** that will be active will continue to be as healthy or healthier than for other areas of the state. The labor force will be more stable than in areas where large construction projects are underway.

Although fishing has not been and will probably never be the dominant **economic sector** in Cook Inlet, it is a persistent and significant factor in the economy of the region.

With this background of the more prominent natural and human environmental factors at work in the Cook Inlet region, it is now reasonable to examine more closely the nature of the salmon resource and the character of the user groups that regularly harvest that resource.

2.4 SALMON FISHERY

The story of the man-salmon relationship in Cook Inlet has been one of increasing participation, harvest, specialization, and management and regulation.

2.4.1 Overview

There are several aspects of the salmon fishery in Cook Inlet that are either equally important to all three major user groups or play an important role in the relationship between the user groups.

2.4.1.1 Historical Perspective

The earliest human interaction with the salmon of Cook Inlet came with the native harvest on a relatively small scale as a means of direct life support. Commercial and sport harvest of the resource were nonexistent.

There is no reason to think that the basic runs of salmon into the Inlet were different than they are today in any very substantive fashion, even though there may be significant changes in the character of the runs into particular streams or lakes (Exhibit N).

In the 1700's salmon had gained "limited" commercial significance for the Russians who were trading them in barter fashion for other commodities. In 1821 the Russians established exclusive trading rights in Alaska.

With the acquisition of Alaska by the United States of America in 1867, the scene was set for some new perspectives. By the late 1800's commer-

cial harvest of the salmon resource had begun on a measurable scale, and the salmon were being directly marketed rather than bartered. Only three of the five species that are now prominent were recorded in this early commercial effort, sockeye, coho, and king salmon.

In the early part of this century pink and chum salmon started to appear in appreciable numbers in the commercial catches. Additionally the sport fishery began to develop so that all three of the major user groups under consideration today were present, if not large or well organized. As early as 1936 sockeye salmon escapement was being monitored in Fish Creek. In 1947 the drift fishery began as a new commercial gear group, and in 1954 it was prohibited in the Northern District. In the period preceding statehood in 1959 general management of the salmon resources was under the U.S. Fish and Wildlife Service. With the passage of statehood the use of fish traps which had been such a large part of the early commercial fishery was prohibited.

The earthquake in 1964 caused the loss of much pink salmon habitat in the Lower Inlet and in the Kasilof River.

Since the middle of the 1940's there have been marked changes in the character of the harvest of Cook Inlet salmon. Not only has there been a pronounced increase in the number of harvesters, but types and quality of gear have improved. During this same period there have been increasing efforts to understand the fishery through such programs as escapement counts and to manage the resource on the basis of those counts so that the continuation of the resource in a viable condition is assured.

2.4.1.2 The Salmon

There are very pronounced differences in the numbers of each species of salmon that annually return to the Inlet. The largest commercial species harvests occur with the dominant year pink salmon. The next largest harvest is taken from the sockeye salmon. In general the chum salmon harvests rank third along with the non-dominant year pink salmon. Fourth in this type of ranking is the annual harvest of coho salmon, and king salmon experience the smallest harvest.

As can be seen in Exhibit N most of the five species come to the Inlet in more than one annual run. That is the total annual return of a species to Cook Inlet may be made up of several distinct runs spread over several weeks or, perhaps, as much as several months. In many cases there is a further distinction possible based on the particular river system to which the return is being made.

Adding to the complexity of this developing picture is the fact that these same five species have different life cycles. There is considerable variation in the amount of time that will pass between the time a given group of eggs is deposited and the time when the product of those eggs will return as mature and spawning adults. Although the king salmon may have a seven-year return period, they and the sockeye salmon are considered to have a four to six-year return pattern. The chum and coho salmon are generally considered to be four-year fish. The pink salmon which occur on a two-year cycle have the shortest "turn around time". However, the two-year cycle the pink salmon is further divided into a distinct dominant year and a clearly non-dominant year. Th has been as dramatically illustrated as in the yea 1961, 1962, and 1963 when the commercial catc was respectively 337,394; 4,960,030; ar 234,052 fish.

Finally there are still further distinctions whic can be made based on suitabilities of the species fc the differing types of processing and the variations i per-pound prices which are paid for the differer species.

2.4.1.3 User Group Definition and Development

The large size and diversity of the region have contributed to the formation of various salmon interest groups. The groups are frequently constituted in such a way that membership represents only one facet of an individual's involvement in the fishery.

Because of the wide geographic area covered by the region, fishermen have formed "local" associations that focus on either the area in which they live or the area in which they do the bulk of their fishing. This alignment of fishermen ignores both the reason for fishing and the means by which the fishing is done.

In recent time three groups of fishermen have been generally recognized by the reason for which they fish. The subsistence fisherman represents a continuation of a concept that goes back to the earliest involvement of man with the salmon resource. Although what constitutes subsistence fishing in today's context is the subject of ongoing discussion and redefinition, the basic premise is that the fish that are caught are directly consumed by those who catch them or are traded for some other life sustaining necessity.

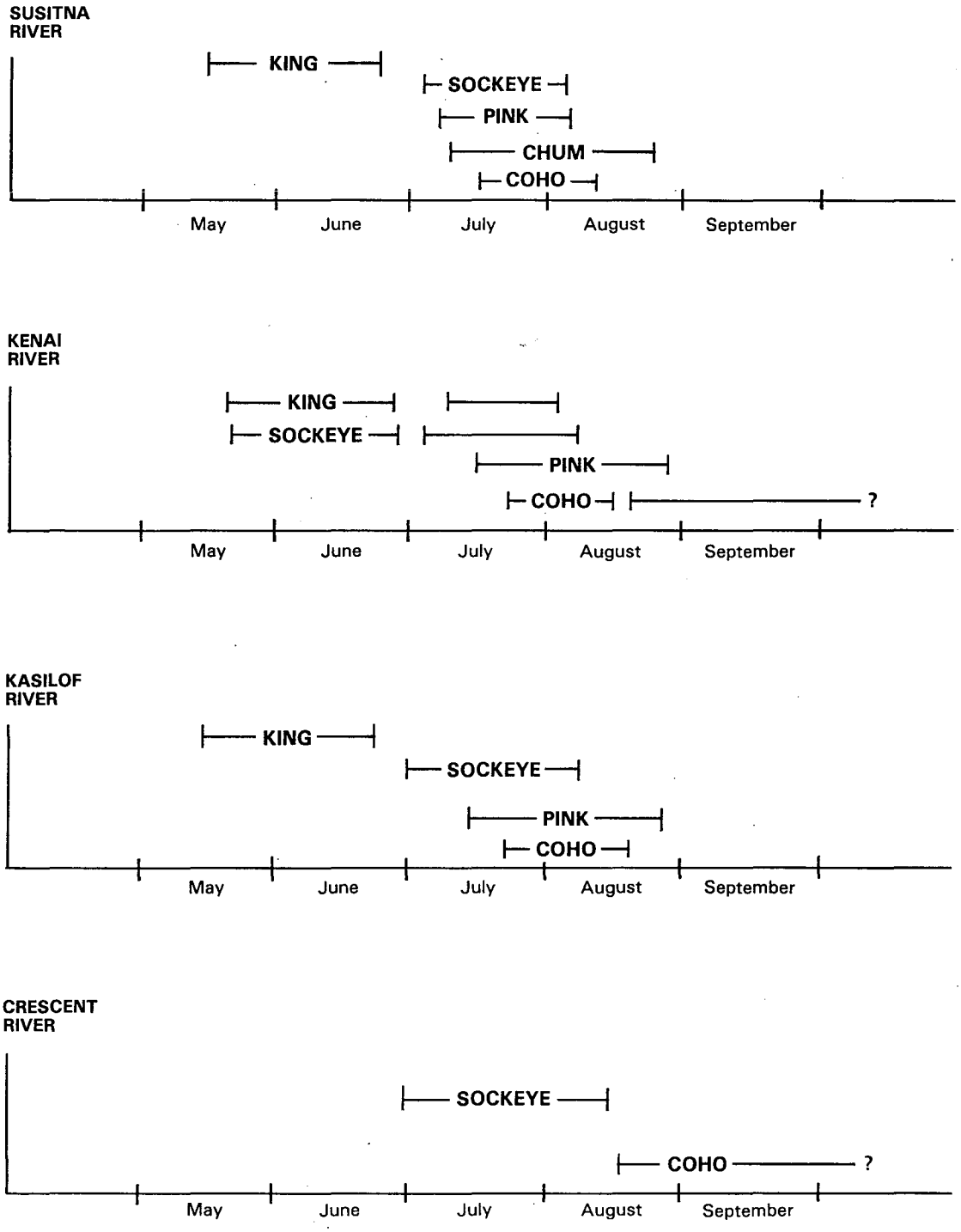
Sport fishing represents the most recent broadly recognized fisherman's group. In this instance there is a strong, if not dominant, recreation perspective; but to the extent that those fish which are caught are consumed by the fisherman it represents a quasi-subsistence fisherman's group.

The commercial fishery is the largest harvester of the three major user groups and has the longest clearly quantifiable record of active involvement with the salmon resource. Although there is a substantial range in the size of the commercial fishing operations, all of the commercial fishermen are harvesting the salmon resource for the primary purpose of sale to a processor and ultimately to a large international market. It is also true that in many cases a small fraction of the individual commercial fisherman's catch is diverted to his own table to fill a quasi-subsistence function.

Finally commercial fishermen can and sometimes do align themselves according to the type of gear which they use in fishing; set gill net, drift gill net, or purse seine. The largest of the three gear group types is the set gill net fishermen. It should be noted that set gill nets are the primary gear used by the acknowledged subsistence fishermen. The second largest gear group contains the drift gill net fishermen, and the third is that comprised of the purse seine fishermen.

It is from this context of overlapping interests that the umbrella organization of the Cook Inlet Aqua-

MAJOR SALMON RUN TIMING — EXHIBIT-N



culture Association has emerged as the single most comprehensive group representing salmon resource users.

2.4.1.4 CIAA Relationships With User Groups

A total of twenty-six of the twenty-nine seats on the CIAA Board of Directors is now occupied, and diversity of representation encompassed by those twenty-six Directors is reasonably extensive.

Sport fish representation through the Izaak Walton League was present at the early formational meetings. Later they requested and were granted a Board seat. The Kenai Peninsula Conservation Society became a member during 1978, but withdrew in 1981. In late 1979 and early 1980 two other sport fish groups, the Kenai River Guides Association and the Alaska Sport Fishing Association, inititated a dialogue with the CIAA about future membership on the Board. In 1981 the Matanuska Valley Sportsmen sought and obtained membership on the Board.

Among the **municipalities** the Matanuska-Susitna Borough, the Kenai Peninsula Borough, the Municipality of Anchorage, the City of Seward and Kachemak City have seats on the Board. This large representation of governmental units is unique among Alaskan aquaculture associations.

In most areas of the state **commercial fishermen** are organized around gear type, but in Cook Inlet this is not the case. After lengthy deliberations, representation on the CIAA Board for commercial fishermen was set at (3) from each of the five commercial fishermen's organizations then in existence. Those organizations were the North Pacific Fisheries Association based in Homer; the Cook Inlet Fishermen's Fund of Ninilchik; the Commercial Fishermen of Cook's Inlet in Kenai; the Kenai Peninsula Fishermen's Cooperative Association of Soldotna; and the Cook Inlet Fishermen's Association of Anchorage.

The **processors** had been represented by an individual from Salamatof Seafoods since the Board was organized. The representation from this group changed in 1981 when a representative from Royal Pacific Fisheries accepted the seat which the prior representative had vacated.

Other groups have representation on the Board. The University of Alaska has been active on the Board, and its representative currently serves as president of the Board. The Cook Inlet Region, Inc., the regional native corporation, has a seat on the Board as does the Ninilchik Village Council.

2.4.1.5 Fisheries Management

Superimposed on the salmon and the various salmon harvesters is a management structure which regulates how the needs of resource maintenance 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 a number of divisions within the Cook Inlet area (Exhibit O). The two broadest divisions are the Upper and Lower Cook Inlet Management Areas. The separation between the two is a line extending due west from Anchor Point. This division has considerable significance because the character of the fishery in each of the two areas is quite different. The overwhelming majority of the set net fishing and all of the drift fishing occur in the Upper Inlet Area, while all of the seine fishing occurs in the Lower Inlet Area. Each of the two major areas is further subdivided as shown in Exhibit O, but the distinction between the Northern District and the Central District is worthy of special note because drift fishing is only allowed in the Central District.

2.4.2 Subsistence Fishery

It has already been acknowledged that subsistence fishing is the oldest category of salmon use that is presently recognized. Accounts of how it was done, by whom, and under what personal relationships are numerous and varied. It is sufficient to indicate that at least in the days prior to statehood and in some cases following 1959 those who had a subsistence need to harvest salmon were able to do so either directly or through informal arrangements with commercial harvesters. However, recently the concept of subsistence fishing has come under scrutiny and been subjected to new and generally expanded definition. Although criteria will be established and refined on a year-by-year basis, there is no immediate prospect for a firm and lasting definition on which precise planning can be based.

2.4.2.1 Regulations

The general trend of subsistence fishing regulations from 1960 through 1980 has been one of steady tightening. The seasons have gotten shorter as have the weekly fishing periods. However during this same period the participation in the subsistence fishery has expanded because of broader public awareness. The subsistence fishery has generally been governed by the same regulations that covered the commercial fishery.

In 1980 and 1981 there has been a concerted effort on the part of the state to define subsistence fishing in a way that will reduce and control the size of the fishery while still providing the resource to those who depend upon it.

2.4.2.2 Catch Analysis

During the 1960's and early 1970's the subsistence catch in the Inlet area ranged between 2,000 and 6,000 fish annually, while during the same period the number of permits ranged from 170 to 450.

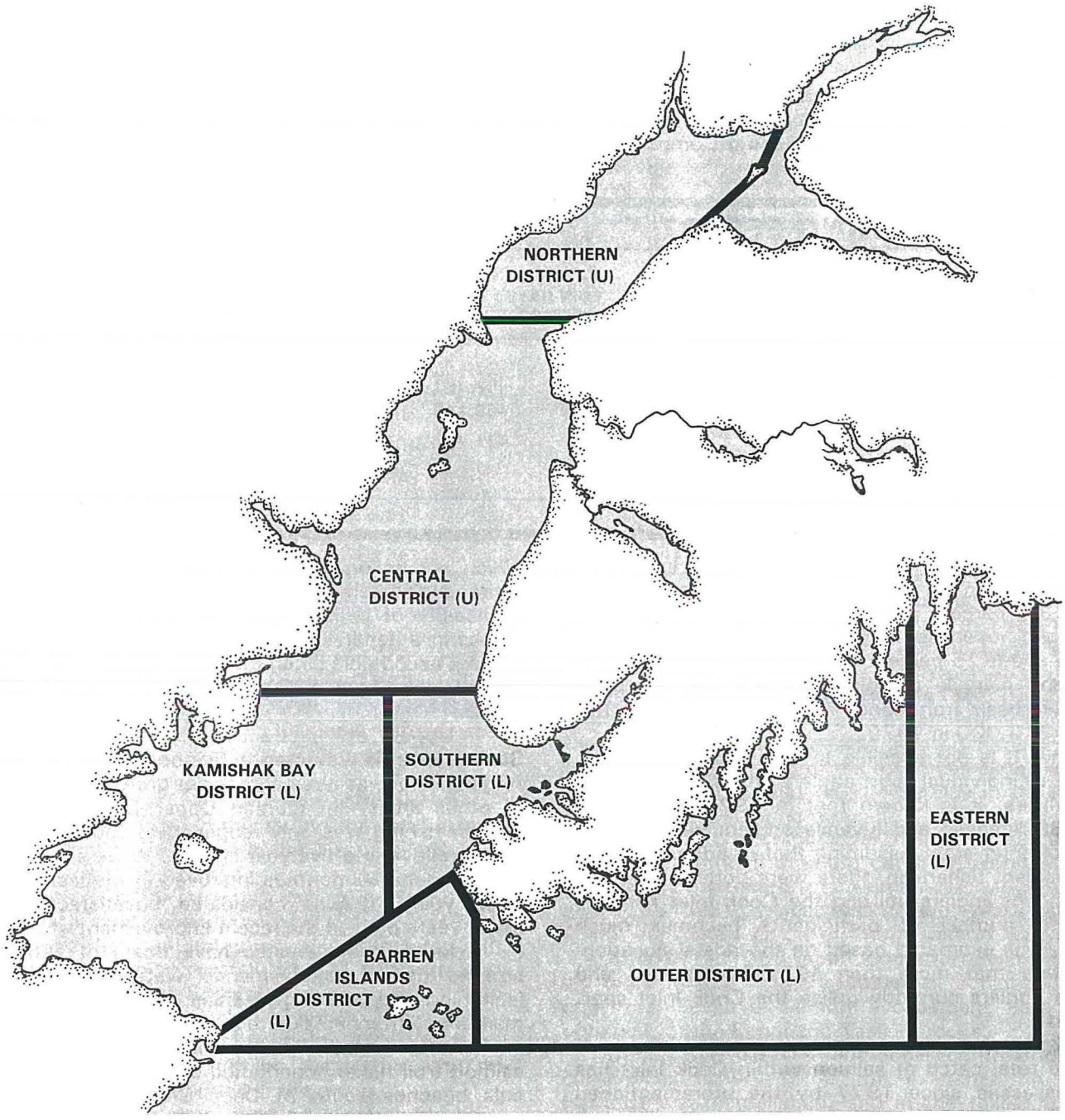
In 1980 in the Inlet area 1,781 subsistence permits were issued, and that does not include 372 special permits that were issued for either special short openings or special areas. Excluding the special permits which accounted for about 2,000 to 4,000 fish, the subsistence catch for the year was 21,366 fish or an average of 12 fish per permit[7].

2.4.2.3 Economic Assessment

The people who are eligible for subsistence fishing may not have been finally defined; and, therefore, their numbers are not concretely known. For this reason it is difficult to make an assessment of the economic impact of this fishery. At its current level of activity it is clear that it does not rank with either the commercial or sport fishery in terms of overall economic benefit. However, this fact does not lessen the individual economic benefit that may accrue to the individual subsistence fisherman in the form of reduced household expenditures.

FISHING DISTRICTS

EXHIBIT-O



(U) UPPER COOK INLET MANAGEMENT AREA
(L) LOWER COOK INLET MANAGEMENT AREA

2.4.3 Sport Fishery

2.4.3.1 Fishing Pressure

Sport fishing effort in Cook Inlet is far more intense than in any other area of the state due to the state's uneven distribution of population. Annually since 1977 an angler survey, conducted by a series of mail questionnaires, has provided an accurate estimate of statewide and regional angler use (Appendix 5). In 1979 this survey indicated a total of 213,309 anglers fished in Alaska, and 59 percent of all statewide angling effort occured in Cook Inlet and Kenai Peninsula waters (Exhibit P). This was up from the 44 percent measured in a Boeing Computer Services Division study in 1973[8].

postal survey (Exhibit Q). Angler use and harvest information received from the series of postal surveys is cross-checked against a number of statistically designed "on-the-ground" creel census programs on the major Cook Inlet salmon fisheries.

With the exception of a very few immature feeder king salmon taken in Kachemak and Resurrection Bays the entire salmon sport fishery in Southcentral Alaska is conducted on adults as they approach their spawning streams or within those streams. Therefore most fisheries in this region are fairly brief, with anglers moving from one fishery to another as the various runs appear.

The high percentage of Cook Inlet sport fishing

SPORT FISHING EFFORT — **EXHIBIT-P**

YEAR	TOTAL MAN-DAYS EFFORT COOK INLET	MAN-DAYS OF EFFORT UPPER INLET	MAN-DAYS OF EFFORT KENAI PENIN.	PERCENT OF TOTAL UPPER INLET	PERCENT OF TOTAL KENAI PENIN.
1977	606,763	225,606	381,157	37.2	62.8
1978	699,611	231,468	468,143	33.1	66.9
1979	766,556	274,805	491,751	35.9	64.1
			THREE YEAR AVERAGE	35.4	64.6

Statewide angling effort during the last three years, based on license sales, has increased approximately 3.0 percent per year. Sampling indicates that unlicensed juveniles increase the total number of anglers about 25 percent over license sales. Anglers, adult and juvenile combined, have increased on a statewide basis from about 75,000 persons in 1961 to over 213,000 in 1979.

While it is not possible to determine exactly the number of individual sport anglers who fished in Cook Inlet waters, it is known that in 1979 there were 101,639 licensed and juvenile anglers who lived in the Cook Inlet area. Assuming that in addition to the local resident fisherman, there were both visiting and non-resident anglers utilizing the Cook Inlet fisheries the total number of participants becomes much greater. It is estimated based on the postal questionnaire data that more than 125,000 licensed and juvenile anglers currently utilize the Cook Inlet sport fisheries.

2.4.3.2 Catch Analysis

The total catch of salmon within Cook Inlet has been assessed since 1977 by the aforementioned

which occurs on the Kenai Peninsula appears to be maintaining itself and is undoubtedly due to (1) the availability of large king, sockeye and coho salmon stocks in a generally healthy condition which provide at least acceptable catch rates and (2) good access to those waters having king, sockeye and coho salmon stocks.

In Upper Cook Inlet access to waters west of the Susitna River is restricted to riverboat or light aircraft. Angling effort, as a result, has not grown as rapidly as in other areas. In addition Upper Cook Inlet king salmon fishing was only reopened to sport fishing in 1979 following a five-year closure. While sport catch rate for coho salmon has improved in the last two to three years, it was considered unsatisfactory for many years prior to the recent improvement.

Relatively few anglers have boats of sufficient size to handle rough marine waters. Additionally launching and berthing facilities at the most popular marine bay (Kachemak) are already crowded.

Another marine fishery for salmon is the king salmon troll fishery conducted along the Kenai Peninsula beaches south of Deep Creek. Effort in this

ESTIMATED SPORT FISH CATCH — **EXHIBIT-Q**

YEAR	KING	COHO	SOCKEYE	PINK	CHUM	TOTAL
1977	16,210	51,907	82,363	45,484	2,287	198,251
1978	17,856	65,230	105,532	105,446	18,419	312,482
1979	25,853	64,039	63,731	25,696	5,826	185,145
1980	16,806	96,032	92,673	105,595	6,154	317,260

fishery has grown rapidly, from 5,000 mandays in 1974 to 22,100 in 1979; but it has shown significant fluctuations in angler effort due to inclement periods and relative availability of fish stocks. In contrast to most marine fisheries, the Deep Creek troll fishery takes place within 100-200 yards of the beach and in relatively small boats. Therefore, weather dictates to a large extent the angler effort directed to this fishery.

River fisheries on the other hand have increased far more rapidly. For example, the Kenai River king salmon fishery has increased from 23,600 man-days in 1974 to 98,600 man-days in 1979.

2.4.3.3 Economic Assessment

Several types of small commercial enterprises function in direct support of the recreational fishery and thereby indirectly generate revenue ultimately attributable to the presence of the salmon. In addition to tackle and provision stores, there are guiding services which may employ aircraft or boats and following a successful venture there are taxidermists. Thus the economic web that spins out from this fishery is quite extensive and complex; and while no one portion of it may be large, its overall impact is significant.

At least two studies have attempted to develop an economic description of the sport fishery in Alaska; and although both provide specific information about Cook Inlet, they date back to the early 1970's. ADF&G, however, is now in the process of developing some new data from studies on the Kenai and Russian Rivers in the summers of 1981 and 1982.

A masters thesis presented at the University of Alaska in 1974 focussed on the economics of the salmon sport fishery in Cook Inlet and Resurrection Bay[9]. The data year for the study was 1972, and the findings were expressed in 1972 dollars. ADF&G estimates that approximately 76,000 total anglers used the Cook Inlet area in that year. The study addresses expenditures on a per party per trip basis. It should be noted that while most of the major sport fisheries in the area were included in this study, the coho salmon fishery at Anchor Point and in the Matanuska-Susitna west area were not included nor were numerous smaller fisheries. On the average the study found that there was a total expenditure of $121.22 per party per trip, and that the total gross sales associated with this fishery was approximately $1,031,000. An additional $460,000 was calculated as being the income generated from this economic activity. The author estimated that an additional several hundred thousand dollars in gross sales might be associated with the smaller fisheries not included in the study.

A second study was done on a statewide basis on the 1973 sport fisheries for all species of fish[8]. It indicated that the combined catch of the five salmon species comprised about 614,000 or about 16 percent of the catch of all fish species. It is estimated that approximately 44 percent of the total effort was expended in the Cook Inlet area or about 641,000 man-days of effort. Unlike the previously mentioned study, this one expressed its findings in terms of expenditures per fish caught ($13.90) and expenditures per fisherman ($315.51). ADF&G estimates of the number of fishermen harvesting in the Cook Inlet area in 1973 are approximately 78,000.

Although the results from the studies that are now underway will provide the best update of this dated information, it is clear that the sport fishery in Cook Inlet, and particularly that portion directed at salmon is a significant economic factor in the region.

2.4.4 Commercial Fishery

2.4.4.1 Introduction

The commercial aspects of the salmon fishery in Cook Inlet were evident at least as early as **1787** when the Russians were trading king salmon to the English for Hawaiian produce[10]. The records show that by the **1880's** a consistent effort to gather commercial catch data was underway and was beginning to provide information on sockeye, coho, and king salmon.

In the **1890's** commercial catch data on pink salmon began to be recorded.

During the **1910's** all streams on the Kenai Peninsula were closed to commercial fishing (1912), and in 1916 the commercial fishing season ran from May 27 through August 27.

In the early **1920's** (1924) commercial fishing was prohibited from 6 p.m. Friday nights to 6 a.m. Monday mornings. At the end of this decade a sanctuary from commercial fishing was established around the mouths of the Kenai and Kasilof Rivers.

In **1942** the record catch of coho salmon was established at 644,823 fish. In 1946 several index stations were established to count salmon escapement. In 1947 a new gear type entered the commercial fishery in Cook Inlet, the drift gill net.

In **1951** the record king salmon commercial catch was taken and totalled 187,513 fish. In 1953 fishing time was drastically reduced, and in 1956 subsistence fishing was banned in the rivers of the Kenai Peninsula. At the end of the decade (1958) fish traps were prohibited as a means of commercial fishing in the Inlet. In 1959 Alaska was granted statehood status, and administration of the resources began to pass from the U.S. Fish and Wildlife Service to the Alaska Department of Fish and Game.

In **1962** the commercial fishery in Cook Inlet experienced both the record catch of even-year pink salmon and the record total salmon catch, 4,960,030 and 7,661,051, respectively. Two years later in 1964 the record catch of chum salmon was set at 1,402,419. By 1968 monitoring efforts were becoming more refined with the advent of sonar counters, and total sockeye salmon escapement data were obtained for the Kenai and Kasilof stocks.

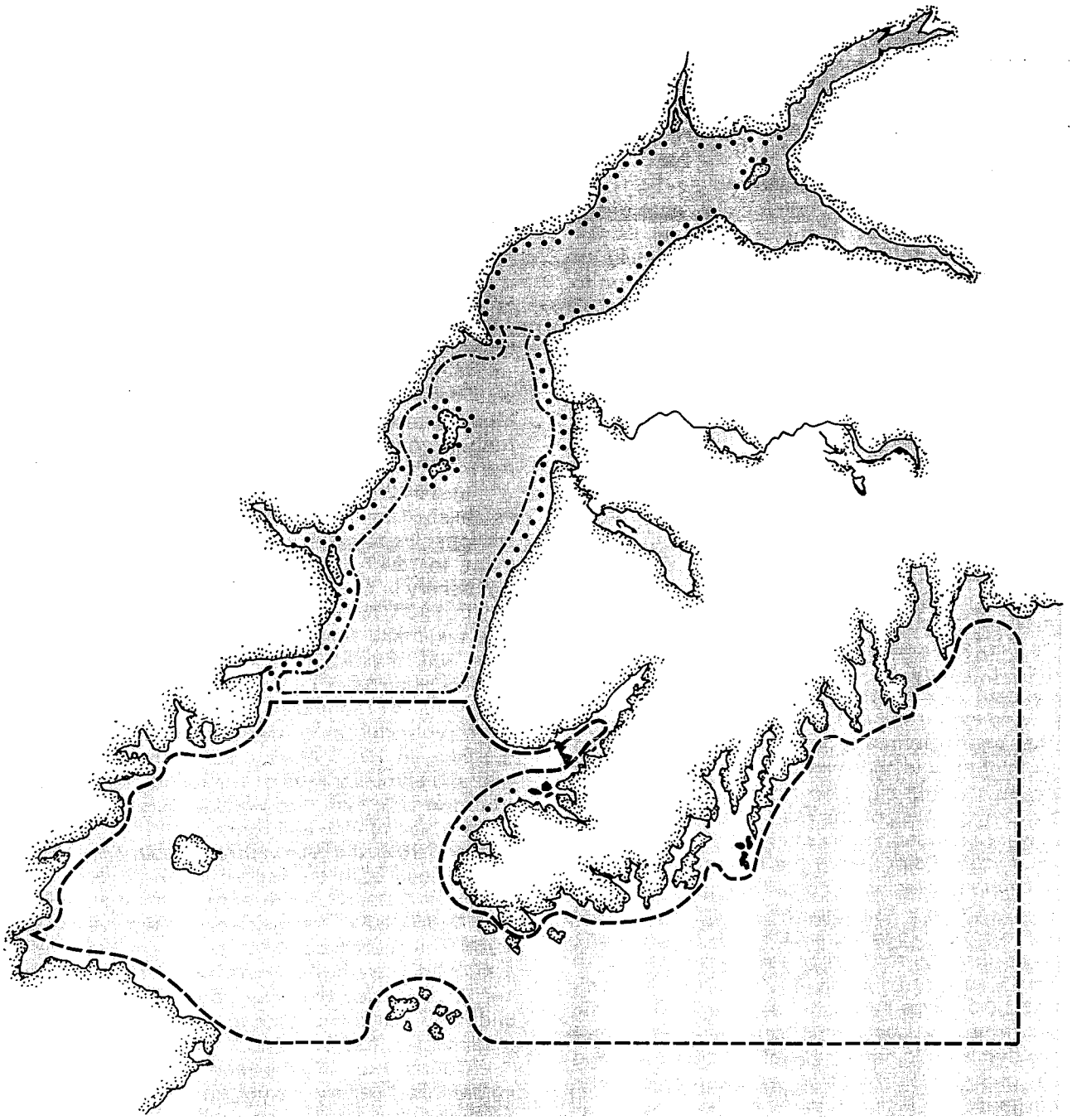
During the **1970's** additional controls on the commercial fishery came into existence. In 1971 F.R.E.D. was established, and in the following year the Commercial Fish Entry Commission was formed to oversee the limited entry permit system which went into effect in 1973. In 1974 the Upper and Lower Cook Inlet Management Areas were established by ADF&G. Total sockeye salmon escapement data for the Susitna stock were obtained. In 1978 the commercial fishery experienced the record catch of sockeye salmon (2,769,751), and in the following year the record catch of odd-year pink salmon (3,073,988).

2.4.4.2 Regulations

There are several layers of regulation that govern

COMMERCIAL GEAR AREAS

EXHIBIT-R



• • • • • SET GILL NETS

—·—·— DRIFT GILL NETS

— — — PURSE SEINES

the fishing in Cook Inlet, and they essentially cover all aspects from who can fish and with what gear to when and where they can fish.

Permits to fish commercially in Cook Inlet must be secured through the Commercial Fish Entry Commission. The numbers of permits issued since the inception of the Commission in 1972 has varied from approximately 1,150 to 1,428, the most recent total. Those permits were distributed among the three commercial gear groups as follows, drift gill net 597, set gill net 747, and seine 84[11]. There is no reason to anticipate a large fluctuation in these numbers in the immediate future even though transfer of ownership of the existing permits is fairly common.

Some gear groups are excluded from fishing in certain districts, and specifications are set on the gear which can be used. In the case of set nets certain beaches within a district that is open to them may be restricted (Exhibit R).

Although the times of openings are generally set, special openings can be granted in specific areas and emergency closures can be invoked on short notice at the discretion of the responsible biologist.

2.4.4.3 Drift Gill Net Fishery

The drift fishery is the most geographically confined of the three commercial gear groups, since it is allowed only in the Central District. Despite this fact and the fact that it is not the largest of the gear groups, it consistently registers catches that put it at or near the top in any year when compared to the other two gear groups.

Although the total catch for the gear group in any year is large, the range of catches by permit within that group is also very wide. In the years 1975 through 1978 the median catch ranged from 1,605 to 3,931 while the high catches ranged from 9,053 to 29,718.

Sockeye, chum and pink salmon make up the major portion of the catch of the drift fleet, and this fishery has the highest component of non-resident fishermen with approximately 30 percent. An average of two people man each drift boat.

2.4.4.4 Set Gill Net Fishery

Set gill nets are present the length of the Inlet with the southernmost sites occuring on the south side of Kachemak Bay. However, because of the nature of their fishing operation many are confined to the beaches and nearshore areas and must have a site from which to fish. In the Upper Inlet it is possible to set net fish without a beach site, if the net can be secured. The bulk of the set net fishing is conducted in the Upper Cook Inlet Management Area on both the east and west sides of the Inlet. It is the largest of the three gear groups and experiences catches that are large and in any year may be surpassed only by the drift fleet.

Within the group there is even wider separation between the catches of the individual permits than was the case in the drift fleet. For the years 1975 through 1978 the median catch ranged from 957 to 1,605 while the high catches ranged from 11,578 to 29,718. Inlet-wide sockeye salmon are the largest component of the set net catch with pink salmon usually occupying second place and occassionally yielding it to chums, but there is wide local variation. It should be noted that set nets make the highest harvest of coho and king salmon of the three groups. An average of 2.5 people man each set net site, and only 6 percent of the set netters are non-residents.

2.4.4.5 Seine Fishery

The seine fleet fishes only in the Lower Cook Inlet Management Area and Chinitna Bay of the region covered by the Plan. It is the smallest of the three gear groups, but it is the most mobile and has the capacity to fish other waters outside the region in years when fishing conditions are not favorable.

In terms of size of catch the seine fleet experiences the largest variation. For the years 1975 through 1978 the median catch ranged from 1,146 to 13,016 while the high catch ranged from 18,125 to 79,830.

Pink salmon clearly make up the largest portion of the seine catch, and in the years 1977 through 1979 the percentage of pinks in the catch ranged from 70 percent to 91 percent. An average of 3.5 people man each seine boat, and essentially all of the seine permit holders are residents.

2.4.4.6 Harvest Summary

Exhibit S depicts the high consecutive year averages for the history of the Cook Inlet commercial fishery by species.

Because the length of time selected for these averages can influence both the amount of the average and the time period that is identified, a range of long-term periods has been shown.

Because a two-year period is the minimum time necessary to catch both the high and low years of the pink cycle, increments of two years were selected as the 32, 30, 28, 26, 24, 22, and 20-year averages were calculated.

The exhibit also shows the highest three single years on record for each species, and where they occur in relation to the long-term averages.

Of interest is the fact that the long-term high consecutive year averages for sockeye, coho and king salmon all occur essentially coincidentally between the years 1925 and 1956, while the corresponding high averages for the pink and chum salmon occur together between the years 1949 and 1980.

2.4.4.7 Economic Catch Analysis

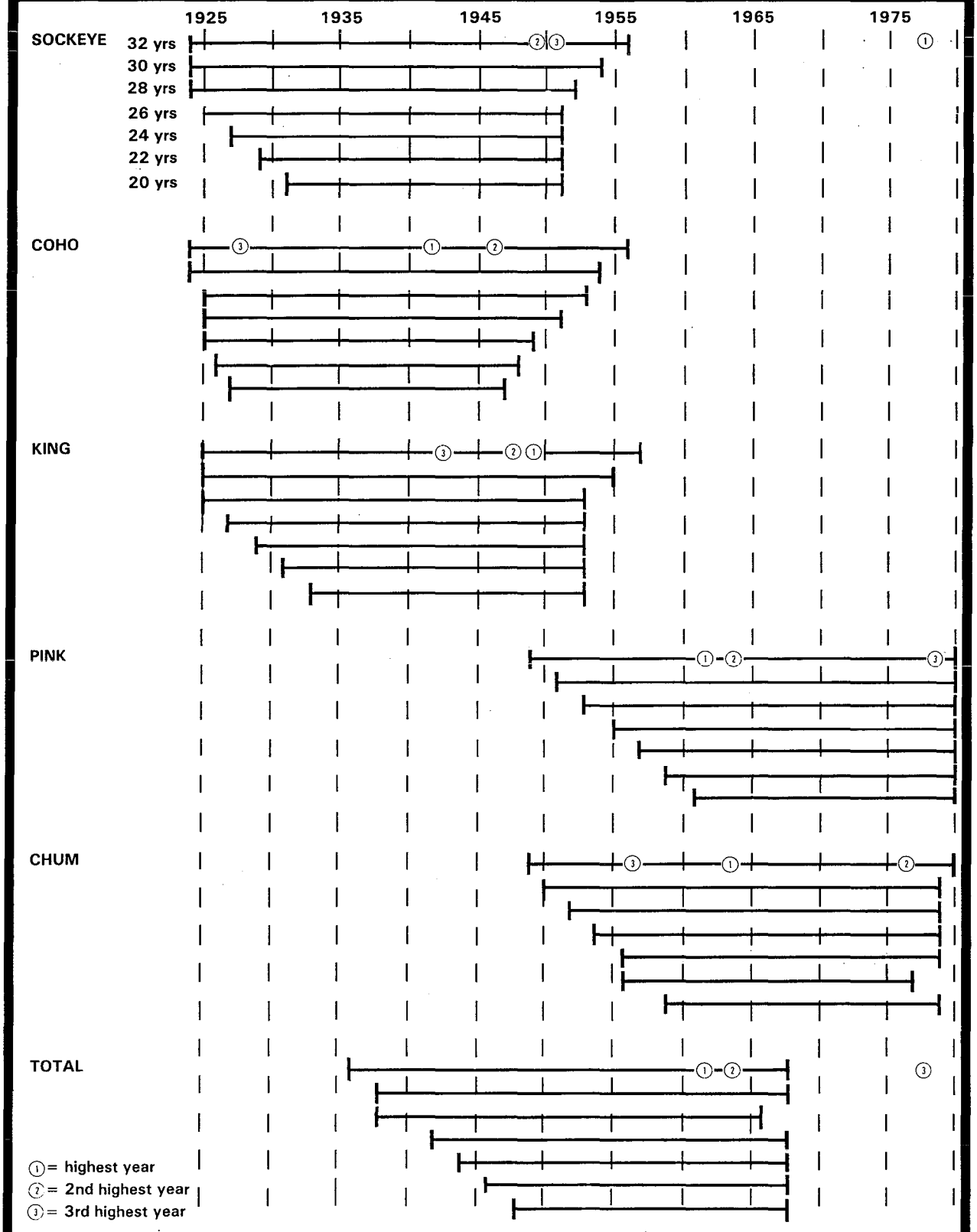
The price paid to fishermen for their catch (ex-vessel price) varies by species and from year-to-year and as a result of causes over which the fisherman has no control (Exhibit T)[13].

The trend of prices per pound of fish was decidedly upward during the decade of the 1970's.

Sockeye salmon are the most abundant of the higher value per pound species. The value of the fisheries fluctuates more than the catch level in numbers of fish. This is because pink and sockeye salmon usually alternate as the largest contributor to catch levels, but their prices per pound and total weight differences affect the value to the fisherman.

The processing capacity in the Cook Inlet area includes an expanding freezing capacity. Larger amounts of both herring and salmon from other areas are being brought to the Inlet for freezing and thereby adding to the basic economy. This factor will probably continue to increase with participation in the industry

RECORD LONG-TERM COMMERCIAL CATCHES EXHIBIT-S



by smaller operators as indicated by increased numbers of requests for permits to operate as processors received by ADF&G.

There is no question that the money that comes to and circulates throughout the Cook Inlet region as a direct result of salmon-related industry is significant to the economy of the area. The ex-vessel prices paid to Upper Cook Inlet fishermen alone in the years 1975 through 1979 totaled over 83 million dollars and ranged from 6 to 28 million in individual years. It should be kept in mind that this is the direct payment to the fishermen and does not include the additional multiplier effect.

2.5 SUMMARY OF IMPLICATIONS FOR THE PLAN

The Plan must address a very valuable resource in the context of a complex natural and human environment. The mixed-stock fishery that exists in Cook Inlet would be difficult to manage effectively even with full understanding of all of the factors that constitute variables in this equation. That understanding is still being developed.

Despite the variety of approaches to developing a description of the total economic impact of the salmon fisheries in Cook Inlet, there is a consistent indication that the economy benefits in a substantial fashion from a productive salmon resource.

The Plan must allow for the acquisition of new information at the same time that the harvest of the resource is being carried out. The following chapters will develop goals, objectives and strategies to lead to a larger salmon resource that is based on the full potential of the Inlet and that can be subjected to a greater harvest without jeopardizing its continuity.

EX-VESSEL PRICES **EXHIBIT-T**

	SOCKEYE	CHUM	PINK	COHO	KING
1971	0.30	0.15	0.15	0.21	0.37
1972	0.34	0.20	0.19	0.27	0.47
1973	0.65	0.42	0.30	0.50	0.62
1974	0.91	0.53	0.46	0.66	0.88
1975	0.63	0.41	0.35	0.54	0.54
1976	0.76	0.54	0.37	0.61	0.92
1977	0.86	0.52	0.38	0.66	1.12
1978	1.35	0.80	0.34	0.85	1.00
1979	1.39	0.83	0.37	0.95	1.61
1980	0.89	0.54	0.39	0.69	1.30

*Average Per Pound Prices

CHAPTER 3

3.0 STOCK STATUS

3.1 INTRODUCTION

In the overall structure of the Plan it is very significant to identify or "freeze" a point in time which represents the present and against which the year 2000 can be measured as the future. Both a single year and a long-term average introduce some distortion, and so a fairly brief period (1971 through 1980) has been selected as both current enough to be useful and long enough in duration to cover five two-year cycles of pinks, and at least one full cycle of each of the other four species.

For all practical purposes the present condition in Cook Inlet concerns only wild stocks. Although hatcheries have been in existence in the Inlet for about the last five years, their contribution has not yet been sufficient to consider it as a significant component of the catches. The Plan will show supplemental production in many forms playing an increasing role in the future salmon resource base.

The amount of resource data available is sizeable and the scope of this plan does not warrant its duplication here. The following sections will present selectively the points from the life histories and stock status of the five species of salmon which are pertinent for planning purposes.

This section should present a perspective on the salmon resource that will allow assessment of the goals and objectives of the Plan, not a complete natural history of Pacific salmon.

3.2 STATUS OF WILD STOCK

To discuss the status of the wild salmon stocks this section will explore the methods for determining wild stock status, the historical trends in salmon stocks in Cook Inlet, and will conclude with a species-by-species examination.

3.2.1 Methods for Determining Wild Stock Status

Several different sets of data contribute to assessment of the wild stock status. However, essentially all consolidated sources originate with the offices of ADF&G. Although secondary sources may make interpretive manipulations of these data as is done in this Plan, the primary information still rests with ADF&G.

3.2.1.1 Commercial Harvest Reports

Although it has not been a consistent method of data collection, the most long-term records exist for the commercial fishery in Cook Inlet. Data from the late 1800's are presented in terms of pack and do not necessarily cover the same fishing area from one year to the next. In more recent years, particularly with the advent of fish tickets and limited entry, the count of commercially caught salmon has become more accurate and is expressed in numbers of fish rather than exclusively in poundage.

These figures alone, however, present only part of the information and cannot be used without understanding the various factors which influence them. Examples of non-run size factors that are at work in any given year include increases or decreases in the number of participants in the fishery, the efficiency of the gear being fished, the number of openings, and the weather during the open periods.

Because the commercial catch is regularly such a large part of the total catch (approximately 95 percent), it is perhaps, the best number with which to begin constructing what the strength of the stocks are in any given period.

3.2.1.2 Sport Fish Harvest Reports

Of the three major user groups the sport fishermen take the second largest harvest of Cook Inlet salmon. During the fishing season there are regular creel census programs that begin to define the catch being exacted by the sport fishermen. These data are further refined by a mail questionnaire that solicits data on effort extended, catch and species preference. The Sport Fish Division annually publishes a statewide harvest report.

3.2.1.3 Subsistence Harvest Reports

The reports on subsistence harvests are, perhaps, the most sporadic of the three major user groups. However, because of the very small portion of the total catch that is clearly attributed to this group, it has relatively little impact on the construction of an overall stock status picture. As has been indicated the subsistence use has been the subject of much discussion and definition. Although there is a great deal of anecdotal reference to subsistence fishing, useful data only dates to the 1960's. In recent years a special subsistence office within ADF&G has served as the focal point for data concerning the subsistence fishery.

3.2.1.4 Escapement Monitoring

Escapement monitoring, particularly on the major sockeye systems, adds another piece of valuable information to the overall picture of stock strength. When coupled with data about the harvest, these data can bring the analysis another step closer to assessment of the total run strength. In addition because it is system specific, it provides the best data on individual component stocks and their relative strengths.

3.2.1.5 Management Reports

The annual management reports that are prepared by both the Upper and Lower Cook Inlet Management Areas for the Board of Fisheries are regular syntheses of the data which have been outlined above. In addition to the most recent information these reports regularly present a brief historical context in which the current information can be assessed.

3.2.1.6 Stock Status Reports

Finally ADF&G has issued stock status reports

dealing with some or all of the Cook Inlet salmon stocks. The most comprehensive of these comes out of a statewide effort being conducted through the ADF&G office in Anchorage. These reports are being prepared by one individual and on a common format so that they form an integrated and total package. The Cook Inlet portion of this effort was completed in the summer of 1981.

3.2.2 Historical Trends

Historically over the 88 years that the salmon fishery has been documented in Cook Inlet annual commercial salmon harvests have averaged 2.8 million fish. It should be noted that pink salmon were only sporadically a part of this tally until 1906 and chum salmon did not become a component of record until 1910[14].

Sockeye salmon dominate the 88-year commercial harvest with an average annual catch of 1.2 million (42%). The contributions of other species are: pinks, 976,000 (35%); chums, 392,000 (13%); coho, 218,000 (8%); and kings, 48,000 (2%). In the 22 years since statehood (1959-1980), salmon production in Cook Inlet has climbed from an average catch of 2.8 million to 3.8 million. The even year average is 4.7 million, and the odd year average is 2.8 million.

From a statewide perspective, Cook Inlet salmon average 7.5 percent of the annual Alaska production (1960-1980). On a species basis, chum and coho each account for 12 percent of the State's production; sockeye, 8 percent; pink, 5 percent; and king salmon, 2 percent.

3.2.3 Sockeye Salmon

3.2.3.1 Life History

Sockeye salmon in Cook Inlet are generally considered to be five years old at spawning, but a significant component of four-year-old fish occurs in most years. The sockeye salmon are also considered to be lake-rearing fish, but spawning sockeyes have been observed in systems that have no lakes. Generally, they will spawn in the streams that are tributaries of a lake and upon emergence will spend one to two months in the stream before moving into the lake. They will spend one or more years in the lake before migrating to sea. In some instances sockeye salmon may become landlocked precluding the marine portion of their development, and in this case, they are called kokanee salmon. The IHN virus is reasonably common among wild stocks; and although it can be devastating in hatchery stocks, its toll on wild stocks is not clear.

The return rate for natural spawning sockeyes is generally considered to be 4 adults to 1 spawner. The returning adults which are harvested average between 6 and 7 pounds per fish. They have been called the "money fish" because they have historically brought the highest per pound price.

3.2.3.2 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 2,769,751 (1978). The highest long-term average catch was for the twenty-year period from 1932 through 1951 when the commercial catch annually averaged 1,803,935. The average annual catch in the twenty-two years since statehood has been 1,176,550, but the median catch during that sam period was only 990,709.

For the period identified as the "present" (1971 through 1980) the average annual catch has beer 1,282,931, while the median catch for the same per iod is 968,572. This suggests the sockeye fishery ir Cook Inlet is in a period of annual yield above the re cent long-term average, but still below this historic long-term average.

Recent run strengths have been estimated in ex cess of 3.5 million fish. The escapement counts fo sockeye have been estimated at between 800,00(and 900,000.

Four river systems are now identified as being th(major producers of sockeye salmon, the Kenai, Kasi lof, Susitna and Crescent. The Kenai and Kasilof sys tems account for between 50 and 75 percent of th(total sockeye production. This dominance of produc tion does not necessarily reflect an absence of po tential production in other systems, but rather a situation which has resulted from past harvest o overharvest of stocks from other systems.

3.2.4 Pink Salmon

3.2.4.1 Life History

Pink salmon are typically two years old at spawn ing and, therefore, have the fastest "turn aroun(time" of the five species of salmon present in Cook Inlet. From a harvest perspective the most notable feature of their life history is the regular alternating between a dominant year and a non-dominant yea that may vary by as much as an order of magnitude.

Unlike the sockeye, the pinks produce about thre(returning adults for each spawner. Those returning adults which are harvested average about 3.5 pounds directly into the estuarine and marine environmen upon emergence.

Like the sockeye, the pinks produce about thre(returning adults for each spawner. Those returning adults which are harvested average about 3.5 pounds in weight. The pink salmon has been called the "bread and butter" fish, partially making up in num bers for its lower per pound price and smaller size.

3.2.4.2 Historical Production

The production of pink salmon varies widely be tween the dominant year and the non-dominant yea as has been pointed out. In addition the history of the pink salmon in Cook Inlet is further complicated by periodic shifts of the dominant year from odd to ever or vice versa. Finally, the pink runs to the Lower Inle may be on a different dominant pattern than runs to the Upper Inlet. The Upper Inlet has been on an even year dominant cycle since at least statehood in 1959 The Lower Inlet was on an even-year dominant cycle until 1970, and in 1971 it began an odd-year domi nant cycle which is still in effect in 1980.

The highest commercial catch of record for the Inlet as a whole occurred in 1962 when both the Up per and Lower Inlet were on an even-year dominan cycle and the total catch was 4,960,030. The 1962 catch for the Upper Inlet remains the highest ever re corded. However, in the Lower Inlet the largest catch was registered in 1979 and totalled 2,997,491 Because of this switchover in the dominant year pat tern in the Lower Inlet, the recent overall pink catch for the Inlet has not shown such pronounced differ

ences between the dominant and non-dominant years as was previously the case.

The highest long-term average catch of pinks has been in the twenty years from 1961 through 1980 when the average catch was 1,604,741. The median catch during this period was 1,390,684, but it should be understood that because of the dominant and non-dominant years nine of these years saw catches of less than 658,000. In the twenty-two years since statehood the average annual catch has been 1,577,061.

At present (1971 through 1980) the average annual catch for the entire Inlet is 1,472,494, while the median catch for the same period is 1,396,490. It is clear that both values are near the long-term average high catch.

3.2.5 Chum Salmon

3.2.5.1 Life History

The chum salmon are generally considered to have a four-year life cycle although there is a distinct two-year cycle that describes their abundance in the commercial catch.

Chum salmon spawn in the side channels of larger systems particularly in areas where there are upwelling springs. Frequently chum salmon will overlay the spawning areas of pink salmon. The emerging chum fry move quite quickly into estuarine environments.

The adults return in a ratio of approximately three adults to one spawner and weigh approximately 8 pounds when they are harvested.

3.2.5.2 Historical Production

The single highest annual catch of chum salmon in Cook Inlet occurred in 1964 when there was a commercial harvest of 1,402,419. The highest long-term average annual catch was during the twenty-four year period between 1956 and 1979 when the yearly commercial catch averaged 751,340. The average annual catch in the twenty-two years since statehood is 718,531, while the median during the same period is 650,988.

For the present period (1971-1980) the annual average is 723,639 and the median is 673,390. Once again these figures are near the record and recent long-term numbers.

The Susitna River drainage and the Chinitna Bay streams are the most clearly identified major chum salmon producers, although there is strong suspicion that the Chakachamna and Beluga River systems may also produce large runs of chum salmon.

The Upper Inlet drift fishermen account for the largest harvest of this species taking approximately 88 percent of the 85 percent of the total inlet chum catch that is taken in the Upper Inlet.

3.2.6 King Salmon

3.2.6.1 Life History

Of the five salmon species in Cook Inlet, the king salmon has the longest life cycle, and it may be as long as seven years. However, returning adults that spawn are generally four, five or six years old. They typically spend one year in freshwater and then up to four years in saltwater. About three adults return in succeeding years for every spawner in the current year.

Although the king salmon occurs in a number of locations in the Pacific, those returning to Cook Inlet are the largest. The average weight of those caught throughout the Inlet is over 22 pounds, but the Kenai River kings average about 30 pounds. Annually a few specimens over 80 pounds are caught.

3.2.6.2 Historical Production

The highest annual commercial catch of king salmon occurred in 1951 with the harvest of 187,513. The highest long-term average catch was in the twenty-year period between 1934 and 1953 when the annual harvest averaged 92,822. The average annual catch in the twenty-two years since statehood has been 13,522 with the median catch during the same period being 11,890.

At the present (1971-1980) the annual catch is averaging 12,636, with the median during the same period being 13,876.

The Susitna drainage accounts for the majority of Cook Inlet king salmon with the Kenai, Kasilof, Ninilchik and Anchor Rivers, Deep Creek and several west-side streams providing additional runs. Escapement in the most recent years has been deemed to be good with perhaps as many as 125,000 kings escaping into the Susitna system in 1977.

3.2.7 Coho Salmon

3.2.7.1 Life History

Most coho salmon in Cook Inlet spend the first two years of life in freshwater and migrate to sea in the Spring of the second year. One and a half additional years are spent at sea before they return in the late Summer/Fall of the third year or in the fourth year as adult spawners. The harvested adults average about 6.5 pounds. Those reaching the spawning areas may spend several weeks in freshwater before spawning in the tributaries.

The coho salmon appear to have a strong "pioneering" instinct that will cause them to readily occupy newly available spawning habitat. That adaptability is present in the juvenile fish that will rear under many varied circumstances. Occasionally landlocked populations of coho develop.

Preliminary data suggest there is an identifiable size difference associated with the various runs or stocks of coho salmon which may provide a means for stock separation. Selected sampling shows the average weight of Knik Arm and Susitna River coho salmon to be 5.8 and 5.6 pounds per fish, respectively. The Swanson River cohoes average 6.5 pounds each, while the August Kenai River cohoes average 7.9 pounds. Coho salmon from the lower peninsula streams (Anchor River, Deep Creek, etc.) average 8.2 pounds, but the September Kenai River cohoes are the largest with an average weight of 10.2 pounds[15].

3.2.7.2 Historical Production

The highest one-year commercial catch of coho salmon was 1942 when 644,823 were harvested. The highest long-term annual average was for the twenty-two years between 1927 and 1948 when the annual harvest averaged 345,878. The average annual catch in the twenty-two years since statehood has been 225,693.

The present average annual catch (1971-1980) is 193,256 and the median is 209,280.

Major known populations of coho salmon are

found in the Susitna drainage, the Kenai River, in the Lower Inlet and on the west side of the Inlet. Additionally there are coho salmon in Resurrection Bay.

3.2.8 Summary

There are many ways in which this type of information can be viewed to construct a description of the status of the wild stocks. Which sets of data are used and the qualifying information that is considered in conjunction with that data will markedly alter the conclusions which are drawn. Exhibit U presents catch data from the commercial fishery in several different forms representing the most commonly discussed categories of catch data.

The qualifications to keep in mind during any interpretation are that the commercial fishery in Cook Inlet is now in a period of relative stability as far as the number of participants is concerned. Additionally, the gear has become noticeably more efficient in recent years. This gear efficiency may in part offset the decreasing amount of time available to the commercial fishermen.

It should be noted that the annual sport fish catch of all five species of salmon would add about 250,000 to these commercial catches. The corresponding subsistence catch under varying criteria for subsistence fishing has averaged about 6,000 fish.

3.3 STATUS OF SUPPLEMENTAL PRODUCTION

3.3.1 Introduction

It has been clear for some time that the demands on the salmon resource have been increasing and that the vagaries of the exclusively natural salmon resource can result in economic instability for fishermen and individuals in support industries, loss of recr tion opportunities, and subsistence hardship. T result was deemed to be undesirable, and several ficial actions were taken to give "assistance" to resource. The most notable of these were the est lishment of the F.R.E.D. Division of ADF&G and aquaculture associations.

In the following sections there will be discuss of the supplemental production techniques that viewed as useful at one or more locations in Cook let and descriptions of the contributions to the ove stock strength that are now being made through s plemental production.

3.3.2 Methods of Supplemental Productio

3.3.2.1 Hatchery

Although hatcheries are the most expens means of supplemental salmon production, they p vide for greater control than any other means of p duction in the Cook Inlet system. Five such facilit are now in operation in the Inlet, and two more are the advanced stages of planning. Those in operat are located at Big Lake, Fort Richardson Army Ba Elmendorf Air Force Base, Kasilof and Tutka Bay. T Eklutna Hatchery is in the final permitting phase, a the Trail Lakes Hatchery is under construction. All the above facilities with the exception of Eklutna a or will be owned and operated by the State of Alas through its F.R.E.D. Division, while the Eklutna facil will be owned and operated as a private non-pro hatchery by the Cook Inlet Aquaculture Association

There is generally a linear relationship betwe the cost of hatchery fish and the life stage at whi the hatchery releases the fish. More specifically, t longer the hatchery holds the fish the more money

HISTORIC CATCH PERSPECTIVES — EXHIBIT-U

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
HIGHEST SINGLE YEAR COMMERCIAL CATCH	2,778,891 (1978)	4,960,030 (1962)	1,402,419 (1964)	644,823 (1942)	187,513 (1951)	7,661,051 (1962)
HIGHEST 30 CONSECUTIVE YEARS OF COMMERCIAL CATCH (ANNUAL AVERAGE)	1,641,385 (1925-1954)	1,531,814 (1951-1980)	695,596 (1950-1979)	329,149 (1925-1954)	85,521 (1926-1955)	3,830,082 (1939-1968)
HIGHEST 30 NON-CONSECUTIVE YEARS OF COMMERCIAL CATCH (ANNUAL AVERAGE)	1,866,899	1,996,999	709,218	374,286	86,650	4,439,220
HIGHEST CONSECUTIVE YEAR LONG TERM COMMERCIAL CATCH 32, 30, 28, 26, 24, 22, OR 20 YEARS (ANNUAL AVERAGE)	1,803,935 20 YEARS (1932-1951)	1,604,741 20 YEARS (1961-1980)	751,340 24 YEARS (1956-1974)	345,878 22 YEARS (1927-1948)	92,822 20 YEARS (1934-1953)	3,860,857 20 YEARS (1949-1968)
HIGHEST NON-CONSECUTIVE YEAR LONG TERM CATCH – COMPARABLE TO PREVIOUS CATEGORY (ANNUAL AVERAGE)	2,046,410 20 YEARS	2,391,488 20 YEARS	786,554 24 YEARS	409,314 22 YEARS	96,981 20 YEARS	4,930,909 20 YEARS
ANNUAL AVERAGE CATCH FOR 22 YEARS SINCE STATEHOOD (1959-1980)	1,176,550	1,560,746	718,531	225,693	13,522	3,715,485
CONDITION DESCRIBED AS THE "PRESENT" IN THE PLAN – ANNUAL COMMERCIAL CATCH AVERAGE FOR 1971-1980	1,282,931	1,472,494	723,639	193,256	12,636	3,684,954
1980 COMMERCIAL CATCH	1,650,752	2,765,882	461,931	296,276	12,898	5,187,739

invests in each individual fish, however this fact is somewhat mitigated by the improved survival which is attained with fish that are more fully developed in a hatchery.

3.3.2.2 Habitat Modification - Stream Clearance

Stream clearance as a means of supplementing salmon production is at the other end of the complexity spectrum from hatcheries. It has a long history as a technique for salmon enhancement in Cook Inlet with stream improvement on the Salmon River, Bear Creek, and Grouse Creek recorded in 1922 and in 1930 in the Susitna, Little Susitna, and Knik Arm tributaries.

Because of its simplicity, the concept is one that is generally supported by user groups. There are, however, some attendant risks which should be considered. Complete removal of a barrier may cause a velocity barrier, scour downstream gravels, or eliminate pooling areas in the stream. Therefore, selective removal of a portion of the barrier sufficient to allow 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 are usually relatively small. Therefore, the number of fish to benefit can be smaller and still have the project produce a net gain of fish for the effort expended.

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.

3.3.2.3 Habitat Modification - Fish Pass

The construction of a fish pass (fish ladder or fishway) is the more structured and permanent form of stream clearance habitat modification. Within the Cook Inlet area there are two such facilities in operation, one at Ship Creek and the other at Russian River Falls. Additionally a number of sites throughout the Inlet have been identified as locations where this type of habitat modification would prove beneficial. Among the sites so designated are Scurvy Creek, the Paint River, Big River Lakes, Coffee Creek, Ptarmigan Lake and Port Chatham.

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

3.3.2.4 Habitat Modification - Fertilization

Fertilization as it is being considered in the Cook Inlet area involves the addition of nutrients to lakes that serve as nurseries for rearing salmon, particularly sockeye salmon. The intent of this action is to increase the quantity of phytoplankton and subsequently zooplankton, the primary source of food for the rearing salmon. Past studies have drawn a clear and strong correlation between the availability of food to the young salmon, their size at outmigration, and their survival to return as adults.

At the same time, numerous studies have shown an immense variation in the results achieved through this means of habitat modification. Results in any individual case may not be extrapolated to all other cases. Some systems have shown a negative benefit from fertilization while others have experienced up to twenty-fold increases in the returning adults. However, the majority of cases do show some positive benefit.

The ADF&G has published ''Policy and Guidelines for Lake Fertilization'' in which it outlines three stages for this type of project. The first stage, pre-fertilization study, calls for a detailed study of the physical, biological and chemical status of the lake. The 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 potential contribution of the effort to the salmon fishery.

3.3.2.5 Habitat Modification - Spawning Channels

The construction of artificial spawning channels is an effort to both increase and enhance the spawning environment. It permits the control of factors such as water flow, substrate, sedimentation and predation so that egg-to-fry survival averages 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 30 to 80 percent in 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. There has been discussion of employing such a procedure in Fourth of July Creek, but that effort has not yet been undertaken.

3.3.2.6 Habitat Modification - Water Flow Control

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

3.3.2.7 Habitat Modification - Predator/Competitor Control

This technique differs somewhat from those previously discussed because it is more a modification of the biological habitat than the physical habitat. It is often the case that in the process of trying to improve conditions for the salmon stocks at any one or a number of the different stages in their life cycles it will be necessary to take direct action on non-salmon species which function as either predators on the

young salmon or as effective competitors for food or advantageous spawning areas.

Perhaps the most widely known use of this technique has been in situations where a lake has been treated with rotenone to eliminate the resident fish populations prior to the stocking of the favored salmon species. This procedure was implemented in Bear Lake for the enhancement of sockeye salmon.

3.3.2.8 Stocking - Streams

The use of a stream stocking technique, and there are several, may be indicated when there is either a stream with low production levels and underutilized rearing habitat that is unable to rehabilitate itself within an acceptable time frame or an area of underutilized habitat which may serve as a natural rearing area. Generally, either situation would require an incubation facility.

There are at least five different approaches to implementation of this technique, and they are identified by the stage of life at which the "new" fish are released. With artificial 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 and final choice is to depend entirely upon artificial spawning, incubation and rearing and release of smolts into the stream.

This technique has been employed in some of its variations throughout the area. Crooked Creek, Seward Lagoon and Paint River are three examples of systems which have been the subject of this practice.

3.3.2.9 Stocking - Lakes

When rearing area is a limiting factor in salmon production, lakes can be used as natural nursery areas. Some lakes are underutilized while others have areas where rearing habitat is naturally void of salmon. Generally productive lakes accessible to anadromous fish have existing runs; and artificial incubation of the native stock, followed by stocking the fry in the lake, could be used to enhance the natural runs.

It is necessary to have a suitable lake in a location where a harvest is feasible and there is an available broodstock source. Pre-stocking studies are required to select suitable lakes and to ensure that stocked fry will grow and survive to migrate to sea in sufficient numbers. Careful determination of stocking density and timing may be crucial to success.

Tustumena Lake has been one of the lakes subjected to this procedure.

3.3.3 Supplemental Production Programs

In the following sections there will be a brief description of the supplemental production programs that are underway in the Inlet. In Chapters 5, 6 and 7 there is additional information about these programs and projects.

At the present time, active salmon research and enhancement programs are being conducted by the Alaska Department of Fish and Game, the Cook Inlet Aquaculture Association, the U. S. Forest Service and the U. S. Fish and Wildlife Service.

The ADF&G is the most prominent agency with regard to the overall enhancement of salmon populations in Cook Inlet. In addition to the present enhancement and research programs, the Department has five hatcheries in construction or operating in the Inlet.

The Cook Inlet Aquaculture Association is currently engaged in habitat surveys, cooperative stocking projects, smolt counts, and is in the final permit application process for a chum salmon hatchery at Eklutna. Possible future projects include lake fertilization and spawning channels.

Private non-profit hatcheries, CIAA facilities and ADF&G hatcheries are reviewed by the Regional Planning Team before they are sent to the Commissioner of Fish and Game for final approval.

The other two agencies currently involved with salmon in the Cook Inlet are the U. S. Forest Service which is working cooperatively with the ADF&G evaluating the feasibility of building fish passes on Six Mile River in the Turnagain Arm area and on Ptarmigan Creek on the Kenai Peninsula.

The U. S. Fish and Wildlife Service is conducting salmonid research in the Kenai River and the Kenai National Wildlife Refuge. At present, U. S. Fish and Wildlife studies are concentrating on various aspects of king salmon spawning behavior.

Supplemental production of sockeye salmon occurs at the Kasilof hatchery and the Big Lake hatchery and it is the major target of the Trail Lakes hatchery which is under construction.

Pink salmon supplemental production occurs at the Tutka Lagoon facility.

King salmon production results from combining efforts at the Kasilof facility (egg, smolt release) and the Anchorage Complex facility (incubation, rearing).

Coho salmon production is, at present, limited to the Anchorage Complex facility and Big Lake hatchery.

The initiation of production of chum salmon at the Tutka Hatchery is the first such effort for this species in the Inlet.

3.3.3.1 Summary of Supplemental Production

The assignment of numbers of additional fish attributable to many of the supplemental production procedures with the exception of the hatcheries is very difficult. However, it is safe to say that they are making a contribution to the overall enhancement program. As has been pointed out, the total hatchery program for the Cook Inlet area is still in a stage of growth where it is not producing what is eventually expected from it.

Since the F.R.E.D. Division is the only one now engaged in hatchery production, their projections of returns from the most recent egg takes (1980) will help to put some quantification on this effort. These estimates are based on standard survival rates with the adults returning over a period of years beginning in 1982[16]. The returning adult projections are 131,139 sockeye, 129,238 pink, 203 chum 56,250 coho and 10,680 king salmon. Thus, at this point in time it is possible to identify a contribution of at least 327,510 salmon from supplemental production.

3.4 SUMMARY OF SALMON PRODUCTION STATUS

The history of the salmon resource in Cook Inlet is a long one, but its history as an intensely managed and enhanced resource is quite short. As will be seen throughout this document, there has been improvement in the size of the runs over the last ten years and in particular in the last four years. This increase has come from an intense interest in obtaining the proper escapements, searching out opportunities to supplement the wild stocks, implementation of the 200 mile limit and favorable weather. The present status is one that should offer encouragement about the progress which is possible and which is outlined in the following chapters.

CHAPTER 4

4.0 TARGET 2000 STATUS

4.1 CONTEXT OF TARGET 2000 STATUS

The production of more fish in Cook Inlet is contemplated as a means of strengthening and preserving a resource base which will subsequently be available for harvest. That harvest will take place in order to satisfy any one or a combination of the following needs; obtaining a product for subsequent sale, meeting life-supporting needs directly, providing a commodity for barter in exchange for other needs, or providing a recreational outlet.

To determine what future harvest levels might be, the CIRPT examined recent patterns of the various user groups and trends in the strength of the resource base. Increasing harvest pressure was one of the dominant patterns. The CIRPT recognized there was not necessarily a connection between what the users might want to harvest from the resource and the ability of the Inlet to sustain the resource at that level of harvest.

The estimate of future harvest pressure in the sport fishery was initially developed by the area personnel from the Sport Fish Division of the ADF&G[17]. It represents their overall perception of that segment of the total fishery and their best assessments for future user patterns during the period covered by the Plan. The result of that assessment was presented to the CIAA Board of Directors who agreed to accept it as the best available approximation of the future harvest pressure.

The past user patterns in the commercial fishery seems to support the contention that when more fish are available to be caught and are harvested, that increased harvest is widely distributed over the majority of fishermen representing all three gear groups which are active in the commercial fishery. If this assumption is true, the production of more fish in the Inlet would set up a potential harvest situation that would be beneficial to most of the commercial fishermen. The CIAA Board of Directors endorsed the concept that future satisfaction with the fishery would be dependent on the ability of each individual fisherman to realize increased harvests.

The uncertainty surrounding the subsistence user group made assessment of what its future harvest might be very difficult. With full recognition that there might well be annual changes in the status of this group and the subsequent harvest attributable to it, the CIRPT made an assessment of potential future harvest levels. The relevance of that assessment to prevailing conditions at any given point in the future will have to be qualified by the relative change from conditions in 1980.

4.2 QUALIFICATION OF THE TARGET 2000 STATUS

Achievement of a more productive and predictable future in the salmon fishery of Cook Inlet will require identification of the relationship between what the user groups seek from the resource and the resource's ability to respond to that pressure. By establishing a target status as an expression of user group aspirations there is recognition of the first half of the relationship (what is sought). The identification of numerous projects and the volume of salmon they may produce begins the definition of the second half, capacity of the resource to respond to harvest pressure as well as utilize the available habitat to the maximal non-destructive level.

Collectively and individually user groups must recognize there is a chance their future harvest prospects as estimated here will be beyond the capacity of the Inlet resources. However, the resource may also be found to have harvest potential greater than the target status.

The programs outlined in later chapters of this Plan provide for the orderly and systematic examination of the resource potential. They also carry the implicit assumption that as the resource base is better understood and seen to be increasing, harvest of the resource will be allowed to increase in a biologically sound manner.

A key element in the relationship of user groups to a potentially expanding resource base is the number of participants in the harvest. Entry into the sport fishery requires only the purchase of a license which is available to all adults for the payment of a fee. For children under the age of sixteen even the license is not required. In this sense it is the most permissive of the three major user groups.

The maximum number of people who could be participants in the subsistence fishery is directly related to the qualifications established by the Alaska Board of Fisheries. However, what portion of those who are eligible will actually participate is unknown; and no effective prediction can be made until lasting qualifications have been in place for a sufficient length of time for an understandable pattern to develop.

Since 1973 entry into the commercial fishery of Cook Inlet has been controlled and limited. There is every reason to believe that this situation will continue, and thus the commercial fishery is the most tightly controlled of the major user groups. It is within the power of the Commercial Fisheries Entry Commission to increase the number of permits it issues, and this fact becomes important in the assessment of future harvest pressure. If the premise is that a large number of fish will result in a larger harvest for the majority of individual commercial fishermen, then the direction of the Plan to provide a greater number of

fish can be construed as an effort to improve conditions for members of this user group. However, if the number of participants in the user group increases in parallel with the increases in the resource base, any effective improvement for the individual user may well be lost.

4.3 TARGET 2000 STATUS

It became necessary to establish some target towards which the efforts of the Plan would be directed. There is no clear definition of the carrying capacity of the Inlet. Additionally, to all but the managers, the most meaningful number is the one that describes the harvest goal for the year 2000. After considerable review of historic and current trends and levels of harvest by all user groups a target of 12.000 million salmon of all species available to harvest in the year 2000 was adopted. This mark, which is about 50 percent higher than the best total harvest of salmon ever recorded in the Inlet, is both high enough to necessitate a more thorough understanding of the salmon and of the Inlet and modest enough to be within reach, if all identified projects proved both feasible and successful. It is not feasible for the Plan to consider what harvest policies may be in place in the future; and so a single total harvest number for the future target was accepted. The CIRPT's deliberations in defining this target extended over a 2-year period and could not be easily summarized without greatly expanding the text of the Plan. Therefore, the interested reader is referred to minutes of CIRPT meetings and attendant working documents for a fuller analysis of the background information used in setting the target.

Varying preferences for species of salmon based on personal taste preference, size, commercial value and other factors were recognized. However technical and biological limitations govern the increased production of each species of salmon. Therefore, the target status has been identified as a total number without reference to species composition.

The following chapter is an examination of how this target status with its attendant escapement reconciles with the recognized opportunities to enhance the total run strength of salmon in Cook Inlet.

CHAPTER 5

5.0 GAP ANALYSIS

5.1 INTRODUCTION

To conduct this analysis it is first necessary to define the gap with its qualifying elements. It is then possible to identify many of the variables which could affect the magnitude of such a gap. Finally, consideration can be given to the means of closing that gap and the implications of that closure.

5.1.1 Definition of Gap

The CIRPT developed a definition of the present condition in terms of total harvest, escapement and run strength. A comprehensive list of known and developing projects was assessed, and the respective project potentials for salmon production were quantified. The combination of that present condition and the recognized potentials produced a projected total harvest and escapement the year 2000. The difference between those projected numbers and the target status for 2000 set out in Chapter 4 is called the gap.

5.1.2 Perspective on Gap

At this point in the planning process there is no certain knowledge that the gap defined in this way can ever be entirely closed or that it can be closed within the twenty years under discussion. Achievement of that closure represents a long-term benchmark to guide examination of the potential of the Inlet and the conditions under which that potential can be realized. Efforts to close the gap need to be carefully coordinated because of the interrelationships of the salmon stocks in the Inlet and the less obvious factors associated with any one project aimed at increased salmon production.

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

Additionally the growth of one species in total numbers may have an as yet undetermined effect on the ability of another species to reach its potential.

Many opportunities to increase the number of salmon above present levels and to improve the management of the fishery exist. Each of these will have to be assessed thoroughly before it is implemented. It also seems clear that new opportunities will present themselves as work with the fishery becomes more extensive.

Thus, the gap represents not only an additional quantity of fish, but also the need for a greater depth of data about the salmon resource and a better understanding of the intricacies of its mixed-stock nature.

In the last analysis, the point of trying to close the gap is to maintain and strengthen the wild stocks while developing the ability to produce more harvestable salmon on a sustained basis and in a manner that facilitates effective management. Although harvest policies applied to that increased resource are outside the jurisdiction of the Regional Planning Team, it is clearly the intent of the Plan that that resource benefit all user groups.

5.1.3 Structure of the Analysis

The following sections develop the analysis in four major stages. Each of the four sections is introduced with a pair of exhibits made up of two charts (one chart for the even years and one for the odd years) similar to Exhibit V.

Exhibit V directs attention to the sections dealing with each of the major points of the analysis.

Each pair of exhibits highlights and summarizes the information presented in that section. The exhibits appear in succeeding sections with the new information for each section added.

Also appearing in each section is a second exhibit which summarizes the projected species composition of the harvest at that stage.

The analysis follows the headings shown in Exhibit V and concludes with a section exploring the requisite conditions and implications of complete gap closure.

GAP ANALYSIS **EXHIBIT-V**

	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	SECT. 5.2	SECT. 5.3	SECT. 5.4	SECT. 5.5	CHAP. 4.0
NON-HARVESTABLE FISH	SECT. 5.2	SECT. 5.3	SECT. 5.4	SECT. 5.5	SECT. 5.5
RUN STRENGTH	SECT. 5.2	SECT. 5.3	SECT. 5.4	SECT. 5.5	SECT. 5.5

The data and calculations supporting this chapter are found in the Appendix 6.

5.2 THE PRESENT CONDITION

To initiate this analysis it is necessary to define a beginning point against which future actions may be referenced. Exhibits W(1) and W(2) indicate what has been accepted as the current condition. They also include one other piece of "present" condition, specifically the target harvest status for the year 2000 which has been accepted by the CIRPT.

5.2.1 Time Frame

The CIRPT agreed to designate the ten-year period 1971 through 1980 as the "present." It represents a long enough period to moderate the anomalies of any one year and at the same time it encompasses at least two full cycles of each of the five salmon species being considered. Additionally, it has relevance to the history of the salmon fishery and its management. It is the second full decade of state management of the resource. This fact should suggest that there had been a full decade for the state as manager taking over from the federal government to overcome start-up problems and to begin to establish its own pattern of management. It is reasonable to assume at this time that that is the general pattern that will be in effect during the life-span of this Plan.

To derive the necessary numbers to work with in the analysis this ten-year period was divided into two five-year sets, the even years and the odd years. Total catch averages were taken in each set as were averages for the species-by-species components.

5.2.2 Data

The total catch including commercial, sport, and subsistence user groups for the even years was 4 million and for the odd years was 3.8 million. To calculate the total escapement averages for these years the

GAP ANALYSIS — **EXHIBIT-W(1)**

EVEN YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	4,078,000				12,000,000
NON-HARVESTABLE FISH	1,770,000				
RUN STRENGTH	5,848,000				

GAP ANALYSIS — **EXHIBIT-W(2)**

ODD YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	3,810,000				12,000,000
NON-HARVESTABLE FISH	1,720,000				
RUN STRENGTH	5,530,000				

HARVEST COMPOSITION-PRESENT — **EXHIBIT-X**

	Even Years	Odd Years
Sockeye	1,621,000	1,119,000
Pink	1,577,000	1,513,000
Chum	561,000	902,000
Coho	289,000	243,000
King	30,000	33,000
	4,078,000	3,810,000

only distinction by species that was made was to assume that sockeye salmon return at a per spawner rate of 4:1 while all other species were assumed to have a comparable rate of 3:1. During the present period it was assumed that all fish were natural stocks. The hatcheries which are now in operation are at less than total capacity and have been operative for considerably less than the full ten years.

The species composition in the present condition is shown in Exhibit X.

5.3 PROJECTED 1990 STATUS

The first benchmark that the CIRPT recognized was the halfway point in the Plan, the year 1990. Progress is expected by that time across a broad front. There will be increased natural production and significant supplemental production. Additionally, there will be refined management techniques and a greater understanding of the relationship between the Cook Inlet ecosystem and the salmon which occupy niches within that system. Exhibits Y(1) and Y(2) display what the CIRPT felt was possible to achieve within this short-term period if all the planned projects and management efforts were successful.

5.3.1 Identified Activities

It is expected that expansion and improvement of such things as test fishing and stock separation will noticeably facilitate the management of the fishery by 1990. Additionally, appropriate escapements during the ten-year period will bolster the overall run strength. Approximately 4.7 million of the harvest and 6.8 million of the production will come from natural stocks in the even years. In the odd years, the comparable numbers are 3.9 million and 5.6 million.

At least three major types of supplemental production and several individual site specific projects will contribute additional salmon to the harvest and, therefore, to the run by 1990.

Those hatcheries which are now in existence, in construction, or in the permitting process will be contributing in an increasing fashion during this ten-year period. Approximately 1.9 million additional salmon of all species may be anticipated in the runs from these sources.

Lake fertilization is expected to begin and to contribute to the increasing salmon resource base.

Development projects such as the transplants into Scurvy Creek and Paint River with attendant modifications such as fish passes will also begin to produce noticeable returns in the overall run.

In addition, throughout this period, it is expected that reconnaissance and research work will expose still further potential improvement opportunities which will have to be evaluated as they occur and implemented as assessments of them warrant.

5.3.2 Character of the 1990 Status

As projected here, the total condition of the salmon fishery in 1990 will exhibit several differences from the present. It will almost certainly be a fishery that is more dependent on direct and indirect human manipulation for its maintenance and stability. For that reason also, it will be more subject to socio-economic pressures.

The projected species composition of the fish available to be harvested by 1990 is shown in Exhibit Z.

GAP ANALYSIS **EXHIBIT-Y(1)**

EVEN YEAR	PRESENT 1971-1980 AVERAGES	**PROJECTED 1990 STATUS**	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	4,078,000	**6,892,000**			12,000,000
NON-HARVESTABLE FISH	1,770,000	**2,984,000**			
RUN STRENGTH	5,848,000	**9,876,000**			

GAP ANALYSIS **EXHIBIT-Y(2)**

ODD YEAR	PRESENT 1971-1980 AVERAGES	**PROJECTED 1990 STATUS**	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	3,810,000	**6,092,000**			12,000,000
NON-HARVESTABLE FISH	1,720,000	**2,584,000**			
RUN STRENGTH	5,530,000	**8,676,000**			

5.4 PROJECTED 2000 STATUS

The year 2000 represents the final benchmark for this Plan. For the second decade (1991 through 2000) the patterns of activity that were highlighted during the previous decade are expected to continue. Once again, based on the premise that the projects which have been identified will all be successful, the CIRPT could in the long-term envision attaining the levels of production and harvest shown in Exhibits AA(1) and AA(2).

5.4.1 Identified Activities

The key distinction to be made about enhancement activities during this period is that they will be based on a broader and stronger information base than was previously available. It is also assumed that this data base will point to other opportunities which cannot be identified at this time.

It is also worthy of note that all of the hatcheries which are now comtemplated or in existence are planned to be in full operation during most of this decade.

At this point, natural stocks will be contributing about 6.0 million to the harvest and about 8.7 million to the total run in the even years. In the odd years the comparable numbers are 5.0 million and 6.4 million.

5.4.2 Character of the 2000 Status

The work that is envisioned during this twenty-year period suggests that in 2000 the base of the salmon resource will be more diversified and more thoroughly distributed throughout the Inlet. There will be more natural and supplemental systems in effect. The contribution of more of the smaller systems in the Inlet drainage will be known. Management of the fishery will be more tuned to the eccentricities of the Cook Inlet system and the resource harvest which is conducted there. All of this suggests a more predictable condition which is less vulnerable to any single damaging event.

PROJECTED HARVEST COMPOSITION - 1990 **EXHIBIT-Z**

	Even Years	Odd Years
Sockeye	2,120,000	2,120,000
Pink	3,292,000	2,492,000
Chum	851,000	851,000
Coho	547,000	547,000
King	82,000	82,000
	6,892,000	6,092,000

GAP ANALYSIS **EXHIBIT-AA(1)**

EVEN YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	**PROJECTED 2000 STATUS**	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	4,078,000	6,892,000	**10,091,000**		12,000,000
NON-HARVESTABLE FISH	1,770,000	2,984,000	**4,113,000**		
RUN STRENGTH	5,848,000	9,876,000	**14,204,000**		

GAP ANALYSIS **EXHIBIT-AA(2)**

ODD YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	**PROJECTED 2000 STATUS**	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	3,810,000	6,092,000	**9,091,000**		12,000,000
NON-HARVESTABLE FISH	1,720,000	2,584,000	**3,613,000**		
RUN STRENGTH	5,530,000	8,676,000	**12,704,000**		

The projected composition of the harvest at that time is shown in Exhibit BB.

5.5 RESIDUAL GAP

Comparison of the projected 2000 status with the target 2000 status developed in Chapter 4 reveals that there is in fact a residual gap between the two harvest numbers. Using a basic per spawner return rate of 3:1 it is possible to calculate a supporting escapement for that difference in harvest. Combination of that escapement with the target 12.000 million harvest from Chapter 4 produces a total run strength necessary to support the target 2000 status harvest. Exhibits CC(1) and CC(2) present these numbers and thereby complete the last stage of the gap analysis.

The dimensions of the residual gap may be altered significantly depending on the nature of the projects found to apply against it. If some of those projects contributing to its closure allow a higher rate of harvest than that generally possible with wild stocks in a mixed stock fishery, the harvest numbers would grow more rapidly as the necessary escapement became smaller, thus requiring a lower overall run strength.

Because the projects which may be applied against the gap are largely unidentified at this time, it is not possible to estimate what the full species composition of the 12.000 million harvest would be.

The CIRPT envisions that identified, but as yet unquantifiable, projects and those presently unknown projects which will emerge during the twenty years will contribute to reducing this gap still further. Although in this analysis the gap may appear to be a matter to be addressed in the year 2000, in fact, efforts and opportunities to reduce it will be occurring throughout the twenty years.

PROJECTED HARVEST COMPOSITION - 2000 **EXHIBIT-BB**

	Even Years	Odd Years
Sockeye	3,163,000	3,163,000
Pink	4,235,000	3,235,000
Chum	1,906,000	1,906,000
Coho	695,000	695,000
King	92,000	92,000
	10,091,000	9,091,000

GAP ANALYSIS **EXHIBIT-CC(1)**

EVEN YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	4,078,000	6,892,000	10,091,000	**1,909,000**	12,000,000
NON-HARVESTABLE FISH	1,770,000	2,984,000	4,113,000	**955,000**	**5,068,000**
RUN STRENGTH	5,848,000	9,876,000	14,204,000	**2,864,000**	**17,068,000**

GAP ANALYSIS **EXHIBIT-CC(2)**

ODD YEAR	PRESENT 1971-1980 AVERAGES	PROJECTED 1990 STATUS	PROJECTED 2000 STATUS	RESIDUAL GAP	TARGET 2000 STATUS
HARVESTABLE FISH	3,810,000	6,092,000	9,091,000	**2,909,000**	12,000,000
NON-HARVESTABLE FISH	1,720,000	2,584,000	3,613,000	**1,455,000**	**5,068,000**
RUN STRENGTH	5,530,000	8,676,000	12,704,000	**4,364,000**	**17,068,000**

5.6 REPRESENTATIVE IMPLICATIONS OF GAP CLOSURE

It is clear that undertaking this ambitious program requires commitments, and it is equally clear that its eventual success would have diverse and significant implications for the salmon fishery of Cook Inlet. Some of those implications can only be hypothesized now, but a generic awareness of their potential should properly temper the progress of the work outlined in the Plan.

Assuming that there is no large scale increase in the number of commercial fishermen, there should be sufficiently more fish available to satisfactorily meet the anticipated increase in sport, subsistence and commercial fishing pressure.

The knowledge of the complete Inlet drainage and the contribution that each part is making to the entire salmon resource should increase markedly.

Certainly one of the results of this overall program would be to introduce somewhat more predictability into the fishery, making it less subject to the year-to-year fluctuations that have marked its history.

A secondary effect of that predictability, were it to be achieved, would be a stronger position for "support" industries such as processing and those smalle businesses which are an integral part of the spor fishery.

The commercial salmon fishery of Cook Inlet is part of a large and international economic scenari and is subject to supply and demand pressures arisin far outside the region or the State. Should efforts lo cally and internationally create an excess supply salmon prices and the overall condition of the industr locally would have to be re-examined.

The commitment to monitor and assess the ef fects of these new fish on the existing fish stock must be made. It is entirely possible that any new pro ject will exact some toll on the existing stocks directl associated with it. The project may then represen some net gain which can only be measured agains the specific "cost" that it exacts.

Finally the Plan as it is implemented will inevitabl require an increasing and continuous human interven tion in the status of the salmon resource. The impli cation of this requisite is the commitment to fund an staff projects and programs at a level that allow them to function effectively.

The next two chapters spell out the goals an objectives and the strategies and projects that ar implicit in the analysis carried out here.

CHAPTER 6

6.0 GOALS AND OBJECTIVES

6.1 INTRODUCTION

The overall goal of all participants in the fisheries of Cook Inlet is an improved condition in the foreseeable future. What constitutes that better condition is expressed in a series of discrete but related goals. These goals may represent a larger number of fish available to harvest by the various user groups, the collection and evaluation of new data about the production of salmon in the Inlet, or revision of management policies and practices. Binding all three types of goals together are three basic beliefs; (1) the salmon resource needs to be maintained in the strongest possible condition, (2) the most effective management can only come with the attainment of the most complete information base, and (3) the prudent harvest of the salmon to the greatest extent possible is a positive benefit to the user groups and ultimately to the region and the State.

6.1.1 Production/Harvest Goals

These goals are expressed in numbers of fish available to harvest by the user groups. They are presented in terms of the various projects which have been identified as potentially contributing to an increased resource base. In turn each individual within a user group will view that greater number in relation to his own past experience and present condition.

6.1.2 Research/Data-Gathering Goals

There are a number of efforts that need to be extended that will not directly result in more fish. They will, however, lead to a stronger and more precise harvester-manager-resource relationship so that the harvest will be as efficient as it can be. Habitat surveys will help to clarify the manner and extent to which the salmon resource of the Inlet is making use of the habitat which is available. Broadening the group of systems to which escapement monitoring is applied and the continued recording of the harvests will increase understanding of the resource. Expansion of the stock separation studies should provide a basis for refining the application of harvest pressure. Basically additional knowledge and experience are a prerequisite to the achievement of the greater harvests that are sought by all user groups.

6.1.3 Policy/Management Goals

Certainly one of the goals of the Plan is to support the adequate funding of proposed research, data-gathering, and production projects.

As a matter of policy and management the Plan will continuously be re-examined in the context of new information about the resource and the roles of the user groups.

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

6.1.4 Relationship of Goals to the Target 2000 Status

Chapter 4 established a harvest target for the year 2000 of 12.000 million salmon of all species. In Chapter 5 that target harvest was examined in the context of known projects and the production and harvests which might be expected from them. The results of that examination showed the projected species composition of a possible harvest in the year 2000 totalling approximately 10.901 million and a residual gap in harvest of 1.909 salmon of undesignated species composition. The Chapter 5 species composition of harvests in 1990 and 2000 was derived from the enhancement potential of each species as estimated by project opportunities described in this chapter.

6.2 PRODUCTION/HARVEST GOALS AND OBJECTIVES

There are three broad goals relating to the harvest and production of salmon, and two of them can be discussed in terms of more specific species goals and objectives.

GOAL:

TO MAINTAIN THE PRESENT CONDITION AS A BASE AND INCREASE AND STABILIZE THROUGH IDENTIFIED PROJECTS THE RUNS OF ALL SALMON SPECIES TO THE POINT THAT THEY WILL SUPPORT AN ANNUAL HARVEST OF 6.892 MILLION IN THE EVEN YEARS AND 6.092 MILLION IN THE ODD YEARS BY 1990.

GOAL:

TO MAINTAIN THE PRESENT CONDITION AS A BASE AND INCREASE AND STABILIZE THROUGH IDENTIFIED PROJECTS THE RUNS OF ALL SALMON SPECIES TO THE POINT THAT THEY WILL SUPPORT AN ANNUAL HARVEST OF 10.091 MILLION IN THE EVEN YEARS AND 9.091 MILLION IN THE ODD YEARS BY 2000.

GOAL:

TO PURSUE DISCOVERY OF NEW ENHANCEMENT OPPORTUNITIES AND THROUGH THE IMPLEMENTATION OF THOSE THAT ARE FOUND TO BE FEASIBLE INCREASE THE RUNS OF ALL SALMON SPECIES TO THE POINT THAT THEY WILL SUPPORT IN THE ANNUAL HARVEST AN ADDITIONAL 1.909 MILLION IN THE EVEN YEARS AND 2.909 MILLION IN THE ODD YEARS BY 2000.

The supporting goals and objectives are detailed in the following sections and summarized in Exhibit DD (page 54). For each species the goals and objectives can be categorized into those applicable to the period 1981-1990, 1991-2000, and those for which there is no specific timetable within the twenty-year bracket.

PROJECT PRODUCTION SUMMARY — EXHIBIT-DD

PROJECT	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
KASILOF HATCHERY SEE SECTION 7.3.2.1	120,000 / 160,000					120,000 / 160,000
TRAIL LAKES HATCHERY SEE SECTION 7.3.2.2	182,000 / 243,000			61,000 / 92,000	12,000 / 18,000	255,000 / 353,000
BIG LAKE HATCHERY SEE SECTION 7.3.2.3	97,000 / 130,000			53,000 / 80,000		150,000 / 210,000
ANCHORAGE HATCHERY COMPLEX SEE SECTION 7.3.2.4				133,000 / 200,000	50,000 / 75,000	183,000 / 275,000
TUTKA HATCHERY SEE SECTION 7.3.2.5		342,000 / 360,000	190,000 / 200,000			532,000 / 560,000
EKLUTNA HATCHERY SEE SECTION 7.3.2.6			205,000 / 308,000			205,000 / 308,000
ENGLISH BAY LAKES HATCHERY SEE SECTION 7.3.2.7	80,000 / 100,000	600,000 / 750,000	74,000 / 92,000			754,000 / 942,000
PAINT RIVER SEE SECTION 7.3.2.8	74,000 / 100,000	600,000 / 900,000	400,000 / 600,000			1,074,000 / 1,600,000
SCURVY CREEK SEE SECTION 7.3.2.9		160,000 / 240,000	4,000 / 6,000			164,000 / 246,000
BIG RIVER LAKES SEE SECTION 7.3.2.10	33,000 / 44,000					33,000 / 44,000
PTARMIGAN LAKE SEE SECTION 7.3.2.11	14,000 / 19,000					14,000 / 19,000
CHENIK LAKE SEE SECTION 7.3.2.12	71,000 / 95,000					71,000 / 95,000
DELIGHT AND DESIRE LAKES SEE SECTION 7.3.2.13	96,000 / 129,000					96,000 / 129,000
CRESCENT RIVER SEE SECTION 7.3.2.14	127,000 / 170,000					127,000 / 170,000
LARSON LAKE SEE SECTION 7.3.2.15	48,000 / 64,000					48,000 / 64,000
BYERS LAKE SEE SECTION 7.3.2.16	24,000 / 32,000					24,000 / 32,000
SHELL LAKE SEE SECTION 7.3.2.17	60,000 / 80,000					60,000 / 80,000
BEAR LAKE SEE SECTION 7.3.2.18				7,000 / 10,000		7,000 / 10,000
FINGER, DELYNDIA, AND BUTTERFLY LAKES SEE SECTION 7.3.2.19				8,000 / 12,000		8,000 / 12,000
OTHERS-UNSPECIFIED SEE SECTION 7.3.2.20	37,000 / 50,000	33,000 / 50,000	33,000 / 50,000	33,000 / 50,000		136,000 / 200,000
TOTAL HARVEST / RUN	1,063,000 / 1,416,000	1,735,000 / 2,300,000	906,000 / 1,256,000	295,000 / 444,000	62,000 / 93,000	4,061,000 / 5,509,000

6.2.1 Sockeye Salmon

No distinction has been made between the even and odd year runs of sockeye salmon.

6.2.1.1 Goals Scheduled for 1981-1990

GOAL:

TO INCREASE THE NATURAL STOCKS OF SOCKEYE SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 1.700 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.567 MILLION RETURNING SOCKEYE SALMON OF WHICH 0.420 MILLION WOULD BE AVAILABLE FOR HARVEST ANNUALLY BY 1990.

OBJECTIVE: To have 0.160 million returning sockeye salmon annually produced through the Kasilof Hatchery by 1990.

OBJECTIVE: To have 0.243 million returning sockeye salmon annually produced by the Trail Lakes Hatchery by 1990.

OBJECTIVE: To have 0.130 million returning sockeye salmon annually produced by the Big Lake Hatchery by 1990.

OBJECTIVE: To have 0.034 million returning sockeye salmon annually produced in the Paint River by 1990.

6.2.1.2 Goals Scheduled for 1991-2000

GOAL:

TO INCREASE THE NATURAL STOCKS OF SOCKEYE SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 2.100 MILLION FISH ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.016 MILLION RETURNING SOCKEYE SALMON OF WHICH 0.016 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To have 0.016 million additional returning sockeye salmon annually produced in the Paint River by 2000.

6.2.1.3 Unscheduled Goals (1981-2000)

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES OR COMBINATIONS OF TECHNIQUES AN ADDITIONAL 0.833 MILLION RETURNING SOCKEYE SALMON OF WHICH 0.627 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To produce through natural lake enhancement of Big River Lakes an additional 0.044 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through natural lake enhancement of Ptarmigan Lake an additional 0.019 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through natural lake enhancement and fertilization of Chenik Lake an additional 0.095 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through natural lake enhancement and fertilization of the Paint River system an additional 0.050 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through natural lake enhancement and fertilization of Delight and Desire Lakes an additional 0.129 million returning sockeye salmon by 2000.

OBJECTIVE: To produce through fertilization of Crescent Lake an additional 0.170 million returning sockeye salmon by 2000.

OBJECTIVE: To produce through fertilization of Larson Lake an additional 0.064 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through fertilization of Byers Lake an additional 0.032 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through fertilization of Shell Lake an additional 0.080 million returning sockeye salmon annually by 2000.

OBJECTIVE: To produce through the English Bay Lakes Hatchery an additional 0.100 million returning sockeye salmon by 2000.

OBJECTIVE: To produce through miscellaneous rehabilitation and enhancement projects such as stream clearance and rechannelization a total of an additional 0.050 million returning sockeye salmon by 2000.

6.2.2 Pink Salmon

In keeping with the character of pink salmon runs in Cook Inlet a distinction has been made between the even year and odd year runs.

6.2.2.1 Goals Scheduled for 1981-1990

GOAL:

TO INCREASE THE NATURAL STOCKS OF PINK SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 2.000 MILLION IN THE EVEN YEARS AND 1.200 MILLION IN THE ODD YEARS.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 1.700 MILLION RETURNING PINK SALMON OF WHICH 1.292 MILLION WOULD BE AVAILABLE FOR HARVEST BY 1990.

OBJECTIVE: To have 0.560 million returning pink salmon annually produced through the Tutka Hatchery by 1990.

OBJECTIVE: To have 0.900 million returning pink salmon annually produced in the Paint River system by 1990.

OBJECTIVE: To have 0.240 million returning pink salmon annually produced in Scurvy Creek by 1990.

6.2.2.2 Goals Scheduled for 1991-2000

GOAL:

TO CONVERT SOME OF THE CAPACITY OF THE TUTKA HATCHERY PREVIOUSLY USED FOR PINK SALMON TO THE PRODUCTION OF CHUM SALMON.

OBJECTIVE: To reduce the production of pink salmon at the Tutka Hatchery by 0.200 million annually by 2000. (There will be a corresponding increase in chum salmon.)

6.2.2.3 Unscheduled Goals (1981-2000)

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES OR COMBINATIONS OF TECHNIQUES AN ADDITIONAL 0.800 MILLION RETURNING PINK SALMON OF WHICH 0.633 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To have 0.750 million returning pink salmon produced annually through the English Bay Lakes Hatchery.

OBJECTIVE: To produce through miscellaneous rehabilitation and enhancement projects such as stream clearance and rechannelization a total of an additional 0.050 million returning pink salmon by 2000.

6.2.3 Chum Salmon

No distinction has been made between the even and odd year runs of chum salmon.

6.2.3.1 Goals Scheduled for 1981-1990

GOAL:

TO INCREASE THE NATURAL STOCKS OF CHUM SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 0.700 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.347 MILLION RETURNING CHUM SALMON OF WHICH 0.151 MILLION WOULD BE AVAILABLE FOR HARVEST BY 1990.

OBJECTIVE: To have 0.040 million returning chum salmon annually produced through the Tutka Hatchery by 1990.

OBJECTIVE: To have 0.126 million returning chum salmon annually produced in the Paint River system by 1990.

OBJECTIVE: To have 0.006 million returning chum salmon annually produced in Scurvy Creek by 1990.

OBJECTIVE: To have 0.175 million returning chum salmon annually produced through the Eklutna Hatchery by 1990.

6.2.3.2 Goals Scheduled for 1991-2000

GOAL:

TO INCREASE THE NATURAL STOCKS OF CHUM SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 1.000 MILLION ANNUALLY.

OBJECTIVE: The specific steps that would be taken to achieve this level of harvest from natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.634 MILLION RETURNING CHUM SALMON OF WHICH 0.555 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To have 0.160 million additional returning chum salmon produced through the Tutka Hatchery by 2000.

OBJECTIVE: To have 0.474 million additional returning chum salmon produced in the Paint River system by 2000.

6.2.3.3 Unscheduled Goals (1981-2000)

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES OR COMBINATIONS OF TECHNIQUES AN ADDITIONAL 0.275 MILLION RETURNING CHUM SALMON OF WHICH 0.199 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To produce through the Eklutna Hatchery an additional 0.133 million returning chum salmon annually by 2000.

OBJECTIVE: To produce through the English Bay Lakes Hatchery an additional 0.092 million returning chum salmon annually by 2000.

OBJECTIVE: To produce through miscellaneous rehabilitation and enhancement projects such as stream clearance and rechannelization a total of an additional 0.050 million returning chum salmon by 2000.

6.2.4 Coho Salmon

No distinction has been made between the even and odd year runs of coho salmon.

6.2.4.1 Goals Scheduled for 1981-1990

GOAL:

TO INCREASE THE NATURAL STOCKS OF COHO SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 0.300 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.372 MILLION RETURNING COHO SALMON OF WHICH 0.247 MILLION WOULD BE AVAILABLE FOR HARVEST BY 1990.

OBJECTIVE: To have 0.092 million returning coho salmon annually produced through the Trail Lakes Hatchery by 1990.

OBJECTIVE: To have 0.080 million returning coho salmon annually produced through the Big Lake Hatchery by 1990.

OBJECTIVE: To have 0.200 million returning coho salmon annually produced through the Anchorage complex of hatcheries by 1990.

6.2.4.2 Goals Scheduled for 1991-2000

GOAL:

TO INCREASE THE NATURAL STOCKS OF COHO SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 0.400 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

6.2.4.3 Unscheduled Goals (1981-2000)

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES OR COMBINATIONS OF TECHNIQUES AN ADDITIONAL 0.072 MILLION RETURNING COHO SALMON OF WHICH 0.048 MILLION WOULD BE AVAILABLE FOR HARVEST BY 2000.

OBJECTIVE: To produce through fertilization of Bear Lake an additional 0.010 million returning coho salmon annually by 2000.

OBJECTIVE: To produce through fertilization of Finger, Delyndia, and Butterfly Lakes an additional 0.012 million returning coho salmon annually by 2000.

OBJECTIVE: To produce through miscellaneous rehabilitation and enhancement projects such as stream clearance and rechannelization a total of an additional 0.050 million returning coho salmon annually by 2000.

6.2.5 King Salmon

No distinction has been made between the even and odd year runs of king salmon.

6.2.5.1 Goals Scheduled for 1981-1990

GOAL:

TO INCREASE THE NATURAL STOCKS OF KING SALMON TO A LEVEL THAT WOULD ALLOW A HARVEST FROM NATURAL STOCKS OF 0.020 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stocks come under the headings of research and management and are discussed in sections 6.3 and 6.4.

GOAL:

TO PRODUCE THROUGH SUPPLEMENTAL PRODUCTION TECHNIQUES AN ADDITIONAL 0.093 MILLION RETURNING KING SALMON OF WHICH 0.062 MILLION WOULD BE AVAILABLE FOR HARVEST ANNUALLY BY 1990.

OBJECTIVE: To have 0.018 million returning king salmon annually produced through the Trail Lakes Hatchery by 1990.

OBJECTIVE: To have 0.075 million returning king salmon annually produced through the Anchorage complex of hatcheries by 1990.

6.2.5.2 Goals Scheduled for 1991-2000

GOAL:

TO INCREASE THE NATURAL STOCKS OF KING SALMON TO A LEVEL THAT WOULD ALLOW HARVESTS FROM THE NATURAL STOCKS OF 0.030 MILLION ANNUALLY.

OBJECTIVE: The specific steps to be taken to achieve this level of harvest from the natural stock come under the headings of research and management and are discussed in sections 6.3 and 6.4.

6.3 RESEARCH/DATA-GATHERING GOALS AND OBJECTIVES

The expression of goals and objectives in this section will of necessity be less concrete than those which have preceded them because they relate to concepts rather to numbers of fish.

GOAL:

TO INCREASE THE DATA BASE RELATING TO HABITAT CHARACTERISTICS THROUGHOUT THE COOK INLET DRAINAGE AREA.

OBJECTIVE: To initiate a comprehensive program of habitat location surveys throughout the drainage area.

OBJECTIVE: To initiate a comprehensive program of habitat productivity surveys throughout the drainage area.

GOAL:

TO IDENTIFY THE SPATIAL AND TEMPORAL DISTRIBUTION OF SALMON STOCKS IN COOK INLET TO FACILITATE EFFICIENT HARVEST AND TO IDENTIFY AND ATTAIN ESCAPEMENT GOALS.

OBJECTIVE: To develop identification of more of the stocks that are major components of the salmon fishery.

OBJECTIVE: To refine and expand the technique of in-season test fishing.

OBJECTIVE: To make greater use of mark and recapture studies to define migratory routes within the Inlet.

OBJECTIVE: To make greater use of mark and recapture studies to identify the timing of runs within the Inlet.

GOAL:

TO IMPROVE THE PREDICTIVE CAPACITY CONCERNING FUTURE RUN STRENGTHS.

OBJECTIVE: To increase the amount of data available to define suitable spawning habitat and evaluate the productivity of the habitat.

OBJECTIVE: To increase the amount of pre-emergent fry sampling and diversify it to include all species of salmon.

OBJECTIVE: To increase the amount of smolt enumeration which is done.

OBJECTIVE: To increase the analysis of the available freshwater rearing habitat.

OBJECTIVE: To increase the research into the estuarine and marine survival criteria for juvenile salmon.

GOAL:

TO INCREASE THE KNOWLEDGE OF LAKE FERTI-

LIZATION AS IT MAY APPLY TO SOUTHCENTRAL ALASKA.

OBJECTIVE: To conduct thorough analyses of fertilization projects which are carried to recognize patterns of positive or negative characteristics.

GOAL:

TO CONTINUE EFFORTS TO INCREASE THE EFFICACY OF HATCHERY FACILITIES.

OBJECTIVE: To continue to explore possible solutions to disease problems such as that posed by the IHN virus.

OBJECTIVE: To continue to examine requisite water quality criteria.

OBJECTIVE: To continue to study the benefits associated with various release timings and stages.

OBJECTIVE: To continue to develop better genetic guidelines associated with various stocks of salmon.

6.4 POLICY/MANAGEMENT GOALS AND OBJECTIVES

Some of the goals and objectives outlined here are beyond the authority of the CIRPT, but they do represent the atmosphere in which the CIRPT wishes the Plan to be accepted and function.

GOAL:

TO BROADEN THE MANAGEMENT OF THE SALMON RESOURCE IN COOK INLET TO INCLUDE MANAGEMENT FOR ALL FIVE SPECIES OF SALMON.

OBJECTIVE: To secure sufficient staff and project budgeting to build the information base that would make management of several species possible.

GOAL:

TO INCREASE AWARENESS OF THE NEED FOR HABITAT PROTECTION.

OBJECTIVE: To widely disseminate knowledge about the locations and sensitivities of salmon habitat.

OBJECTIVE: To review all major projects not directly related to salmon for the purposes of determining their potential for habitat destruction.

GOAL:

TO IMPROVE COORDINATION BETWEEN THE MANAGEMENT OF THE RESOURCE AND THE ENFORCEMENT OF REGULATIONS PERTAINING TO THE RESOURCE.

OBJECTIVE: To support installation of permanent markers at the boundaries of closed water areas.

OBJECTIVE: To support enforcement staffing levels that will allow increases in user contacts.

OBJECTIVE: To support research that will help to prevent violations by identifying key problem areas.

OBJECTIVE: To support the acquisition of equipment that will maximize enforcement mobility.

GOAL:

TO ESTABLISH AN ACTIVE AND SIGNIFICANT ROLE FOR THE CIRPT IN THE PLANNING AND IMPLEMENTATION OF SALMON ENHANCEMENT EFFORTS IN COOK INLET.

OBJECTIVE: To have the CIRPT review all salmon enhancement projects planned for Cook Inlet.

OBJECTIVE: To have the CIRPT review and comment on all major projects which are not directly related to salmon enhancement for their potential to impede the progress of the work planned for enhancement.

GOAL:

TO ASSURE THE CONTINUED USEFULNESS AND TIMELINESS OF THE PLAN.

OBJECTIVE: To review major plan components in the light of any major changes in the base condition as described in the Plan.

OBJECTIVE: To conduct a formal review and adjustment of the Plan's components in 1985, 1990, 1995, and 2000.

CHAPTER 7

7.0 STRATEGIES AND PROJECTS

7.1 INTRODUCTION

In the preceding chapters there has been analysis of current conditions in the Cook Inlet salmon fishery (Chapters 2 and 3) and projections of the changes which may take place in the next twenty years (Chapters 4 and 5). Chapter 6 attached names and numbers to several projects which were sufficiently identified at this time to do so.

The organization of this chapter is based on the major strategies which will govern salmon enhancement in Cook Inlet in the next twenty years. Within the discussion of each strategy will be the identification of those projects which are tangible manifestations of the strategy. As has been the case throughout the Plan, a selection of the information that is presented has been made. The Plan does not contain all possible strategies or tactics, but rather those which are considered as having a practical application in Cook Inlet.

The strategies referred to are those general statements of priorities and mission that guide the specific actions of the agencies and associations working toward the enhancement of the salmon resource. The tactics are those specific actions which are usually employed to address a particular situation in a manner that furthers the overall strategy.

In the presentation of each project there is a description of the major participants in the completion of the project. Wherever possible the species involved, the work to be done, and the schedule for completion are also identified.

The projects which are still in the formative stages will, of necessity, be discussed in somewhat less detail. The process of detailing them and quantifying them will be one of the tasks to be undertaken during the twenty years of the Plan. The projects listed in this chapter are recognized and approved as strategically desirable. It should be emphasized that technical review and approval must still occur before these projects can be implemented. Should an unfavorable technical review prevent a project from implementation, alternative projects will have to be found. It is not expected that there will be a large number of new strategies or tactics between now and 2000, but new opportunities for application of these concepts and techniques should be numerous.

Exhibit EE presents a simplified schematic layout of the relationships between the major strategies, the tactics related to each of them, and the projects which arise from their implementation. Because the salmon fishery is an ongoing process with a long historical background, no clear starting place for this discussion logically presents itself. Therefore, for discussion purposes we will suggest that consideration of the process begin with the research and evaluation strategy (1). It is through this strategy that a understanding of the resource begins.

To implement the research and evaluation strategy there is a choice of several tactics (2). These tactics may be used singly or in combination, whichever is most appropriate for the problem that is being addressed.

The implementation of these tactics may lead to one of two possible results. It may point out that additional research projects are necessary (3), or it may yield information that is directly applicable to one or more of the four other major strategies (4).

Each of the other four strategies has its own set of tactics that have been identified as useful (5).

The application of all tactics occurs through specific projects which are proposed and carried out (6).

With the completion of each project there may be a contribution to the enhancement of the salmon resource (7) and new data to be fed into the research and evaluation strategy (1). Thus the cycle begins again.

As was indicated earlier there is activity in all phases of the cycle at the same time when all the enhancement efforts that are being put forth are considered. In practice there are additional cross-relationships not shown in Exhibit EE between the major strategies. That activity and those cross-relationships will be identified in more detail in the subsequent narrative sections of this chapter.

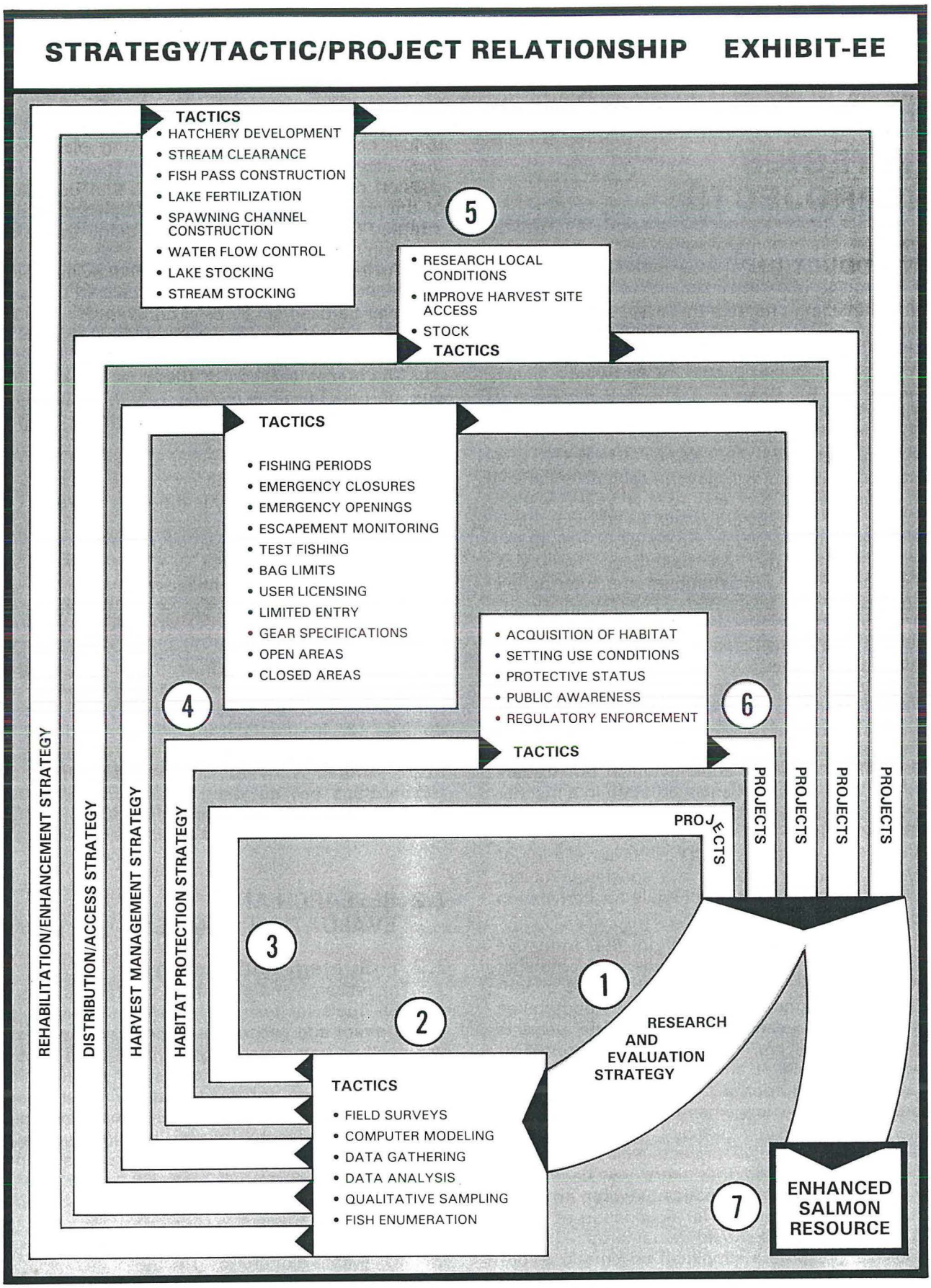
7.2 RESEARCH AND EVALUATION STRATEGY

7.2.1 Strategy and Tactics

The research and evaluation strategy is to provide effective tools for resource management. It is, therefore, indirect and supportive as compared with strategies such as harvest management. It is, of necessity, a long-term strategy that demands a dedication of funding and staff and a consistency of approach to derive useful results. Those results may lead to additional required research or may be directly applied in some other strategy. The principal tactics employed under this strategy are:

- field surveys
- computer modeling
- data gathering
- data analysis
- qualitative sampling
- fish enumeration

STRATEGY/TACTIC/PROJECT RELATIONSHIP EXHIBIT-EE



7.2.2 Projects

There are several identified projects which have to do with research, data-gathering and, ultimately, management.

7.2.2.1 Spawning Ground Survey

This project would deal with only Upper Cook Inlet and would be carried out primarily by the research arm of the Commercial Fish Division. The thrust of the project is to verify and explore the ramifications of sonar escapement counts where they exist and develop comparable monitoring where it would be useful and is not now in place. Three specific elements have now been defined within this general project. First, because of problems with migration outside the sonar counter verification of the counts on the Kasilof River is necessary. Second, there should be a program to assess the distribution of spawners in the Kenai, Kasilof and Susitna River systems. Finally, it would be useful to develop an historical perspective on previous escapements in the Susitna system where sonar has only been in operation for two years.

7.2.2.2 Upper Cook Inlet Run Modeling

There are serious time constraints on the data acquisition/management decision process which is central to the effective management of the Upper Cook Inlet fisheries. The continued development and refinement of a computer simulation model for the Upper Cook Inlet salmon stocks would be of marked assistance in data compilation and analysis.

The types of data to be processed include catch, excapement, off-shore test fishing results, and in-district test fishing results. A management system has been developed to make possible in-season data analysis. The simulation techniques will allow the managers to evaluate variations in run timing, stock abundance, and harvest management tactics so that there can be appropriate applications of fishing times and area schedules.

7.2.2.3 Evaluation of Hatchery Stocked Fry Survival - Kenai Lake

When funded, this high priority project will assess the freshwater survival of sockeye, king, and coho salmon fry released from the Trail Lakes Hatchery into Kenai Lake and its tributaries. The work will involve estimating the number of smolts resulting from the release of sockeye fry and king and coho fingerlings. Additionally there will be identification of the contribution of Trail lakes Hatchery salmon fry to the total smolt outmigration from Kenai Lake and the optimum time, location and developmental stage for fry/fingerling release.

7.2.2.4 Hidden Lake Assessment

This ongoing F.R.E.D. project is directed at gathering the requisite information to plan, implement and evaluate efforts to enhance the Hidden Lake sockeye salmon run to an optimum level commensurate with its high productivity and potential rearing capacity. Detailed information will be gathered on the significant characteristics of the adult run into Hidden Lake and the outmigrating smolt. At the same time data will be gathered to develop a limnological profile of the Lake to determine lake productivity and optimum timing for fry release into the Lake.

7.2.2.5 Quartz Creek Broodstock Evaluation

The object of this funded and ongoing F.R.E.D. project is to provide a broodstock source for the Trail Lakes Hatchery and to assess the rearing potential and survival of salmon fry to smolt in the Quartz Creek system. Adult escapement to and smolt outmigration from the Quartz Creek system will be evaluated with particular reference to wild stocks of sockeye, king and coho salmon. Similar outmigration data will be collected for hatchery stocked sockeye, king and coho salmon in the Quartz Creek system. Finally there will be an evaluation of the escapement levels, rearing capability, and other biological, chemical and physical data on the Quartz Creek system to determine a management program for this system.

7.2.2.6 Kasilof Hatchery Evaluation

The aim of this funded and ongoing F.R.E.D. project is to assess the freshwater survival of sockeye salmon released from the Kasilof Hatchery into Tustumena Lake. A related goal from a separate project is to determine the sockeye salmon rearing capacity of Tustumena Lake based on data collected through this project and through a cooperative study with the U.S. Fish and Wildlife Service. The project will determine adult escapements in selected inlet streams of Tustumena Lake. The spring-to-fall survival of both wild and hatchery sockeye salmon fry rearing in Tustumena Lake will be determined as will the fry-to-smolt survival of sockeye salmon migrating from the Lake. Finally there will also be the collection of limnological data to assess the productive potential of the Lake.

7.2.2.7 Crooked Creek King Salmon Enhancement

The goal of this F.R.E.D. project is to enhance the run of king salmon to Crooked Creek and to maintain a viable broodstock source at this site. A related goal is to assess the survival of hatchery released king salmon smolts to adult stage.

It will be necessary to assess fingerling and/or smolt survival of hatchery released king salmon to adult stage and to determine adult escapement, age composition, length and weight of returning king salmon. There will be an estimate of commercial, subsistence and sport utilization of hatchery released king salmon. Finally, there will be determination of optimum size, number and time of release for hatchery reared king salmon in order to manage the program with biological and economic efficiency.

7.2.2.8 Homer Area Salmon Smolt Stocking Program

The major goal of this F.R.E.D. project is the enhancement of the sport and subsistence fisheries in the Kachemak Bay area in future years to accommodate the greatly increased fishing pressure. This includes cooperation with the Sport Fish Division in providing an additional harvest of 15,000 coho salmon to satisfy 30,000 man-days of effort.

Coho smolt stocking programs were initiated several years ago in the Kachemak Bay area in an effort to promote the sport and subsistence fisheries. Sites utilized thus far include Fritz Creek, Homer Spit and Beluga Lake. Tasks involved with this project include: (1) smolt transport and release approval for Fritz Creek; (2) release site reconnaissance and preparation; (3) Fritz Creek release; (4) public information on release and potential returns; and (5) evaluation of adult returns.

7.2.2.9 Tutka Hatchery Evaluation

The ultimate goal of this funded and ongoing

F.R.E.D. project's tasks in combination is the increased survival and quality of Tutka Hatchery produced pink and chum salmon fry with the subsequent increase in the hatchery contribution to the Tutka Bay system adult salmon returns.

This project includes several component tasks which when conducted will combine to evaluate production at the Tutka Lagoon Hatchery. Individual tasks include: (1) evaluation of short-term rearing of pink and chum salmon fry with special emphasis on monitoring plankton population levels to determine optimum timing of release; (2) Tutka Creek wild pink and chum salmon fry evaluation performed to provide comparisons to hatchery fry quality; to provide for wild fry marking and release for comparisons of adult quality and ultimate ocean survival rates; to maintain an annual comparative index relating to levels of natural production within Tutka Creek; (3) adult salmon return evaluation program is designed to determine the number of marked salmon present in the return to ultimately estimate ocean survival rates as well as hatchery contribution to the total Tutka Bay salmon run. This program also provides for ultimate comparison of various hatchery treatment release groups as well as natural stocks; (4) Tutka Lagoon predator control study conducted to continue to collect baseline data on Dolly Varden and herring predation of wild and hatchery pink and chum salmon fry within the Tutka Creek and Lagoon system. It will help to determine the extent and feasibility of conducting future predator control programs and/or improving on hatchery release methods. Major emphasis should be placed upon determining the potential levels of herring predation; and (5) pink and chum salmon fry food habit study involves the identification and reverification of primary food sources within the Tutka Bay and Lagoon system. This task will also attempt to reconfirm as well as determine additional nursery areas utilized by pink and chum fry in Tutka Bay and Lagoon.

7.2.2.10 Halibut Cove Lagoon Saltwater Rearing Evaluation

This F.R.E.D. smolt release experimental project was designed to enhance the king salmon sportfishery in the Kachemak Bay area. It involves the ongoing king salmon smolt stocking program at Halibut Cove Lagoon which was originally started in 1974. Approximately 100,000-200,000 king salmon smolts at 20-30 per pound size were transported to the facility by barge and tanker truck where they were short-term reared and imprinted for a 2-3 week period and subsequently released on-site.

The program attempts to evaluate the relative success of releasing king salmon smolts to provide a sportfishery in the Kachemak Bay area by providing an additional harvest of 2,000 king salmon to satisfy 10,000 man days of effort.

This project, which was active in 1981 but is not scheduled for 1982, involves the continued evaluation of king salmon smolt releases by adult capture and sampling for coded wire tags (CWT). Valuable data on comparative quality of adults as well as ultimate ocean survival rates will be obtained. In addition, contribution to the fishery will also be determined. The tasks involved with this project include: (1) screening adult king salmon returns in Kachemak Bay area; (2) sample adults for age, weight and length and CWT; (3) lab analysis of CWT; (4) data reduction and analysis.

7.2.2.11 Evaluation of Responses to Sockeye Fry Stocking in a Lake with Naturally Reproducing Sockeye Stocks - Tustumena Lake

This two-part research project involves the Commercial Fish and F.R.E.D. Divisions of ADF&G in Soldotna and the Fishery Resources Program of the U.S. Fish and Wildlife Service in Kenai.

Part one of the project is to determine the potential of oxytetracycline (OTC) marking and recovery analysis as a technique for evaluating sockeye fry stocking in Tustumena Lake.

Part two involves the use of hydroacoustics to estimate the spatial and temporal distribution of juvenile sockeye salmon in Tustumena Lake.

The combination of the two parts of the project will lead to the determination of which stocking densities and procedures provide the maximal survival of stocked fry which can be obtained without detrimental impact to natural stocks.

ADF&G has a long history of research work on Tustumena Lake, one of the major sockeye producing systems in Cook Inlet. This project was initiated in 1981 with hydroacoustical surveys, and it will be ongoing through early 1986.

The information obtained from this study should have wide application in the State of Alaska and will be particularly useful in future evaluations of major sockeye producing systems in Cook Inlet. Although Tustumena Lake is currently the only major lake in Cook Inlet receiving substantial stocking of hatchery-reared sockeye fry, significant expansion of hatchery sockeye production will occur in the near future. The techniques developed for evaluating stocking responses in Tustumena Lake and the results obtained from this investigation should be very useful in planning, coordinating and implementing an effective stocking program for sockeye production.

7.2.2.12 Marking Effectiveness on Sockeye Salmon

The National Fisheries Research Center (U.S. Fish and Wildlife Service) through its Alaska Field Station is assisting the F.R.E.D. Division of ADF&G with a research project on the effectiveness of fin clipping and OTC marking of sockeye salmon. The stocks being examined originated from Tustumena and Russian Lakes. The project is exploring the rate of fin regeneration and the length of time that OTC markings are effective. The project, which was initiated in 1981, may continue in 1982. The reliability of marking techniques is important to many other research and management strategies.

7.2.2.13 Deshka River Coho Salmon Study

Since 1980 the Alaska Field Station of the National Fisheries Research Center and the Sport Fish Division of ADF&G have been involved in radio tagging of coho salmon in the Deshka River. The purpose of the study was to identify both spawning areas and travel time of coho salmon using the Deshka River. The method employed was to tag, release and radio track migrating adults. Several mainstem spawning areas were found in 1980. The project may be continued in 1982.

7.2.2.14 Anchor River King Salmon Study

The Sport Fish Division of ADF&G and the Alaska Field Station of the National Fisheries Research Center plan to undertake a radio tagging study in 1982 to investigate the behavior of king salmon in the Anchor River. The tagging, which would occur near the mouth of the Anchor River, would be designed to yield information on travel patterns and timing and to determine the vulnerability of king salmon to the anglers.

7.2.2.15 Sixmile Creek King Salmon and Coho Salmon Study

During 1980 and 1981 the U.S. Forest Service undertook a project to determine the run size and behavior of adult king and coho salmon returning to Sixmile Creek. The Alaska Field Station of the National Fisheries Research Center assisted with this study in 1980. A velocity barrier in the Creek had already been identified as an impediment to at least some of the adult salmon. The three major points of this project were: (1) to determine the size of the king and coho salmon runs to the Creek, (2) to determine how many salmon are able to negotiate the velocity barrier and (3) to determine the portions of the upstream habitat which they use for spawning. The observation of adult salmon above the velocity barrier indicated that significant numbers of fish make it through the barrier and make use of the upstream habitat.

7.2.2.16 Kenai River Spawning and Rearing Study

The Alaska Field Station of the National Fisheries Research Center, under contract with their Division of Ecological Services, and with assistance from the Sport Fish and F.R.E.D. Divisions of ADF&G has been conducting studies on salmon in the Kenai River system. The studies cover two broad areas of concern: (1) the spawning areas, travel timing and patterns of returning adults, and (2) the identification and definition of preferred habitat for juvenile salmon. In both cases the data were sought as a means of identifying impacts on the salmon resource from development and to provide management data for ADF&G biologists.

Adult king and coho salmon were tagged to determine their rate of upstream movement and spawning destination. The project has already identified significant differences between the early and late runs of king salmon in the Kenai River. Early run salmon preferred tributaries for spawning, while late run fish preferred the Kenai River proper. In addition a clearer picture of the characteristics of the preferred habitat and the extent of habitat usage in the Killey River system (a Kenai tributary used by early run kings) has begun to emerge.

The second portion of this work was also going on in 1979, 1980 and 1981 through studies to determine the habitat requirements of juvenile king, coho and sockeye salmon in the Kenai River. The project included data collection for the development of preference curves for velocity range, depth range, food and cover. Major rearing areas were identified through catch-per-unit-of-effort analysis.

7.2.2.17 Genetics of Russian River Sockeye Salmon

Since 1978 the Alaska Field Station of the National Fisheries Research Center, in cooperation with the Sport Fish Division of ADF&G, has studied the genetics of Russian River sockeye salmon. In each of four years a major genetic difference was found between early and late run sockeye, thus a potential exists for future stock separation. This study is being continued.

7.2.2.18 Susitna River Radio Tagging Study

Under contract to ADF&G (SuHydro), the Alaska Field Station of the National Fisheries Research Center has assisted in radio tagging of king, coho and chum salmon in the Susitna River during 1981. Objectives of the study were to determine the extent of habitat utilization by salmon in the upper Susitna near the proposed hydroelectric facility.

7.2.2.19 Preliminary Site Investigations For Potential Hatchery, Lake Stocking, and Habitat Improvement Sites

The major goal of this project which is not currently funded is to insure the proper selection of candidate F.R.E.D. Division project sites in the lower Cook Inlet area.

It involves the inventory and ultimate identification of lower Cook Inlet area potential F.R.E.D. projects. More specifically, an attempt would be made to prioritize these inventoried areas as potential hatchery, lake stocking and rehabilitation, fish ladder or habitat improvement sites. The following tasks would be involved: (1) identification of potential sites by map and aerial photo interpretation; (2) on-site reconnaissance of selected sites; (3) initiate physical and biological monitoring at high priority sites; (4) engineering site reconnaissance of top priority sites.

7.2.3 Summary

The preceding nineteen projects are representative of the research and evaluation strategy which seeks to understand the present condition in the context of the major factors that influence it. This effort to understand is more than purely academic because it is directed at more effective application of management and enhancement practices. This strategy functions like an umbrella over the other strategies preceding their application (Section 7.2.2.19), serving as an integral part of their implementation (Section 7.2.2.2), and assessing their effectiveness (Section 7.2.2.10).

7.3 REHABILITATION/ENHANCEMENT STRATEGY

7.3.1 Strategy and Tactics

These are strategies designed to replenish depressed stocks and increase the number of naturally occuring salmon beyond levels that they would reach without the intervention of man. In most cases a sequence of tactics is necessary to achieve the end which is sought. They are procedures applied to the fish and/or the various habitats in which they are or could be present. After appropriate consultation with ADF&G, any one of several associations and agencies which are interested in salmon enhancement might actually carry out the work.

The following prominent tactics used under this strategy have been discussed in detail in Section 3.3.2.

- hatchery development
- stream clearance
- fish pass construction
- lake fertilization
- spawning channel construction
- water flow control
- lake stocking
- stream stocking

7.3.2 Projects

While a large number of projects have received the attention of the CIRPT, the members realize that still others, perhaps many of them, will emerge as offering some potential during the twenty years of the Plan. The most fully developed of these rehabilitation and enhancement projects have been accounted for in Chapter 5 and identified in Chapter 6. These can be designated as quantifiable projects (Exhibit FF), but it should be clearly understood that much examination of their individual feasibility remains to be done.

7.3.2.1 Kasilof Hatchery

The Kasilof Hatchery functions as a remote incubation facility for sockeye salmon and as an egg take site for king salmon and steelhead. Selected tributaries of Tustumena Lake are the sources of sockeye salmon eggs which are taken to the hatchery and reared to the fed fry stage. The hatchery will be at its capacity of 20 million eggs in 1981. Most of the fry are released in Tustumena Lake.

It is a F.R.E.D. facility that will account for 160,000 adult sockeye salmon by 1990. This projection is based on the assumption that appropriate levels of funding and staffing will be continued.

7.3.2.2 Trail Lakes Hatchery

Construction of this F.R.E.D. facility began in the spring of 1981. While three salmon species may be handled by the hatchery (sockeye, coho, and king), sockeye salmon will be the dominant species accounting for about 69 percent of the annual production. The facility located in the eastern portion of the Kenai Peninsula near Kenai Lake is expected to be at full capacity by 1992. This would mean the annual production of 243,000 adult sockeye salmon, 92,000 adult coho salmon, and 18,000 adult king salmon. It is anticipated that the facility will function as a central incubation facility, receiving eggs from as yet undesignated sites and returning fry to as yet undesignated locations. The assumption is that sufficient funding will be made available for the hatchery to proceed as now envisioned.

7.3.2.3 Big Lake Hatchery

F.R.E.D.'s Big Lake Hatchery a short distance north of the Knik Arm has been operational since 1974. The strategy involved is to rear sockeye and coho salmon fry and release the sockeye salmon into Fish Creek, Meadow Creek, Nancy Lake and Wasilla Lake. The coho salmon fry are released into the Little Susitna River and other systems in the Matanuska-Susitna valleys. By 1990 it is expected that production from this facility will be about 130,000 adult sockeye salmon and 80,000 adult coho salmon.

7.3.2.4 Anchorage Hatchery Complex - Ft. Richardson and Elmendorf

The F.R.E.D. facility at Fort Richardson is the major component of this complex. Crooked Creek is the present source of king salmon eggs for this facility. Coho salmon eggs are secured in Bear Creek near Seward, but a new site is being sought. King salmon releases occur in the Matanuska-Susitna valleys, Halibut Cove, and Crooked Creek. The coho salmon are released in Fritz Creek, Halibut Cove, Seward, Whittier, and on the Homer Spit and are used in lake stocking in landlocked situations. Given the appropriate funding and staffing it is projected that this complex which is undergoing expansion that will be complete in 1982 could account for the annual production of 75,000 adult king salmon and 200,000 adult coho salmon by 1990.

7.3.2.5 Tutka Hatchery

This F.R.E.D. hatchery on Tutka Lagoon on the south side of Kachemak Bay has been in operation since 1975 and has been functioning primarily as a producer of pink salmon. The location is such that it lends itself to a terminal harvest. Overall production is expected to increase at this facility, and in the process there will be a change in emphasis so that by the year 2000 chum salmon will be approximately 36 percent of the annual production. The broodstock for this facility comes from Port Dick and Tutka Creek, and in addition to releases at the hatchery some releases have occurred in the Paint River system. Assuming funding and staffing support annual production is expected to reach 360,000 adult pink salmon and 200,000 adult chum salmon.

7.3.2.6 Eklutna Hatchery

The Eklutna Hatchery is now in the final stages of permitting and will be a CIAA facility located near the upper end of the Knik Arm. Construction of the facility is scheduled to begin in 1981 with production slated to begin in 1982. This will be the first private non-profit hatchery in Cook Inlet and will be basically a chum salmon facility, although there is some provision for experimentation with the production of coho salmon. Initial broodstocks will come from stocks originating in the vicinity of the hatchery. By 2000 annual chum salmon production from this facility is expected to be 308,000 adult fish.

7.3.2.7 English Bay Lakes Hatchery

Details of this project have not yet been developed nor has it been funded, however the site on the south side of Kachemak Bay did emerge as a good candidate for a hatchery as a result of the F.R.E.D. site selection process. Three species are contemplated as being feasible for this hatchery, sockeye, pink and chum salmon. It is a site that would lend itself to a terminal harvest technique. Annual production could account for 100,000 adult sockeye salmon, 750,000 adult pink salmon, and 92,000 adult chum salmon by 2000.

7.3.2.8 Paint River System

Work has already been undertaken on the Paint River as a result of cooperative efforts between the F.R.E.D. Division and CIAA. Both are expected to continue involvement in the project and will probably be joined in an increasing fashion by the Commercial Fish Division in the later stages of the project. Three basic tactics may be involved in this effort. First, salmon have already been planted in the system; but a large falls near the mouth of the river prevents returning salmon from reaching the upper portions of the river system. Thus, the second tactic which may be funded

QUANTIFIABLE PROJECTS

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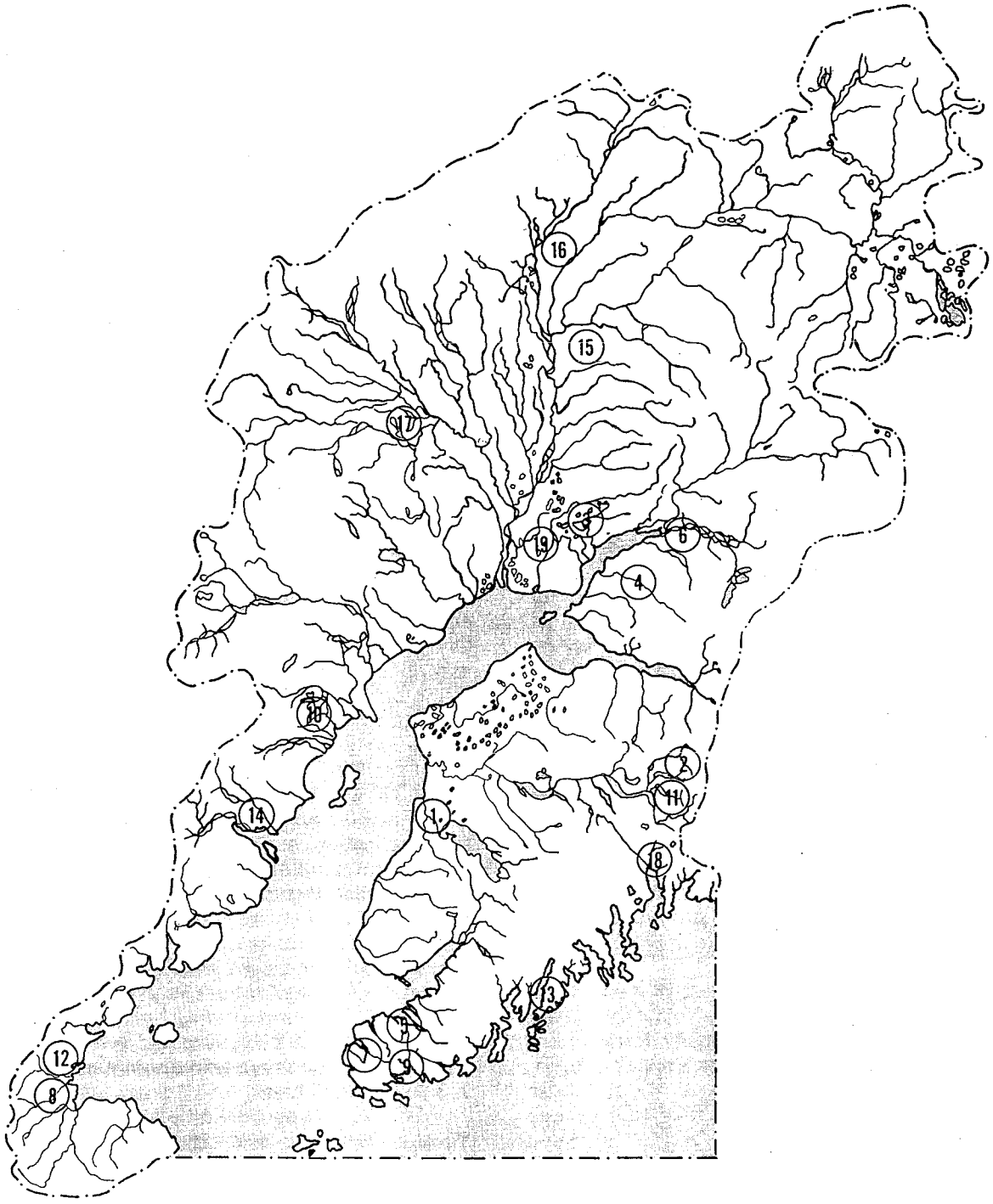


1 KASILOF HATCHERY
2 TRAIL LAKES HATCHERY
3 BIG LAKE HATCHERY
4 ANCHORAGE HATCHERY COMPLEX
5 TUTKA HATCHERY
6 EKLUTNA HATCHERY
7 ENGLISH BAY LAKES HATCHERY
8 PAINT RIVER
9 SCURVY CREEK
10 BIG RIVER LAKES
11 PTARMIGAN LAKE
12 CHENIK LAKE
13 DELIGHT AND DESIRE LAKES
14 CRESCENT RIVER
15 LARSON LAKE
16 BYERS LAKE
17 SHELL LAKE
18 BEAR LAKE
19 FINGER, DELYNDIA, AND BUTTERFLY LAKES

in FY 82 is feasibility planning which will examine construction of a fish pass. Finally, once the fish pass is complete and the runs have been established, it is possible that the system will be a suitable candidate for fertilization. Once established the production of this system would be sufficiently discrete to be the subject of a terminal harvest. That production could number 100,000 adult sockeye, 900,000 adult pink, and 600,000 adult chum salmon annually.

7.3.2.9 Scurvy Creek

This is a project in Rocky Bay in which CIAA has taken the lead in cooperative efforts with the F.R.E.D. and Commercial Fish Divisions. Work began with the stocking of pink and chum salmon in 1980. Port Dick and Rocky River served as sources of broodstocks. Observation of the system indicated that the presence of a velocity chute creates a serious impediment to the upstream migration of adult pink salmon. It appears that some blasting of the ledge that forms the velocity chute will allow for the creation of a partial channel diversion with sufficient pools to allow adult salmon to pass upstream. When sufficient runs have been established the project would lend itself to a terminal harvest. Production is estimated at 240,000 adult pink salmon and 6,000 adult chum salmon annually.

7.3.2.10 Big River Lakes

This project located inland from Redoubt Bay and the West Forelands is one that has been undertaken by CIAA. Initial habitat surveys were done in 1980; and additional, more detailed work, is scheduled for 1981. The site contains six non-glacial lakes one of which has no apparent potential and four of which already have natural runs of sockeye and coho salmon. The remaining lake in the system has several barriers to the migration of adult salmon. One of the tactics involved would be the clearance of those barriers. Certainly an additional tactic would be to plant fish in the lake. Further study will reveal whether the most suitable use of the complex is rearing, the establishment of annual runs, the construction of a hatchery, or some combination of these possibilities. With the clearance of the barriers and the planting of fish in the lake, it is expected annual production could be increased by 44,000 adult sockeye salmon.

7.3.2.11 Ptarmigan Lake

This 640 acre lake just to the east of Kenai Lake could provide production through the installation of a fish pass, some stocking and potentially fertilization. F.R.E.D. Division and the U.S. Forest Service are cooperatively involved in this project. After the fish pass is built, it is expected that it would take four or five years of stocking to establish the run of sockeye salmon which would account for about 19,000 adult fish annually.

7.3.2.12 Chenik Lake

Chenik Lake is a 292 acre lake located just west of Kamishak Bay and is the object of an as yet unfunded F.R.E.D. Division project involving several tactics. The lake has an historic escapement of about 50,000 sockeye salmon. However it is felt that with channel improvement in the area of the rock sills near the mouth, stocking, and fertilization the system could annually produce 95,000 adult sockeyes. The system was stocked with fry from Tustumena Lake in 1978 and 1979.

7.3.2.13 Delight and Desire Lakes

Although they are physically separate, these two lakes on the east side of the East Arm of Nuka Bay are viewed as a single 1,086 acre unit for this project proposed by the F.R.E.D. Division. Both lakes are candidates for fertilization and would provide the opportunity for terminal harvests. Production from this project could reach 129,000 adult sockeye salmon annually.

The Regional Planning Team has been advised by the National Park Service that this project would require actions which would "constitute an inappropriate and unacceptable change to National Park Service lands and waters and are directly contrary to both law and policy." The Team understands this present limitation but will continue to carry the project representing a potential resource which would be available for realization should law and policy change during the life of the Plan.

7.3.2.14 Crescent River

The Crescent River and Crescent Lake, a glacial lake, are located on the north side of Tuxedni Bay and are the objects of a project involving both F.R.E.D. and Commercial Fish Divisions. The key element of the project would be fertilization of the 1,658 acre lake, and pre-fertilization studies are already underway. The success of this project could mean an additional 170,000 adult sockeye salmon annually.

The Regional Planning Team has been advised by the National Park Service that this project would require actions which would "constitute an inappropriate and unacceptable change to National Park Service lands and waters and are directly contrary to both law and policy." The Team understands this present limitation but will continue to carry the project representing a potential resource which would be available for realization should law and policy change during the life of the Plan.

7.3.2.15 Larson Lake

This 800 acre lake near Talkeetna is a candidate for fertilization as a F.R.E.D. Division project. Pre-fertilization studies have yet to be done, but it is believed that this tactic could produce an additional 64,000 adult sockeye salmon annually.

7.3.2.16 Byers Lake

This 400 acre lake east of the Chulitna River is a candidate for fertilization as a F.R.E.D. Division project. Pre-fertilization studies have yet to be done, but the success of this tactic could produce an additional 32,000 adult sockeye salmon annually.

7.3.2.17 Shell Lake

This 1,000 acre lake between the Skwentna and Yentna Rivers is a candidate for fertilization as a F.R.E.D. Division project. Pre-fertilization studies have yet to be done, but it is believed that this tactic could produce an additional 80,000 adult sockeye salmon annually.

7.3.2.18 Bear Lake

This 445 acre lake just north of Resurrection Bay is a candidate for fertilization as a F.R.E.D. Division project and, in fact, has already had two years of pre-fertilization studies conducted on it. It is expected that the employment of this tactic could annually produce an additional 10,000 adult coho salmon.

7.3.2.19 Finger, Delyndia and Butterfly Lakes

These three lakes situated between the Susitna

River and Big Lake and totalling approximately 600 acres are candidates for fertilization as a F.R.E.D. Division project. Pre-fertilization studies have yet to be done, but it is believed that this tactic could produce an additional 12,000 adult coho salmon annually.

7.3.2.20 Developing Projects

The level of information about some projects is such that no project-by-project estimate of potential salmon production can be made. However, there was general consensus that some increased production was possible. Thus, a total of 50,000 each for four species of salmon were included in the projected 2000 status described in Chapter 5 and attributed to these projects. It is entirely possible that as some of these projects become more fully developed refinement of those numbers will be possible. The location and nature of each of these projects is shown in Exhibit GG.

These projects include general fisheries development work at Packers Lake, Portage Ponds, Sixmile Creek, and Bull Dog Cove. There are also construction oriented projects such as fish passes at Leisure Lake and rearing ponds in Resurrection Bay. The remainder of these projects involve some form of obstacle clearance to facilitate the passage of salmon in Island Creek, Dogfish Bay Creek, Windy Right Creek, Porcupine Cove, Two Arm Bay, Port Dick (Middle Creek), Gore Point Lake, Rocky River, and at Anderson Beach and Nuka Island.

The Regional Planning Team has been advised by the National Park Service that the Bull Dog Cove, Porcupine Cove, Two Arm Bay and Nuka Island projects would require actions which would "constitute an inappropriate and unacceptable change to National Park Service lands and waters and are directly contrary to both law and policy." The Team understands this present limitation but will continue to carry the projects representing potential resources which would be available for realization should law and policy change during the life of the Plan.

7.3.2.21 Suspected Projects

One step further removed are those projects which have not yet received any study and are based on the most general knowledge of their locale. They would, however, rank high on the list of investigative priorities as the Cook Inlet salmon enhancement planning process moves into Phase II, the specific addressing of the goals and objectives set out here. These projects are located and identified on Exhibit HH.

The Regional Planning Team has been advised by the National Park Service that the Delight Lake Hatchery, Nuka Bay Hatchery and Strike Creek projects would require actions which would "constitute an inappropriate and unacceptable change to National Park Service lands and waters and are directly contrary to both law and policy." The Team understands this present limitation but will continue to carry the projects representing potential resources which would be available for realization should law and policy change during the life of the Plan.

7.3.3 Summary

These 46 projects represent a broad range of tactics under the general heading of rehabilitation/enhancement strategy. More fish will be made available through hatchery incubation of eggs (Section 7.3.2.1), new or additional habitat will be made accessible to spawning salmon (Section 7.3.2.8) and production of existing systems can be increased (Section 7.3.2.13). Each of these efforts will have to be subjected to the evaluation strategy discussed previously and will provide additional considerations for the harvest management strategy which will be discussed in a later section.

7.4 DISTRIBUTION/ACCESS STRATEGY

7.4.1 Strategy and Tactics

There are several ADF&G projects for sport fish enhancement which involve stocks already accounted for in other previously discussed projects, and these additional projects concern themselves with the distribution of those stocks and harvester access to them. Therefore, the following projects deal with new harvest opportunities, not additional fish. The tactics used in this strategy are:

- research local conditions
- improve harvest site access
- stock

7.4.2 Projects

7.4.2.1 Little Susitna River Coho Salmon Enhancement

The object of this project is to provide a harvest of 10,000 late run coho salmon which will result in an estimated 20,000 man-days of additional recreational fishing opportunity.

In addition to improving the Burma Road access to lower portions of the Little Susitna River, it will be necessary to determine magnitude, distribution and timing of all segments of the escapement. Identification of various adult capture and juvenile release sites will include study of lakes of the Nancy Lake Recreation Area, including Nancy Lake. Subsequently, there will be determination of optimum smolt release size, age, timing and locations, and assessment of the contribution to the recreational fisheries of the Little Susitna River. Finally, there will be evaluation of the effect of coho salmon plants on other rearing species, i.e., king, sockeye, etc. King salmon enhancement may be practical in this system if it can be demonstrated that such a program does not conflict with the primary goal of coho salmon production (See Section 7.4.2.2).

7.4.2.2 Little Susitna River King Salmon Enhancement

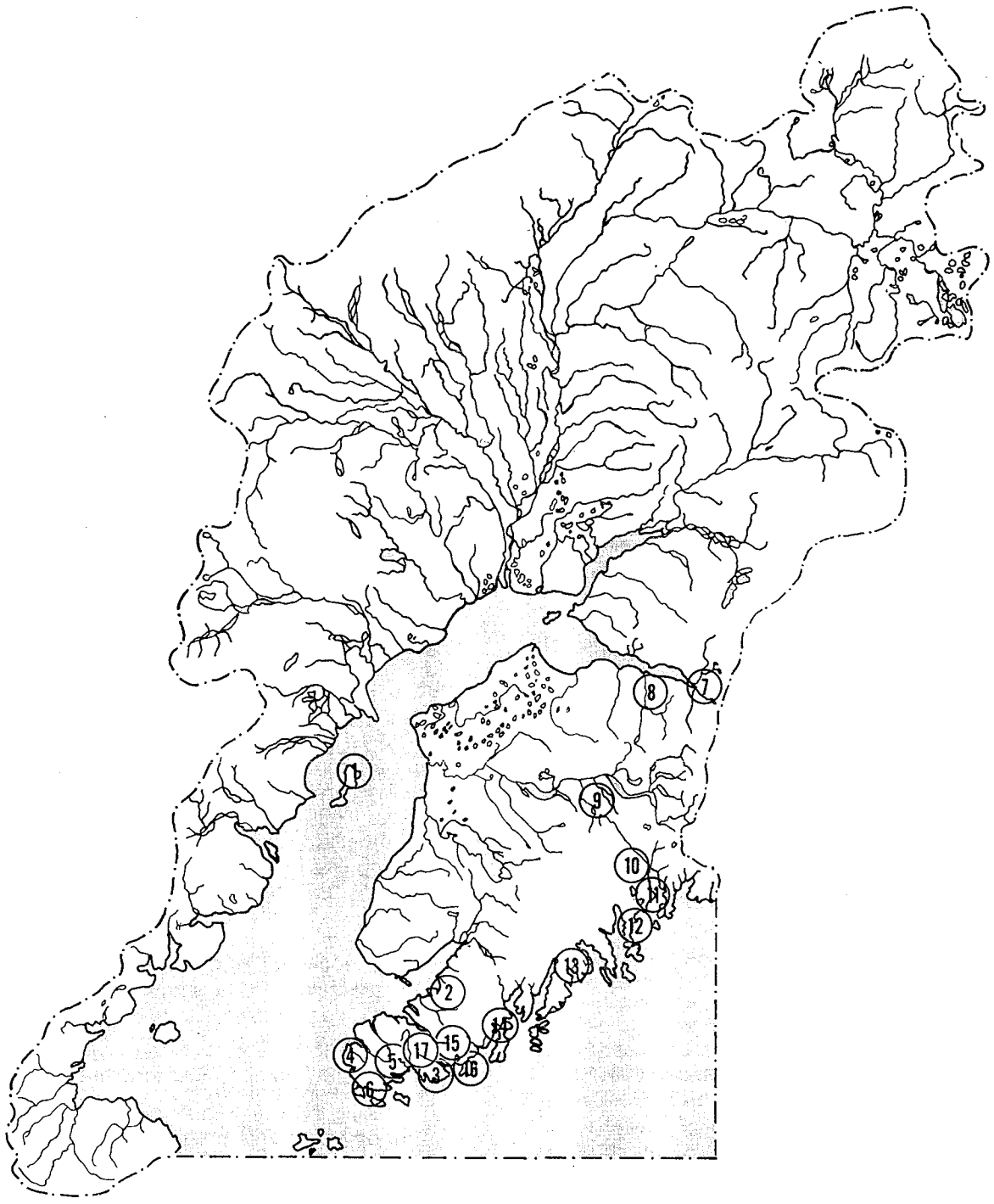
The object of this project is to provide a harvest of 6,000 king salmon which will result in an estimated 30,000 man-days of additional recreational opportunity. The requirements and procedures would be the same as were outlined in Section 7.4.2.1.

7.4.2.3 Early Russian River Sockeye Salmon Enhancement

This presently unfunded project would provide an additional harvest of 20,000 sockeye salmon to satisfy 33,000 man-days of effort. It would initiate studies on the types of sockeye salmon egg incubation systems or flood bypass systems that would provide stable fry production from Upper Russian Creek. The early run of Russian River sockeye salmon has been

DEVELOPING PROJECTS

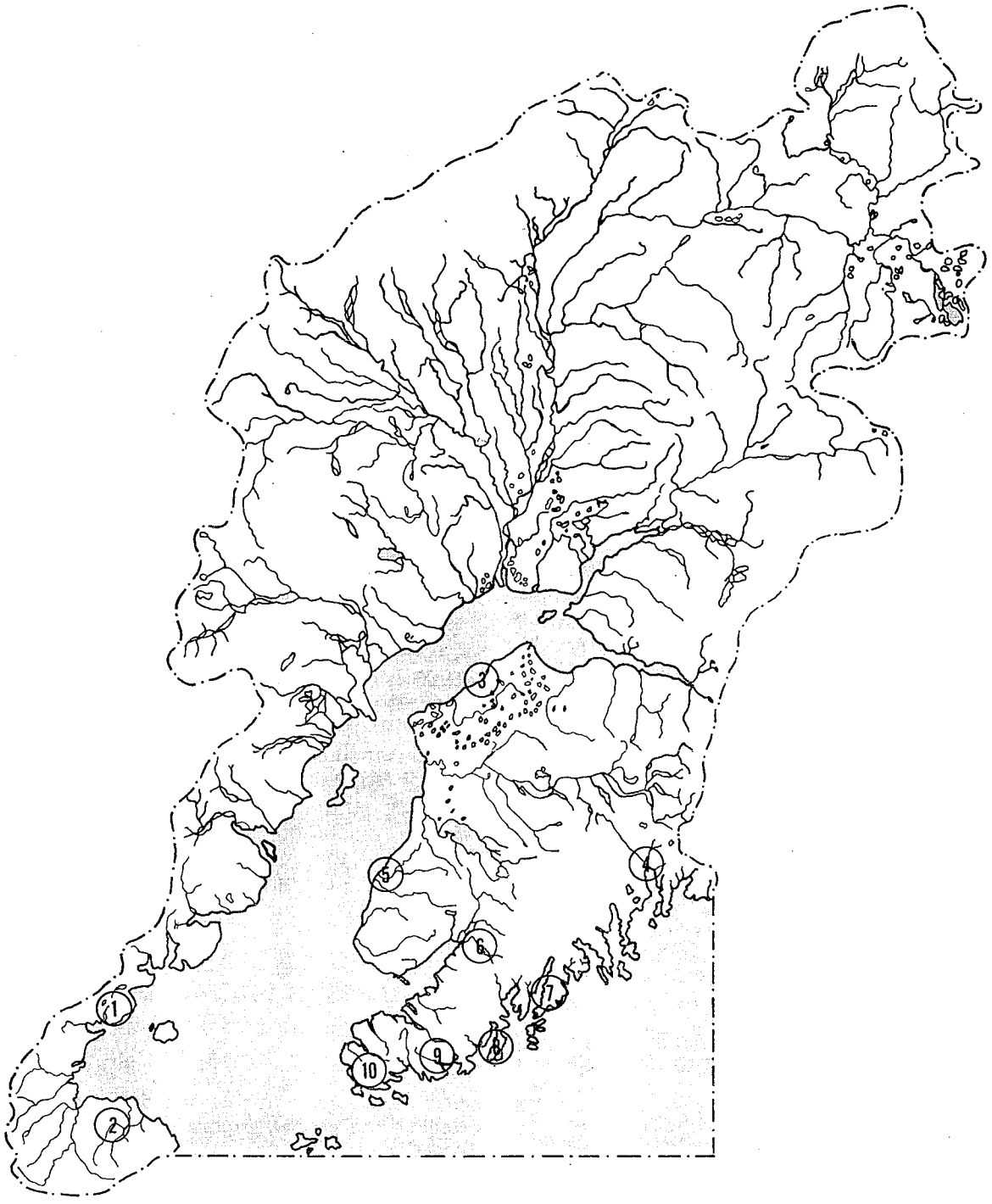
EXHIBIT-GG



1 PACKERS LAKE DEVELOPMENT
2 LEISURE LAKE FISH PASS
3 ISLAND CREEK CLEARANCE
4 DOGFISH BAY CREEK CLEARANCE
5 WINDY RIGHT CREEK CLEARANCE
6 ANDERSON BEACH CLEARANCE
7 PORTAGE PONDS DEVELOPMENT
8 SIX MILE CREEK RUN DEVELOPMENT
9 RUSSIAN RIVER FLOW BYPASS
10 RESURRECTION BAY REARING PONDS
11 BULL DOG COVE CLEARANCE
12 PORCUPINE COVE CLEARANCE
13 TWO ARM BAY CLEARANCE
14 NUKA ISLAND CLEARANCE
15 PORT DICK (MIDDLE) CREEK CLEARANCE
16 GORE POINT LAKE CLEARANCE
17 ROCKY RIVER CLEARANCE

SUSPECTED PROJECTS

EXHIBIT-HH



1 KIRSCHNER LAKE STREAM RECHANNELIZATION
2 STRIKE CREEK FISH LADDER
3 BIRCH HILL HATCHERY
4 RESURRECTION BAY ODD-YEAR PINK/CHUM DEVELOPMENT
5 NINILCHIK NATIVE ASSOCIATION HATCHERY
6 BRADLEY LAKE HATCHERY
7 DELIGHT LAKE HATCHERY
8 NUKA BAY HATCHERY
9 PORT DICK (MIDDLE CREEK) DEVELOPMENT
10 PORT CHATHAM FISH PASS

selected by the Trail Lakes broodstock planning team as a primary broodstock for the hatchery.

7.4.2.4 Willow Creek Coho and King Salmon Enhancement

This project will provide a harvest of 6,000 king salmon and 6,000 coho salmon which will result in an estimated 42,000 man-days of additional fishing opportunity, but it is contingent upon development of an access road along the lower portion of Willow Creek to its junction with the Susitna River.

Besides improving access to the mouth of Willow Creek by road-boat launch construction, it will be necessary to identify various adult and juvenile release sites. Optimum smolt and/or fingerling stocking densities, sizes and release times must be determined; and then there must be evaluation of enhancement contributions to Willow Creek fishery and to fisheries of the Deshka River and Alexander Creek (downstream Susitna River tributaries). Finally, there will be an evaluation of the effects of king salmon enhancement on the system's coho salmon population. Coho salmon enhancement may be practical in this system, if it can be demonstrated that such a program does not conflict with the primary goal of king salmon enhancement.

7.4.2.5 Caswell Creek Coho Salmon Enhancement

This project will provide a harvest of 6,000 late run coho salmon which will result in an estimated 12,000 man-days of additional recreational fishing opportunity; and to evaluate harvest and catch distributions at the mouths of downstream Susitna River tributaries.

The magnitude, distribution and timing of all segments of the escapement into the system will be determined; and various adult capture and juvenile release sites will be identified. Optimum fry and/or smolt release densities, size, age and timing must be determined. These studies must include, but not be limited to, evaluation of lotic and lentic releases, fry-fingerling versus smolt releases and accelerated versus full-term smolt releases. Finally, there should be assessment of the contribution of enhanced coho salmon to the Caswell Creek fishery and to fisheries of the lower Susitna River.

7.4.2.6 Resurrection Bay Coho Salmon Enhancement

This project will provide an additional harvest of 10,000 coho salmon to satisfy 20,000 man-days of effort. It will involve determination of the optimal coho salmon fry stocking density for rehabilitated Bear Lake and the optimal coho salmon smolt release size and timing for the Seward Lagoon and Resurrection Bay tributary streams. It will require construction of a rearing pond system in the lower Resurrection River area to utilize coho salmon fry "downstream drift." The feasibility of increasing the stocked coho salmon fry to smolt production in Bear Lake by employing artificial fertilization methods must be investigated.

7.4.2.7 Early Kenai River King Salmon Enhancement

This project will provide an additional harvest of 5,000 king salmon to satisfy 25,000 man-days of effort. Optimal king salmon smolt release size and timing must be determined. Additionally, a trap has bee constructed in the lower Kenai River to assess supple mental king salmon production utilizing tag an recovery methods.

7.4.2.8 Knik Arm Tributaries Coho Salmon Enhancement

This project, which includes Fish, Cottonwoo and Wasilla Creeks, will provide a harvest of 9,00 late run coho salmon which will result in an estimate 18,000 man-days of additional fishing and oppor tunity to develop and evaluate various coho salmo enhancement practices.

The magnitude, distribution and timing of all seg ments of the escapement into Cottonwood and Wa silla Creeks must be determined; and various adul capture and juvenile release sites identified. Optima fry and/or smolt release densities, size, age and timin will be determined. These studies must include, bu not be limited to evaluation of lotic versus lentic re leases, fry-fingerling versus smolt releases and accel erated versus full-term smolt releases. The contribu tion of enhanced stocks to the recreational fisheries o the respective systems will be evaluated. There wi be an evaluation of the effect of coho salmon plant on other species. Emphasis should be directed towar interactions between sockeye salmon and rainbo trout. Coho salmon production must not significantl interfere with or impact the enhancement of Fis Creek sockeye salmon.

7.4.2.9 Late Kenai River Coho Salmon Enhancement

This project will provide an additional harvest o 10,000 coho salmon to satisfy 20,000 man-days o effort. It will require identification of major concentra tion areas of late run spawning coho salmon for broo stock development and determination of optimal coh salmon smolt release size and timing.

7.4.3 Summary

This strategy is very closely related to the pre viously discussed rehabilitation/enhancement stra tegy, with the added element that it is directed a enhancing site-specific harvest opportunities. Thes nine projects would contribute to meeting the spor fishing pressure and to distributing that pressur somewhat more widely.

7.5 HARVEST MANAGEMENT STRATEGY

7.5.1 Strategy and Tactics

The principal harvest management strategy is t manage for the preservation and enhancement of th wild stocks, and to this end the primary tactic is t achieve the proper escapements in the major spawn ing systems.

One of the distinguishing characteristics of th harvest management strategy is that it is directed a the user rather than at the salmon. Secondly, of all c the strategies it is the only one which is the sol province of the Department of Fish and Game.

The most prominent tactics employed in the ha vest management strategy in Cook Inlet are:

- imposition of fishing periods
- invocation of emergency closures
- invocation of emergency openings
- escapement monitoring
- implementation of test fishing

- establishment of bag limits
- establishment of user licensing
- limitation of entry into the fishery
- imposition of gear specifications
- closing of open areas
- opening of closed areas

In some forms these tactics may be applied over a long period of time as in the case of restricting certain types of gear to certain fishing districts, or they may be very specific and immediate as in the case of emergency closures.

There is a very direct relationship between the harvest management tactics and the extent of specific knowledge about the salmon stocks which are being harvested. The greater the knowledge the more precise the application of these tactics can become.

7.5.2 Projects

7.5.2.1 Escapement Monitoring

This tactic, which is the cornerstone of the harvest management strategy, is evidenced in an ongoing set of projects in the four major sockeye salmon producing river systems in the Inlet, the Kasilof, Kenai, Susitna and Crescent rivers. Sonar counters are set up and manned annually on these four systems, and it is assumed that proper escapements into these four systems can be extrapolated to mean that the lesser systems are probably achieving appropriate escapements.

7.5.2.2 In-season Effort and Catch Monitoring

This project has several diverse elements all designed to improve the management of the salmon fishery in Upper Cook Inlet. The Commercial Fish Division would provide in-season estimates of effort and catch by the set gill netters and the drift gill netters by means of vehicle surveys on the eastside set nets and aerial catch estimating surveys of the drift fleet. These data can be supplemented through daily contact with processors and weekly collection of the fish tickets. This estimating would be refined to the level of period-by-period estimates on a district-by-district basis. Clear in-season marking of the sub-district boundaries on the west side of the Inlet would be a necessary correlary to complete the information gathering.

7.5.2.3 Upper Cook Inlet Central District Test Fishing

Large concentrations of sockeye salmon enter the Inlet and mill in the lower portion of the district in the middle part of July. This situation enhances the management problems which are inherent in the mixed stock fishery. Experience during 1979 showed that limited test fishing by drift gill netters during closed periods allowed more accurate monitoring of the movement of these stocks. In turn, the managers were better able to set the appropriate fishing times and areas for attainment of escapement goals.

7.5.2.4 Upper Cook Inlet Stock Separation

This project also addresses the management problems posed by the mixed stock nature of the salmon fishery in Upper Cook Inlet. It is keyed to the ability to identify the various sockeye salmon stocks, to determine the portion of each stock that is being harvested, and ultimately to assure that escapement goals are attained on a stock-by-stock basis.

Sockeye salmon from the commercial catch as well as from the escapement are sampled for scales, length, and weight. Through a scale recognition pattern the Statewide Scale Lab can identify the stocks being handled. Under special conditions termed "critical", this identification can be expedited; and the stock identity will be in the hands of the field manager within twenty-four hours of the sampling.

This continuing project aids in the regulation of the fishery, helps to identify the strength of each of the component stocks and relates distribution to the harvest process.

7.5.2.5 Off-shore Test Fishing

This project has been set up to provide early information on the sockeye salmon runs and enable the managers to adjust their day-to-day management accordingly. The catches from a vessel fishing a transect between Anchor Point and the Red River are analyzed, and the results are integrated with the results of the commercial catch and the escapement monitoring to create a broad profile of the timing and run strength of the Upper Cook Inlet sockeye salmon.

7.5.2.6 Humpy Creek Weir

This project would allow more accurate assessment of the escapement to a major spawning stream in Lower Cook Inlet. The manner in which returning salmon behave in the vicinity of Humpy Creek necessitates constant monitoring. Movement of fish upstream seems to begin slowly, builds to an extremely rapid migration and then tapers off. It is during the time that the large numbers of salmon are moving upstream that a more accurate evaluation of numbers would be beneficial. The critical aspect involves proper timing of fishery openings. A weir would allow the best possible management of this specific resource.

7.5.2.7 Kachemak Bay Salmon and Shellfish Subsistence Catch Monitoring

This project would monitor the salmon subsistence fishery and the increasing shellfish subsistence fishery in Kachemak Bay to provide data for future management decisions concerning various species of fish and shellfish. From the perspective of the salmon resource, the primary objective of the program will be to monitor the salmon subsistence harvest to determine the quantity and species of incidentally caught fish. Standard creel census techniques will be established to monitor the fishery primarily in the vicinity of the Homer Spit. Data gathered on harvest and number of participants will be used to assess the adequacy of present regulations governing the fisheries and the need for future regulatory adjustments.

7.5.2.8 English Bay-Port Graham Monitoring

This project would monitor the early subsistence fishery in the villages of Port Graham and English Bay, and a weir operation on the English Bay Lakes system would insure that adequate sockeye and coho salmon escapements are achieved. The weir portion of this project would be a 5 to 10-year program. During this time period, run timing, run characteristics and relationship of actual weir escapements to aerial surveys will be determined for various run strengths. Subsequently, aerial surveys can be used for escapement counting and monitoring. The subsistence catch monitoring will be an annual program that will provide

accurate and timely subsistence catch data for in-season management of the salmon resource.

7.5.3 Summary

The eight projects just described represent ongoing efforts to refine the ability to recognize and manage effectively the various salmon stocks which are part of the mixed stock fishery in Cook Inlet. This work must be closely coordinated with the efforts expended under the other strategies, particularly the rehabilitation/enhancement strategy.

7.6 HABITAT PROTECTION STRATEGY

7.6.1 Strategies and Tactics

This strategy is apparently the most removed from dealing directly with the salmon stocks. It involves the systematic and long-term concern for the preservation of the quality and quantity of the required supporting habitat. It is based on the premise that suitable habitat is an essential long-term component of salmon enhancement.

All tactics involved in support of this strategy are variations of one of the following:

- acquisition of the habitat
- categorization of the habitat for purposes of setting use conditions e.g. wetlands or critical habitat
- invocation of a special protective status e.g. refuge
- institution of public awareness programs
- increase regulatory enforcement
- Conservation of existing habitat through project review and permitting
- Increased monitoring of ongoing developmental activities

At the core of the success of this strategy is a screening mechanism that detects habitat alterations or the potential for them, evaluates the action and suggests the appropriate response.

7.6.2 Programs

Essentially all agencies mentioned throughout the Plan play some role in habitat protection. The Alaska Department of Environmental Conservation is involved in pollution control, and the Department of Natural Resources has control over water appropriations. The U.S. Fish and Wildlife Service, The U.S. Forest Service and the National Park Service all have land use restrictions governing activities on lands over which they exercise control. In addition, the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Environmental Protection Agency, and State resource agencies are active through cooperative agreement with the U.S. Army, Corps of Engineers, in its administration of the Section 404 wetlands and Section 10 navigable waters permitting programs. CIAA is active in public education concerning the need for habitat protection and in supporting efforts to secure that protection.

The most complete program of habitat protection currently in effect in the Inlet is under the direction of the Habitat Division of the Alaska Department of Fish and Game. The Habitat Division has permit issuing authority and controls all activities in anadromous streams. It issues permits for activities on State Game Refuges, Critical Habitat Areas, and State Game Sanctuaries and monitors activities in streams.

The concerns of the Habitat Division fall into five broad categories: projects review and permitting for anadromous streams, State Game Refuges, Critical Habitat Areas, and State Game Sanctuaries; resource assessment; coastal management; major energy development review including oil and gas, coal, hydroelectric and petrochemicals; and major land actions including disposals, trades, easements, and conveyances.

Specific activities that are of concern to the Habitat Division and, therefore, also warrant the consideration and interest of the Regional Planning Team are widespread and diverse in nature.

Logging operations may result in significant habitat destruction without the proper safeguards, and such operations are or have recently been in effect in Tyonek, Rocky Bay and Windy Bay.

Placer mining, which is particularly prevalent on the west side of the Inlet, may also lead to loss of salmon habitat.

Strip mining and various forms of gravel extraction pose considerable threats to salmon habitat. Potential development of the Beluga coal field has been mentioned in earlier chapters. In addition to Beluga, coal strip mining is also proposed in the Yentna and Skwentna drainages.

Dams such as those proposed in Devil Canyon and on the Eagle River and/or water appropriations such as those discussed at Ship Creek and in the Kenai River should another petrochemical plant be sited in the area may also have measurable negative effects on the salmon populations.

The discharge of wastewater into any body of water may significantly alter its chemistry to the detriment of local salmon populations.

New tracts are still coming up for lease for oil and gas development in the Inlet watershed and in the Inlet itself. This is, at least, a cause for continuing vigilance, if not concern.

Finally, continuing land disposal guarantees a continuous change in the status and use of tracts of land throughout the watershed. The accelerated exploitation of agricultural, mineral, and timber resources of State, Federal, and privately owned lands will cause impacts to fishery resources within the drainage. The Cook Inlet Basin will continue to be the major population center of the State. Continued development of lands for urbanization will cause additional losses of salmon habitat.

7.7 SUMMARY

This listing of projects should certainly not be considered the definitive listing of all available projects within the Inlet drainage. It is, however, an identification of those which have come to the fore at this time. It represents a broad approach to the salmon enhancement effort on the part of several key agencies and associations. It is a promising start for a greater and more focused effort in the next twenty years.

APPENDIX

APPENDICES

APPENDIX 1

GLOSSARY

ADF&G - Alaska Department of Fish and Game

chinook salmon - This is a synonym for **Oncorhynchus tshawytscha** or the king salmon.

chum salmon - This is a synonym for **Oncorhynchus keta** or dog salmon.

CIAA - Cook Inlet Aquaculture Association

CIRPT - Cook Inlet Regional Planning Team

coho salmon - This is a synonym for **Oncorhynchus kisutch** or silver salmon.

development - Development describes all actions taken to establish a fishery in a location which has no prior record of supporting a fishery.

dog salmon - This is a synonym for **Oncorhynchus keta** or chum salmon.

enhancement - Enhancement describes procedures applied to a stock already at natural capacity which are designed to supplement the numbers of harvestable fish to a level beyond that which could naturally be produced. This may be accomplished through employment of artificial or semi-artificial production systems or the increase of the amount of productive habitat in the natural environment through physical or chemical modification.

escapement - Escapement refers to those fish in a spawning run which ''escape'' all fisheries to return upstream to spawn in either a spawning ground or a hatchery.

ex-vessel price - This is the per pound price paid to the commercial fisherman for his catch.

fingerling - This is a designation given to young salmon which have doubled their emergence weight but have not begun their seaward migration.

F.R.E.D. - Fisheries Rehabilitation, Enhancement and Development

fry - This is a young salmon which has emerged from the gravel but has not yet doubled its emergence weight.

goals - For this plan goals are broad statements of what the Planning Team hopes to see accomplished within the twenty-year life of the Plan. They are the identification of specifically larger numbers of total fish, the delineation of data deficiencies which will require defined research efforts, and the expressions of overall perspectives on the future of the salmon resources.

humpy salmon - This a synonym for **Oncorhynchus gorbuscha** or pink salmon.

king salmon - This is a synonym for **Oncorhynchus tshawytscha** or chinook salmon.

median - When a group of values is arranged in order from the highest to the lowest, the median is the middle value. Half of all the values are above it, and half are below. It is not as influenced by a few very high or few very low values as the average is.

mixed stock fishery - This expression describes the harvest of fish in a location and at a time during which stocks are intermingled.

natural production - Natural production occurs when fish spawn, hatch, and rear without human intervention, i.e., in a natural stream or lake environment. It should be noted when a previously manipulated stock reaches the point where it is self-perpetuating, it becomes natural production.

objectives - For this plan objectives are specific statements of work to be accomplished in relatively short periods of time. The sum of the successful completion of each of the objectives will equal attainment of the larger goals.

Oncorhynchus gorbuscha - This is the scientific name for the chum or dog salmon.

Oncorhynchus keta - This is the scientific name for the chum or dog salmon.

Oncorhynchus kisutch - This is the scientific name for coho or silver salmon.

Oncorhynchus nerka - This is the scientific name for the red or sockeye salmon.

Oncorhynchus tshawytscha - This is the scientific name for the king or chinook salmon.

pink salmon - This is a synonym for **Oncorhynchus gorbuscha** or humpy.

red salmon - This is a synonym for **Oncorhynchus nerka** or sockeye salmon.

rehabilitation - Rehabilitation describes procedures applied to a depressed stock which are directed toward maximizing the naturally occuring salmon production habitat for the purpose of restoring depressed natural stocks to previously harvestable levels.

run - Run describes a group of salmon generally distinguished by species and the time of year which they pass through the Inlet.

silver salmon - This is a synonym for **Oncorhynchus kisutch** or coho salmon.

smolt - This is a young salmon which has completed its freshwater rearing period and is migrating downstream to an estuarine environment.

sockeye salmon - This is a synonym for **Oncorhynchus nerka** or red salmon.

stock - Stock describes a group of salmon generally distinguished by a discrete combination of species, spawning location, and perhaps genetic similarity.

strategy - This is a general statement of priority or mission that guides more specific actions.

supplemental stocks - Supplemental stocks are those which are annually introduced to a given system at any of a number of stages and would not be present without the active human participation.

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

wild stock - This expression describes stocks which have no history of human intervention (see "natural production").

APPENDIX 2

LITERATURE CITED

1. Selkregg, Lidia L., Coordinator, **Alaska Regional Profiles,** Vol. 1 (Southcentral Region), Anchorage, University of Alaska Arctic Environmental Information and Data Center, 1974.
2. Alaska Department of Fish and Game, **Catalog of Waters Important for Spawning & Migration of Anadromous Fishes,** (Region 2 & 4), 1968, Rev. 1975.
3. Meiners, A., Alaska Division of Parks, Personal Communication, 1981.
4. U.S. Bureau of the Census, **Current Population Reports,** Series P25, No. 815, Washington, 1979.
5. Kenai Peninsula Borough, **Special Census of the Population,** Growth Monitoring Program Special Report No. 1, Soldotna, March, 1979.
6. Scott, Michael J., and Staff, Institute of Social and Economic Research, **Southcentral Alaska's Economy and Population, 1965-2025: A Base Study and Projections** (Report of the Economics Task Force to the Alaska Water Study Committee), Anchorage, Fairbanks, Juneau (University of Alaska), January, 1979.
7. Stanek, R., Alaska Department of Fish and Game, Personal Communication, 1981.
8. Harmer, Dale L., **Economic Characteristics of Sport Fishing in Alaska: A Summary of the Results of the 1973 Alaska Sport Fishing Survey,** Seattle, Boeing Computer Services, Inc., 1974.
9. Brogan, Michael Allen, **An Economic Analysis of the Cook Inlet Resurrection Bay Sport Salmon Fisheries,** Fairbanks, Alaska, Institute of Agricultural Sciences, University of Alaska, 1974.
10. Yancey, Robert M. and Fredrik V. Thorsteinson, **The King Salmon of Cook Inlet, Alaska,** Washington, D.C., United States Fish and Wildlife Service, 1963.
11. Dinneford, E., Commercial Fish Entry Commission, Personal Communication, 1981.
12. Wilson, R. G. and Associates, **Cook Inlet Fishery Economic Study,** Anchorage, Richard G. Wilson and Associates, 1978.
13. Vanderbrink, H., Alaska Department of Fish and Game, Personal Communication, 1981.
14. Middleton, K., **Cook Inlet Stock Status Report,** unpub. ADF&G Report, 1981.
15. Engel, L., Alaska Department of Fish and Game, Personal Communication, 1981.
16. F.R.E.D. Division, Directive No. 3, **Standard Assumptions on Salmon Survivals (Unmarked fish),** 1978.
17. Sport Fish Division, ADF&G, **Plan for Supplemental Production of Salmon and Steelhead for Cook Inlet Recreational Fisheries,** unpub. draft, 1981.

BIBLIOGRAPHY

Alaska Department of Fish and Game, **Alaska Salmon Fisheries Plan,** provisional draft for review and comment, October, 1975.

Alaska Magazine, The Milepost, The Alaska Journal and Alaska Geographic, Editors of, **Facts About Alaska: The Alaska Almanac,** vol. 1, Anchorage, Alaska Northwest Publishing Co., May, 1976.

Alaska, University of, Alaska Sea Grant Program, **1979 Fisherman's Income Survey, Herring and Salmon Fisheries,** Report 80-5, Fairbanks, September, 1980.

Burger, C., United States Fish and Wildlife Service, Personal Communication, 1981.

Dudiak, N., Alaska Department of Fish and Game, Personal Communication, 1981.

Edfelt, Larry, **Statistical History of Alaska Salmon Catches,** Alaska Department of Fish and Game Technical Data Report No. 9, Juneau, 1973.

Flagg, L., Alaska Department of Fish and Game, Personal Communication, 1981.

_____, **An Economic Survey of the Cook Inlet Salmon Fishery,** Alaska Department of Fish and Game Informational Leaflet Number 145, Juneau, June 1, 1970.

Johnston, Richard S., and W. Robert Wood, **A Demand Analysis for Canned Red (Sockeye) Salmon at Wholesale — A Progress Report.**

Joint Southeast Alaska Regional Planning Teams, **Comprehensive Salmon Plan for Southeast Alaska, Phase 1,** Draft for Review, March, 1980.

Kenai Peninsula Borough, **Port and Harbor Demand and Feasibility Project,** Woodward-Clyde Consultants and Soros Associates, April, 1980.

Kenai Peninsula Borough, **Special Census of the Population,** Growth Monitoring Program Special Report No. 1, Soldotna, March, 1979.

League of Women Voters of Alaska, **Know Your State Alaska,** A Survey of the government of the State of Alaska, League of Women Voters Education Fund, Washington, D.C., 1968, Rev. 1972.

Leonard Lane Associates, **Table of Contents for Regional Plans,** August 23, 1979.

McLean, Robert F. and Kevin J. Delaney, Compilers, **Alaska's Fisheries Atlas,** Volumes I and II, Tacoma, Print Northwest, 1978.

McLean, Robert F., Kevin J. Delaney, Beverly A. Cross, **A Fish and Wildlife Resource Inventory of the Cook Inlet — Kodiak Areas,** Vol. 2, Alaska Department of Fish and Game for Alaska Coastal Management Program - Division of Policy Development and Planning, 1977.

McMullen, John C., and Mark Kissel, **F.R.E.D. Report to the Board of Fisheries,** Juneau, November, 1979.

McMullen, John C., and Mark Kissel, **1980 Annual Report, Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.),** Juneau, January, 1981.

Madden, J., Alaska Department of Fish and Game, Personal Communication, 1981.

Miller and Associates, Inc., Leonard Lane and Associates, and Mr. William R. Wilkerson, Attorney, Law Firm of Eisenhower, Carlson, Newlands, Rehan, Henriot and Quinn, **An Analysis of the Alaskan Salmon Fishery,** August 30, 1979.

Mills, M., Alaska Department of Fish and Game, Personal Communication, 1981.

_____, "Statewide Harvest Study," in **Alaska Statewide Sport Fish Harvest Studies,** Sport Fish Division, Vol. 20, Study SW-1-A, July 1, 1978 — June 30, 1979.

_____, "Statewide Harvest Study," in **Alaska Statewide Sport Fish Harvest Studies,** Sport Fish Division, Vol. 21, Study SW-1-A, July 1, 1979 — June 30, 1980.

Owers, James E., "Income Estimates and Reasonable Returns in Alaska's Salmon Fisheries," in **Fishery Bulletin,** Vol. 75, No. 3, 1977.

Reardon, Jim, **Status of the Cook Inlet - Resurrection Bay Commercial Salmon Fishery, 1965,** Homer, Alaska, 1965.

Reynolds, S., Alaska Department of Fish and Game, Personal Communication, 1981.

Sanders, G., Alaska Department of Fish and Game, Personal Communication, 1981.

Schroeder, T., Alaska Department of Fish and Game, Personal Communication, 1981.

Scully, David R., Larry S. Leveen and Raymond S. George, **Surface Water Records of Cook Inlet Basin, Alaska, through September, 1975,** United States Department of the Interior Geological Survey, Anchorage, 1978.

Sheridan, William L., **Summary of Recent Knowledge of Certain Factors Influencing Survival of Salmon in Freshwater,** Alaska Department of Fish and Game Division of Biological Research, Information Leaflet No. 3, November, 1961.

State Members of the Governor's Agency Advisory Committee on Leasing, **A Social, Economic and Environmental Analysis of a State Oil and Gas Lease Sale in Upper Cook Inlet** (A Report to Jay S. Hammond, Governor of Alaska), Juneau, January, 1981.

State Members of the Governor's Agency Advisory Committee on Leasing, **A Social, Economic and Environmental Analysis of a State Oil and Gas Lease Sale in Lower Cook Inlet,** (preliminary draft of a Report to Jay S. Hammond, Governor of Alaska), Juneau, March, 1981.

Steinhoff, Harold W., "Communicating Complete Wildlife Values of Kenai" in **Transactions of the Thirty-sixth North American Wildlife and Natural Resources Conference,** Washington, D.C., The Wildlife Management Institute, 1971.

_____, **Values of Wildlife and Related Recreation on the Kenai National Moose Range,** College, Alaska, 1969.

Stratton, L., et al, **Chugach Region Community Subsistence Profiles,** Anchorage, Alaska, 1981.

Swan, C., **Subsistence Research Project Kenaitze Indian Tribe,** Kenai, Alaska, September 15, 1981.

Tarbox, K., Alaska Department of Fish and Game, Personal Communication, 1981.

Traski, L., Alaska Department of Fish and Game, Personal Communication, 1981.

Wilson, Richard G. and Associates, **Cook Inlet Fishery Economic Study,** Preliminary Report to the Cook Inlet Commercial Fishermen's Council, Anchorage, December 1, 1978.

Van Ray, L., United States Fish and Wildlife Service, Personal Communication, 1981.

Wangaard, D., United States Fish and Wildlife Service, Personal Communication, 1981.

Yanagawa, C., Alaska Department of Fish and Game, Personal Communication, 1981.

APPENDIX 3

PUBLIC PARTICIPATION PROGRAM

SPECIAL NOTE:

The full text of this appendix, which includes all of the written and oral comments and the responses, the complete draft distribution list and other material related to the public participation program, is a part of the ***Final Draft Cook Inlet Regional Salmon Enhancement Plan 1981-2000.*** *It is, therefore, a matter of public record at the Alaska Department of Fish and Game in Juneau, Alaska; and it was part of the Plan which received the approval of the Commissioner of the Alaska Department of Fish and Game. The text, which appears below, is a summary of that material prepared especially for this widely distributed edition of the Plan.*

In late July, 1981, over 260 copies of a Review Draft were distributed throughout the Cook Inlet watershed, to appropriate Department offices in Juneau and to additional agencies and individuals by specific request. The distribution list included the Board of Directors of the Cook Inlet Aquaculture Association, all area offices of the Alaska Department of Fish and Game, all Fish and Game Advisory Boards, all area libraries, native associations, municipalities, commercial fishermen's organizations, sport fishing organizations and federal agencies.

The availability of the Review Draft and the upcoming public meetings were advertised widely on local radio, through feature stories in regional newspapers, and through both legal and display advertisements in newspapers.

On August 19 and 20 public meetings were held in Soldotna and Anchorage, respectively. The complete Team membership attended the public meetings to receive comments.

The comment period was held open until September 15 to receive additional written comments. The Regional Planning Team met on September 22 to review all comments and to decide on the appropriate response to each.

A total of 39 responses to the Review Draft were received; and of those, 36 either approved the Plan outright or approved it with modifications that were acceptable to the Regional Planning Team.

The diversity of respondents is worthy of note. They included commercial fishermen's organizations, sports fishing organizations, fish and game advisory boards, native organizations, municipalities, federal agencies, the University of Alaska, Alaska Department of Fish and Game headquarters staff, the Cook Inlet Aquaculture Association and individuals.

The appropriate revisions were made in the text of the document, and the full text of each of the comments as well as the Team's response were included in the appendix. This completed the work on the Final Draft of the Plan.

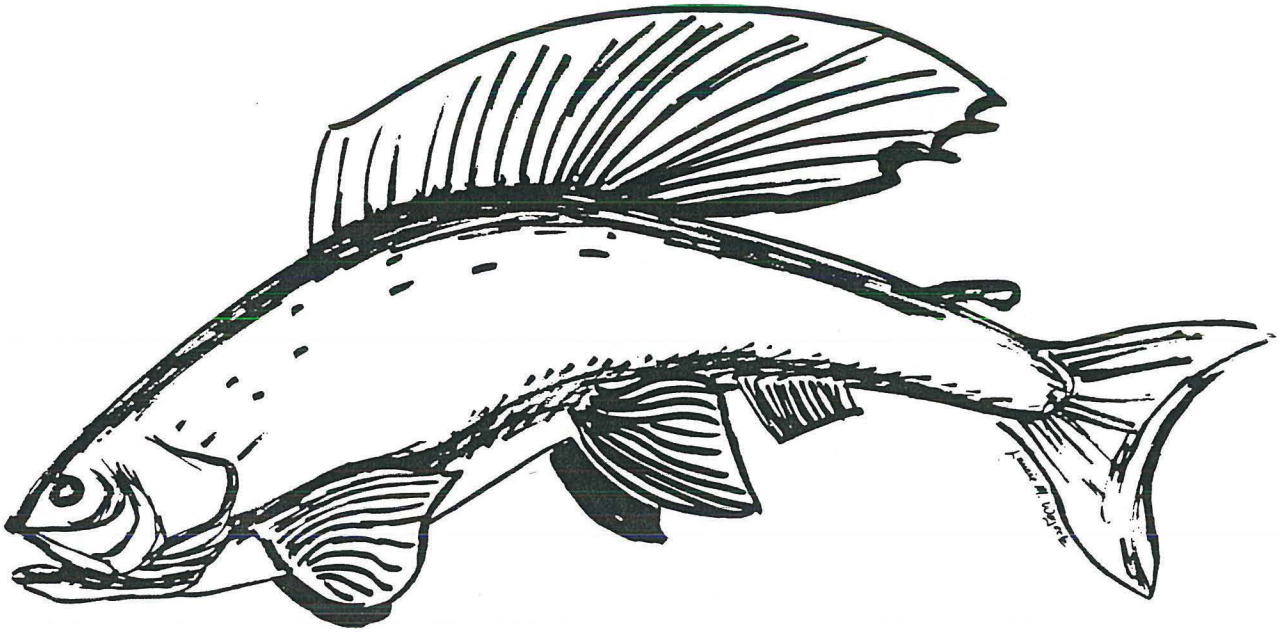
After a final review by the Regional Planning Team, the **Final Draft Cook Inlet Regional Salmon Enhancement Plan 1981-2000** was forwarded to the Commissioner of the Alaska Department of Fish and Game for his review and approval on November 4.

During this review period, three additional comments were received. All three comments suggested modifications but supported the general positions set forth in the Plan.

The Regional Planning Team met on January 27 to consider these comments and agreed to the majority of the modifications suggested.

In a letter from the Commissioner dated February 19 and reproduced at the front of this document the Plan was approved.

SPORT FISH SURVEY



ALASKA DEPARTMENT OF FISH AND GAME

STATE OF ALASKA / JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER / SUBPORT BUILDING
JUNEAU, ALASKA 99801

Dear Alaska Sport Fisherman:

We have not yet received your completed 1980 Alaska Sport Fishing Survey form. If you have not yet returned it to us, please complete the enclosed form and return it in the postage-paid envelope that is provided for your use.

Please do not underestimate the importance of your fishing activities. You have been chosen as part of a representative sample of Alaskan sport fishermen and the information that you can provide is vital to the success of this study, and may have a significant impact on the future management of Alaska's sport fish resources.

If you have already returned your questionnaire, please disregard this letter and accept our sincere thanks.

Sincerely,

Rupert E. Andrews

Rupert E. Andrews, Director
Sport Fish Division

Enclosure

INSTRUCTIONS:

1. Questions apply to all members of your household.

2. If more than one member of your household received a copy of this questionnaire, you need to fill out only one questionnaire, but to avoid repeated mailings, please return all.

3. Please answer the general questions on page 2.

4. If members of your household sport fished during 1980, please fill out the remaining pages which cover the areas you sport fished. The maps on pages 3, 11, and 21 will help you find the pages which deal with those areas. If no members of your household sport fished during 1980, please return your questionnaire in the enclosed postage-paid envelope after answering the questions on page 2.

5. If you cannot remember exactly how much you sport fished or how many fish you caught, please estimate as closely as you can. Do not count commercially-caught or subsistence-caught fish.

6. Please return your completed questionnaire in the enclosed postage-paid envelope.

Thanks for helping us help you.

GENERAL QUESTIONS:

1. How many members of your household purchased an Alaska Sport Fishing license during 1980? _____

2. How many members of your household under the age of 16 sport fished in Alaska in 1980? _____

3. How many members of your household 16 years of age or older sport fished in Alaska during 1980? _____

4. What do you recommend to improve sport fishing in Alaska?

_____

_____

_____

_____

_____

_____

I. GLENNALLEN: ALL WATERS AND DRAINAGES OF THE OSHETNA RIVER AND THE COPPER RIVER UPSTREAM FROM A LINE BETWEEN THE SOUTH BANK OF HALEY CREEK AND THE SOUTH BANK OF CANYON CREEK IN WOODS CANYON, AND INCLUDING THE UPPER SUSITNA RIVER DRAINAGE FROM ITS CONFLUENCE WITH THE OSHETNA RIVER.

I

1. Mark the number of days spent sport fishing. *In the example, a man fished 5 days (count any part of a day as the whole day) and his son fished with him 3 of those days. "8" (5+3) is entered in the space.
2. For each variety of fish, mark the number caught and kept. In the example, 2 burbot and 2 lake trout were caught and kept by that household. (Please note that many fish are called by different names: king = chinook; coho = silver; red = sockeye; pink = humpback; chum = dog.)

	Days Fished	King	Sea-run Coho	Land-locked Coho	Red	Rainbow Trout	Lake Trout	Steelhead	Dolly Varden Arctic Char	Arctic Grayling	Whitefish	Burbot	Other
Example													
Gulkana River													
Lake Louise, Lake Susitna, Tyone Lake													
Van (Silver) Lake													
Paxson Lake Summit Lake													
Strelna Lake													
Sculpin Lake													
Crosswind Lake													
Hudson Lake													
Other waters: (specify)													

The survey form includes separate pages similar to the one above for the following areas.

Knik Arm Drainage

Anchorage Area

East Side Susitna Drainage

West Side Cook Inlet - West Side Susitna River Drainages

Kenai Peninsula

APPENDIX 5

COMMERCIAL CATCH DATA

Historical catch of Cook Inlet salmon in numbers of fish by species, 1893-1980. 1/

Year	King	Sockeye	Coho	Pink	Chum	Total
1893	30,000	170,000	34.000	0	0	234,000
1894	15,500	406,840	19.000	0	0	441,340
1895	25,199	324,277	0	0	0	349,476
1896	18,076	309,863	27,600	37,800	0	393,339
1897	14,083	354,800	28,000	0	0	396,883
1898	16,389	551,168	83,412	0	0	650,969
1899	17,102	558,529	54,890	0	0	630,521
1900	26,683	585,309	20,000	0	0	631,992
1901	34,319	482,406	8,967	5,591	0	531,283
1902	49,013	710,280	54,864	79,246	0	893,403
1903	66,023	564,189	58,968	0	0	689,180
1904	30,073	489,348	23,800	0	0	543,221
1905	17,668	95,547	0	0	0	113,215
1906	22,420	225,506	93,485	64,100	0	405,511
1907	62,944	460,620	177,276	6,420	0	707,260
1908	33.774	670.774	94.936	375.140	0	1.174.624
1909	59,624	582,562	88,350	3,740	0	734,276
1910	49,028	840,187	79,702	217,666	1,318	1.187,901
1911	55,845	1,249,154	87,909	70,665	749	1.464.322
1912	47,366	1,194,888	70,567	1,661,874	121,628	3,096,823
1913	63,652	1,369,196	81,484	10,926	10,813	1,536,071
1914	47,554	1,472,829	188,341	1,255,798	39,905	3,004,427
1915	83,793	1,860,684	122,028	19,308	27,833	2,113,646
1916	62,895	1,699.323	209,978	1,682,672	128,322	3,763,190
1917	65,499	1,659,907	60,776	54,286	78,468	1,918,936
1918	34,886	1,668,394	251,151	721,231	108,200	2,783,862
1919	23,801	943,694	172,855	43,447	54,333	1,238,130
1920	39,563	1,314,916	302,353	445,524	97,541	2.199,897
1921	13,946	983,625	20,519	4,717	42,409	1,065,216
1922	31,030	860,019	199,923	637,405	74,389	1,802,766
1923	29,911	1,099,465	142,926	39,146	23,481	1,334,929
1924	27,012	1,056,090	187,656	752,016	36,755	2,059,529
1925	51,033	1,510,861	198,146	11,828	15,064	1,786,932
1926	75,620	1,999,720	353,173	586,054	118,455	3,133,022
1927	87,404	1,459,068	387,746	251,866	59,380	2,245,464
1928	69,885	1,172,959	522,509	568,052	101,086	2,434,491
1929	67,694	1,049,851	184,858	376,863	134,601	1,813.867
1930	72,317	917,882	498,475	1,022,679	99,630	2,610,983
1931	51,402	805,526	328,294	472,221	62,628	1,720,071
1932	70,931	1,131,958	374,976	441,125	64,749	2.083,739
1933	59,281	1,336,135	187,972	118,187	57,245	1,758,820
1934	72,379	1,815,267	251,260	929,992	91,319	3,160,217
1935	75,075	1,355,787	170,438	430,540	161,424	2,193,264

Year	King	Sockeye	Coho	Pink	Chum	Total
1936	81,062	2,390,281	328,496	852,924	264,909	3,917,672
1937	85,982	1,581,183	215,700	487,692	148.869	2.519.426
1938	57,663	2,425,253	213,804	848,733	191,328	3,736.781
1939	52,726	2.334,904	163,010	319,312	231,645	3,101,597
1940	63,016	1,648,952	478,096	2,604,235	280,831	5,075.130
1941	104,822	1,293,234	359,224	715.211	272,345	2,744,836
1942	95,180	1,540,185	644,823	965,507	400,989	3,646.684
1943	111,381	1,468,279	279,852	1,457,161	301,899	3,618,572
1944	85,210	1,939,932	256,621	1,815,441	258,840	4,356,044
1945	69.202	1,556,713	329,828	1,367,950	305,901	3,629,594
1946	64,281	1,474,473	581,374	1,338,731	383,563	3,842,422
1947	106,804	1,473,973	443,879	681,731	279,227	2,985,614
1948	105,996	2,035,306	408,079	1,660,147	439,314	4,648,842
1949	111,281	2,153,213	279,701	433,003	238,646	3,215,844
1950	162,942	2,642,374	351,366	1,132,164	463,507	4,752,353
1951	187,513	2,481,346	284,715	417,485	292,293	3,663,352
1952	74,500	1,510,214	233,771	2,277,019	450,580	4,546,084
1953	89,430	1,490,062	227,612	550,073	536,639	2,893,816
1954	65,325	1,246,672	336,685	2,460,051	775,659	4,884,392
1955	46,499	1,064,128	180,452	1,286,008	317,053	2,894,140
1956	65,310	1,295,095	207,534	1,803,295	870,269	4,241,503
1957	42,767	670,629	127,199	306,841	1,207,920	2,355,356
1958	22,847	496,842	241,561	2,598,314	596,179	3,955,743
1959	32,783	634,313	112,664	137,255	411,157	1,328,172
1960	27,539	948,040	314,153	2,023,252	776,079	4,089,063
1961	19,778	1,185,079	119,397	337,394	405,221	2,066,869
1962	20,270	1,172,859	358,051	4,960,030	1,149,841	7,661,051
1963	17,632	958,101	203,876	234,052	525,537	1,939,198
1964	4,622	990,709	462,114	4,287,378	1,402,419	7,147,242
1965	9,751	1,426,352	154,481	139,561	344,521	2,074.666
1966	9,603	1,867,323	295,101	2,585,820	660,887	5,418,734
1967	8,035	1,409,106	180,455	407,717	382,282	2,387,595
1968	4,600	1,200,146	475,333	2,863,638	1,194,248	5,737,965
1969	12,462	815,050	101,575	235,866	331,058	1,496,011
1970	8,455	753,526	280,156	1,388,179	999,325	3,429,641
1971	19,838	658,537	105,197	428,495	475,631	1,687,698
1972	16,174	937,721	83,167	657,243	705,691	2,399,996
1973	5,339	699,234	106,521	633,587	783,086	2,227,767
1974	6,779	524,613	206,639	534,331	416,050	1,688,412
1975	4,933	712,960	233,583	1,399,791	973,442	3,324,709
1976	11.317	1,722.309	211,926	1,393,189	520,629	3,859,370
1977	15,009	2,154,078	195,847	1,846,337	1,379,511	5,590,782
1978	19,050	2,778,891	225,181	2,039,653	649,443	5,712,218
1979	14,972	987,628	365,875	3,037,772	879,519	5,285,766
1980	12,898	1,650,752	296,276	2,765,882	461,931	5,187,739

1/ 1979-1980; Preliminary Data.

APPENDIX 6

DATA AND CALCULATIONS RELATED TO CHAPTERS 5 & 6

THE "PRESENT" IS 1971 THROUGH 1980 (ALL SUB-TOTAL AND TOTAL VALUES REDUCED TO X.XXX MILLION)

EVEN YEARS (COMMERCIAL CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1972	937,721	657,243	705,691	83,167	16,174	2,399,996
1974	524,613	524,331	416,050	206,634	6,779	1,678,407
1976	1,722,309	1,393,189	520,629	211,926	11,317	3,859,370
1978	2,769,751	2,010,121	641,089	227,327	19,215	5,667,503
1980	1,650,822	2,757,859	461,174	294,567	12,899	5,177,321
TOTAL	7,605,216	7,342,743	2,744,633	1,023,626	66,384	18,782,597
AVERAGE	1,521,043	1,468,549	548,927	204,725	13,277	3,756,519
	1.521	1.471	0.549	0.205	0.013	3.757

ODD YEARS (COMMERCIAL CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1971	658,537	428,495	475,631	105,197	19,838	1,687,698
1973	699,234	633,587	783,086	106,521	5,339	2,227,767
1975	712,960	1,399,791	973,442	233,583	4,933	3,324,709
1977	2,153,938	1,846,337	1,379,511	195,847	15,009	5,590,642
1979	999,423	3,073,988	880,084	267,781	14,853	5,236,129
TOTAL	5,224,092	7,382,198	4,491,754	908,929	59,972	18,066,945
AVERAGE	1,044,818	1,476,440	898,351	181,786	11,994	3,613,389
	1.045	1.476	0.898	0.182	0.012	3.613

EVEN YEARS (SPORT CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1978	105,532	105,446	18,419	65,230	17,856	312,482
1980	92,673	105,595	6,154	96,032	16,806	317,260
TOTAL	198,205	211,041	24,573	161,262	34,662	629,742
AVERAGE	99,103	105,521	12,287	86,631	17,331	314,781
	0.009	0.106	0.012	0.081	0.017	0.315

ODD YEARS (SPORT CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1977	82,363	45,484	2,287	51,907	16,210	198,251
1979	63,731	25,696	5,826	64,039	25,853	185,145
TOTAL	146.094	71,180	8,113	115,946	42,063	383,396
AVERAGE	73,047	35,590	4,057	57,973	21,032	191,698
	0.073	0.036	0.004	0.058	0.021	0.192

EVEN YEARS (SUBSISTENCE CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1972	15	75	84	1,030	1	1,205
1974	30	60	79	667	1	837
1976	67	1,626	69	2,529	16	4,307
1978	77	723	65	6,011	9	6,885
1980	5,489	5,795	518	7,128	2,302	21,232
TOTAL	5,678	8,279	815	17,365	2,329	34,466
AVERAGE	1,136	1,656	163	3,473	466	6,893
	0.001	0.002	0.000	0.003	0.000	0.007

ODD YEARS (SUBSISTENCE CATCH)

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
1971	16	44	7	1,697	2	1,766
1973	53	96	77	1,636	0	1,862
1975	51	640	153	2,619	5	3,468
1977	59	642	133	2,543	14	3,391
1979	5,601	2,610	313	5,688	164	14,376
TOTAL	5,780	4,032	683	14,183	185	24,863
AVERAGE	1,156	806	137	2,837	37	4,973
	0.001	0.001	0.000	0.003	0.000	0.005

EVEN YEARS

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
COMMERCIAL	1.521	1.469	0.549	0.205	0.013	3.757
SPORT	0.099	0.106	0.012	0.081	0.017	.315
SUBSISTENCE	0.001	0.002	0.000	0.003	0.000	.006
	1.621	1.577	0.561	0.289	0.030	4.078

ODD YEARS

	SOCKEYE	PINK	CHUM	COHO	KING	TOTAL
COMMERCIAL	1.045	1.476	0.898	0.182	0.012	3.613
SPORT	0.073	0.036	0.004	0.058	0.021	.192
SUBSISTENCE	0.001	0.001	0.000	0.003	0.000	.005
	1.119	1.513	0.902	0.243	0.033	3.810

"PRESENT" CALCULATED ESCAPEMENT AND RUN STRENGTH BASED ON HARVEST FIXED IN PRECEDING CALCULATIONS

EVEN YEARS

	RATIO	HARVEST	ESCAPEMENT	RUN
SOCKEYE	4:1	1.621	0.540	2.161
PINK	3:1	1.577	0.789	2.366
CHUM	3:1	0.561	0.281	0.842
COHO	3:1	0.289	0.145	0.434
KING	3:1	0.030	0.015	0.045
		4.078	1.770	5.848

ODD YEARS

	RATIO	HARVEST	ESCAPEMENT	RUN
SOCKEYE	4:1	1.119	0.373	1.492
PINK	3:1	1.513	0.757	2.270
CHUM	3:1	0.902	0.451	1.353
COHO	3:1	0.243	0.122	0.365
KING	3:1	0.033	0.017	0.050
		3.810	1.720	5.530

1981-1990 SUPPLEMENTAL PRODUCTION

	RATIO	HARVEST	ESCAPEMENT	RUN	
KASILOF HATCHERY					
SOCKEYE	4:1	120,000	40,000	160,000	
TRAIL LAKES HATCHERY					
KING	3:1	12,000	6,000	18,000	
SOCKEYE	4:1	182,000	61,000	243,000	
COHO	3:1	61,000	31,000	92,000	
BIG LAKE HATCHERY					
SOCKEYE	4:1	97,000	33,000	130,000	
COHO	3:1	53,000	27,000	80,000	
ANCHORAGE HATCHERY					
KING	3:1	50,000	25,000	75,000	
COHO	3:1	133,000	67,000	200,000	
TUTKA HATCHERY					
PINK	95% HARVEST [1]	532,000	28,000	560,000	
CHUM	NOTE [2]	31,000	9,000	40,000	
EKLUTNA HATCHERY					
CHUM	3:1	116,000	59,000	175,000	
PAINT RIVER					
SOCKEYE	4:1 [2]	21,000	13,000	34,000	
PINK	3:1 [2]	600,000	300,000	900,000	
CHUM	3:1 [2]	-0-	126,000	126,000	
SCURVY CREEK					
PINK	3:1	160,000	80,000	240,000	
CHUM	3:1	4,000	2,000	6,000	
		2,057,000	848,000	2,905,000	
SOCKEYE		420,000	147,000	567,000	0.567
KING		62,000	31,000	93,000	0.093
COHO		247,000	125,000	372,000	0.372
PINK		1,292,000	408,000	1,700,000	1.700
CHUM		151,000	196,000	347,000	0.347
		2,172,000	907,000	3,079,000	3.079
		2.172	0.907	3.079	

1. BASED ON THE ASSUMPTION THAT THE STOCK WILL BE SEPARABLE AND CAN BE SUBJECTED TO MAXIMUM HARVEST

2. BASED ON THE ESCAPEMENT THAT IS NECESSARY TO BUILD THE BROODSTOCK

1990 CALCULATIONS

NATURAL PRODUCTION

	EVEN YEARS					ODD YEARS			
	HARVEST	RATIO	ESCAPEMENT	RUN		HARVEST	RATIO	ESCAPEMENT	RUN
SOCKEYE	1.700	@4:1	0.567	2.267	SOCKEYE	1.700	@4:1	0.567	2.267
PINK	2.000	@3:1	1.000	3.000	PINK	1.200	@3:1	0.600	1.800
CHUM	0.700	@3:1	0.350	1.050	CHUM	0.700	@3:1	0.350	1.050
COHO	0.300	@3:1	0.150	0.450	COHO	0.300	@3:1	0.150	0.450
KING	0.020	@3:1	0.010	0.030	KING	0.020	@3:1	0.010	0.030
TOTAL	4.720		2.077	6.797	TOTAL	3.920		1.677	5.597

SUPPLEMENTAL PRODUCTION

	EVEN YEARS					ODD YEARS			
	HARVEST	RATIO	ESCAPEMENT	RUN		HARVEST	RATIO	ESCAPEMENT	RUN
SOCKEYE	0.420	@4:1	0.147	0.567	SOCKEYE	0.420	@4:1	0.147	0.567
PINK	1.292	@ : *	0.408	1.700	PINK	1.292	@ : *	0.408	1.700
CHUM	0.151	@ : *	0.196	0.347	CHUM	0.151	@ : *	0.196	0.347
COHO	0.247	@3:1	0.125	0.372	COHO	0.247	@3:1	0.125	0.372
KING	0.062	@3:1	0.031	0.093	KING	0.062	@3:1	0.031	0.093
TOTAL	2.172		0.907	3.079	TOTAL	2.172		0.907	3.079
TOTAL 1990	6.892		2.984	9.876		6.092		2.584	8.676

* SPECIAL CONDITIONS-SEE PREVIOUS SHEET

1981-2000 SUPPLEMENTAL PRODUCTION (INCLUDES 1990 INCREMENTS)

	RATIO	HARVEST	ESCAPEMENT	RUN
PAINT RIVER				
PINK	3:1	600,000	300,000	900,000
CHUM	3:1	400,000	200,000	600,000
SOCKEYE	4:1	37,000	13,000	50,000
SCURVY CREEK				
PINK	3:1	160,000	80,000	240,000
CHUM	3:1	4,000	2,000	6,000
BIG RIVER LAKES				
SOCKEYE	4:1	33,000	11,000	44,000
PTARMIGAN				
SOCKEYE	4:1	14,000	5,000	19,000
CHENIK				
SOCKEYE	4:1	17,000	6,000	23,000
DELIGHT				
SOCKEYE	4:1	20,000	7,000	27,000
DESIRE				
SOCKEYE	4:1	12,000	4,000	16,000
FERTILIZATION				
CRESCENT				
SOCKEYE	4:1	127,000	43,000	170,000
DELIGHT & DESIRE				
SOCKEYE	4:1	64,000	22,000	86,000
CHENIK				
SOCKEYE	4:1	54,000	18,000	72,000
PAINT RIVER				
SOCKEYE	4:1	37,000	13,000	50,000
LARSON				
SOCKEYE	4:1	48,000	16,000	64,000
BYERS				
SOCKEYE	4:1	24,000	8,000	32,000
SHELL				
SOCKEYE	4:1	60,000	20,000	80,000
BEAR				
COHO	3:1	7,000	3,000	10,000
FINGER, DELYNDIA, BUTTERFLY				
COHO	3:1	8,000	4,000	12,000

1981-2000 SUPPLEMENTAL PRODUCTION (INCLUDES 1990 INCREMENTS)

	RATIO	HARVEST	ESCAPEMENT	RUN
HATCHERIES				
EKLUTNA				
CHUM	3:1	205,000	103,000	308,000
ENGLISH BAY LAKES				
CHUM	80%HARVEST	74,000	18,000	92,000
PINK	80%HARVEST	600,000	150,000	750,000
SOCKEYE	80%HARVEST	80,000	20,000	100,000
KASILOF				
SOCKEYE	4:1	120,000	40,000	160,000
TRAIL LAKES				
KING	3:1	12,000	6,000	18,000
SOCKEYE	4:1	182,000	61,000	243,000
COHO	3:1	61,000	31,000	92,000
BIG LAKE				
SOCKEYE	4:1	97,000	33,000	130,000
COHO	3:1	53,000	27,000	80,000
ANCHORAGE				
KING	3:1	50,000	25,000	75,000
COHO	3:1	133,000	67,000	200,000
TUTKA				
PINK	95%HARVEST	342,000	18,000	360,000
CHUM	95%HARVEST	190,000	10,000	200,000
OTHER				
COHO	3:1	33,000	17,000	50,000
CHUM	3:1	33,000	17,000	50,000
PINK	3:1	33,000	17,000	50,000
SOCKEYE	4:1	37,000	13,000	50,000
		4,061,000	1,448,000	5,509,000

SOCKEYE	1,063,000	353,000	1,416,000
PINK	1,735,000	565,000	2,300,000
CHUM	906,000	350,000	1,256,000
COHO	295,000	149,000	444,000
KING	62,000	31,000	93,000
	4,061,000	1,448,000	5,509,000
	4.061	1.448	5.509

2000 CALCULATIONS

NATURAL PRODUCTION

	EVEN YEARS				ODD YEARS			
	HARVEST	RATIO	ESCAPEMENT	RUN	HARVEST	RATIO	ESCAPEMENT	RUN
SOCKEYE	2.100	@4:1	0.700	2.800	2.100	@4:1	0.700	2.800
PINK	2.500	@3:1	1.250	3.750	1.500	@3:1	0.750	2.250
CHUM	1.000	@3:1	0.500	1.500	1.000	@3:1	0.500	1.500
COHO	0.400	@3:1	0.200	0.600	0.400	@3:1	0.200	0.600
KING	0.030	@3:1	0.015	0.045	0.030	@3:1	0.015	0.045
TOTAL	6.030		2.665	8.695	5.030		2.165	7.195

SUPPLEMENTAL PRODUCTION

	EVEN YEARS				ODD YEARS			
	HARVEST	RATIO	ESCAPEMENT	RUN	HARVEST	RATIO	ESCAPEMENT	RUN
SOCKEYE	1.063	@4:1	0.353	1.416	1.063	@4:1	0.353	1.416
PINK	1.735	@ : *	0.565	2.300	1.735	@ : *	0.565	2.300
CHUM	0.906	@ : *	0.350	1.256	0.906	@ : *	0.350	1.256
COHO	0.295	@3:1	0.149	0.444	0.295	@3:1	0.149	0.444
KING	0.062	@3:1	0.031	0.093	0.062	@3:1	0.031	0.093
TOTAL	4.061		1.448	5.509	4.061		1.448	5.509
TOTAL 2000	10.091		4.113	14.204	9.091		3.613	12.704

* SPECIAL CONDITIONS-SEE PREVIOUS SHEET