

ARLIS



3 3755 000 34913 4

SUSITNA HYDROELECTRIC PROJECT

Preliminary Final Plan of Study
Fish and Wildlife Studies
proposed by the Alaska
Department of Fish and Game
November 1979

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

JAY S. HAMMOND, GOVERNOR

111 RASPBERRY ROAD
ANCHORAGE 99502

October 31, 1979

ESTES
TK
1425
.58
A68
NO. 3281

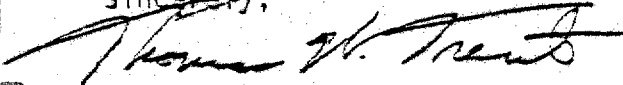
Mr. Eric Yould, Director
Alaska Power Authority
333 W. 4th Avenue
Anchorage, Alaska 99510

Dear Mr. Yould:

The Alaska Department of Fish and Game is providing the enclosed Phase I 25 month portion of the 5-year fisheries and wildlife study proposed to be conducted as part of the Susitna Hydroelectric feasibility investigations. The proposals were developed following discussions with Acres-American and their environmental studies subcontractor, Terrestrial Environmental Specialists. We have also met with representatives of the U.S. Fish and Wildlife Service and the Alaska Department of Natural Resources to obtain their suggestions and advice relative to portions of our proposals and the development of a final revised plan of study. I must indicate, however, that it should not be inferred that USFWS and ADNR have formally endorsed these proposals in their entirety. Their formal positions regarding the entire revised plan of study will undoubtedly come during the next agency and public review stage.

In his letter to me on October 4, Robert Mohn of your staff discussed a number of issues and subject areas which required our input on the development of the revised plan of study. The information provided herein should satisfy part of those requirements outlined by the APA, but specific refinements addressing our concerns outlined in our attached proposal and comments of other agencies will be needed during the period Acres or the Corps of Engineers is revising the POS next month.

Sincerely,



Thomas W. Trent
Regional Supervisor
Habitat Protection Section

cc: Representative R. Halford
Representative B. Rodgers
Commissioner R. O. Skoog - ADF&G
Commissioner E. W. Mueller - ADEC
Commissioner R. E. LaResche - ADNR
J. Lawrence - Acres
J. Barnes - TES
R. Bowker - USFWS
B. Petrie - ADNR

ARLIS

Alaska Resources
Library & Information Services
Anchorage, Alaska

SUSITNA HYDROELECTRIC PROJECT

Preliminary Final Plan of Study

Fish and Wildlife Studies

proposed by the

Alaska Department of Fish and Game

November 1979

3 3755 000 34913 4

ARLIS

Alaska Resources
Library & Information Services
Anchorage, Alaska

DC NO 3281

TABLE OF CONTENTS

<u>LIST OF FIGURES</u>	ii
<u>LIST OF TABLES</u>	iii
<u>PROGRAM JUSTIFICATION</u>	1
Federal/State Laws	1
State Laws	3
<u>ISSUES, PROBLEMS CONCERNS AND RECOMMENDATIONS REGARDING THE SUSTINA HYDRO PLAN OF STUDY</u>	6
Project Review & Interagency Coordinaton	6
Phase I Studies Initiation	7
Phase II Studies	8
Socioeconomic Considerations	8
Administrative Overhead & Time Delays	10
Monitoring & Surveillance	10
Estuarine Studies	11
<u>AQUATIC STUDIES</u>	12
Introduction	12
Study Proposals	13
Stock Assessment of Adult Anadromous Fish Populations	15
Stock Assessment of Adult Resident Fish & Juvenile Resident & Anadromous Fish Populations	23
Seasonal & Spatial Habitat Studies	34
<u>REFERENCES</u>	40
<u>BUDGETS-SUSITNA HYDRO FISHERIES STUDIES</u>	43
Administration & Support	43
Anadromous Adult-Stock Assessment	45
Resident & Juvenile Anadromous Fishery Study	52
Spatial & Seasonal Habitat Studies	57
<u>WILDLIFE STUDIES</u>	61
Introduction	61
Moose Distribution, Movements, & Habitat Use	62
Wolf Distribution, Abundance, Habitat Use & Prey Selection	68
Wolverine Distribution, Abundance, Movements, Patterns, & Habitat Use	70
Bear Distribution, Movements, Abundance & Habitat Use	72
Caribou Herd Identity, Migration Patterns & Habitat Use	74
Distribution & Abundance of Dall Sheep	77

APPENDIX

Attachment I, Letter to Eric Yould, APA, from Theodore Smith,
ADNR, October 26, 1979.

LIST OF FIGURES

1. General Sampling Schedule 39-A
2. Aquatic & Wildlife Studies Organization Chart 80
3. Aquatic Studies Organization Chart 81
4. Wildlife Studies Organization Chart 82

LIST OF TABLES

1. Big Game Studies Phase I Budget	78
2. Budget Summary-Aquatic & Wildlife Studies & Support (Phase I)	79

PROGRAM JUSTIFICATION

The programs proposed by the Alaska Department of Fish and Game (ADF&G) are the first phase of a five year study program, necessary in the opinion of this Department, to meet the provisions of numerous federal and state laws and regulations providing for the consideration of fish and wildlife values in pre-project planning and evaluation of impact assessment, project possibility determination, mitigation of probable impacts should the project be constructed, and surveillance and monitoring during and after project construction. The biological objectives and justification are explained in the task work plans; the statutory and regulatory mandates for conducting these proposed work plans are outlined hereafter:

Federal/State Laws

Fish and Wildlife Coordination Act (FWCA)

The Fish and Wildlife Coordination Act, draft uniform procedures for compliance, May 1979 further standardizes procedures and interagency relationships to insure, "that wildlife conservation is fully considered and weighed equally with other project features in agency decision making processes by integrating such considerations into project planning, National Environmental Policy Act (NEPA) compliance procedures, financial and economic analyses, authorization documents, and project implementation."

As stated in the Federal Register (Vol 44, No. 98) this Act applies not only in the project area, but wherever project impacts may occur.

Subpart B FWCA Compliance Procedures

Sec. 410.21 Equal consideration

Equal consideration of wildlife resource values in project planning and approval is the essence of the FWCA compliance process. It requires action agencies (the Alaska Power Authority, APA) to involve wildlife agencies (the Alaska Department of Fish and Game and U.S. Fish and Wildlife Service, USFWS) throughout their planning, approval, and implementation process for a project and highlights the need to utilize a systematic approach to analyzing and establishing planning objectives for wildlife resource needs and problems and developing and evaluating alternative plans.

Sec. 410.22 Consultation

(a) Initiation. The FWCA compliance process may be initiated by a potential applicant, an action agency, or a wildlife agency.

(b) Potential Applicants. Implementing procedures of action agencies shall provide that applicants for those non-federal project approvals which require a water-dependent power project approval from the Federal Energy Regulatory Commission (FERC) (also applies to preliminary FERC permit) contain written evidence that they initiated the FWCA compliance process with both Regional Directors and the head of the State wildlife agency exercising administration over the fish and wildlife resources of the state(s) wherein the project is to be constructed and early site review (NRC) applicants.

The intent of this paragraph (a)(1) of this section is to assist applicants in designing environmentally sound projects without waste of their planning resources and to minimize the potential for delay in the processing of applications. Action agency implementing procedures shall advise that consultation should be initiated by the applicant at the earliest stages of its project planning, and that its submissions to wildlife agencies shall indicate the general work or activity being considered, its purpose(s), and the general area in which it is contemplated.

National Environmental Policy Act (NEPA)

The Council on Environmental Quality (CEQ), Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR, Parts 1500-1508, July 30, 1979) specifies provisions requiring the integration of the NEPA process into early planning, the integration of NEPA requirements with other environmental review and consultation requirements, and the use of the scoping process.

Clean Water Act

Section 404 of the Clean Water Act of 1977 and regulations for implementation of the permit program of the Corps of Engineers (33 CFR, Parts 320-329, July 19, 1977) requires that a Department of the Army permit(s) be obtained for certain structures or work in or affecting waters of the United States. The application(s) for such a permit(s) will be subject to review by wildlife agencies.

Executive Order 11990 (Wetlands)

This order was issued "in order to avoid to the extent possible the long-term and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative," and Executive Order 11988 (Floodplains) was issued "to avoid to the extent possible the long-term and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." All federal agencies are responsible to comply with these EO's in the planning and decision-making process.

Endangered Species Act

Section 7(c) of the Endangered Species Act, 87 Stat. 884, as amended, requires the APA to ask the Secretary of the Interior, acting through the U.S. Fish and Wildlife Service, whether any listed or proposed endangered or threatened species may be present in the area of the Susitna Hydroelectric Power Project. If the Fish and Wildlife Service advises that such species may be present in the area of the project, the APA is required by Section 7(c) to conduct a Biological Assessment

to identify any listed or proposed endangered or threatened species which are likely to be affected by the construction project. The assessment is to be completed within 180 days, unless a time extension is mutually agreed upon. No contract for physical construction may be entered into and no physical construction may begin until the Biological Assessment is completed. In the event the conclusions drawn from the Biological Assessment are that listed endangered or threatened species are likely to be affected by the construction project, the APA is required by Section 7(a) to initiate the consultation process.

Water Resources Council, Principles and Standards

The principles and standards for Planning Water and Related Land Resources (18 CFR, Part 704, April 1, 1978) were established for planning the use of the water and related land resources of the United States to achieve objectives, determined cooperatively, through the coordinated actions of the Federal, State, and local governments; private enterprise and organizations; and individuals. These principles include providing the basis for planning of federal and federally assisted water and land resources programs and projects and federal licensing activities as listed in the Standards. The President in his June 6, 1978 statement further defined federal water policies.

State Laws

Title 16

Title 16, independently of Federal laws, mandates the Alaska Department of Fish and Game to manage, protect, maintain, enhance, and extend the fish and game, and aquatic plant resources and the habitat that sustains them including assisting the U.S. Fish and Wildlife Service in the enforcement of federal laws and regulations pertaining to fish and wildlife.

Sec. 16.05.870 also states that:

(b) If a person or governmental agency desires to construct a hydraulic project, or use, divert, obstruct, pollute, or change the natural flow or bed of a specified river, lake or stream, or to use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed of a specified river, lake, or stream, the person or governmental agency shall notify the commissioner of this intention before the beginning of the construction or use.

(c) If the commissioner determines to do so, he shall, in the letter of acknowledgement, require the person or governmental agency to submit to him full plans and specifications of the proposed construction or work, complete plans and specifications for the proper protection of fish and game in connection with the construction or work, or in connection with the use, and the approximate date the construction, work, or use will begin, and shall require the person or governmental agency to obtain written approval from him as to the sufficiency of the plans or specifications before the proposed construction or use is begun.

Purpose. The purpose of this section is to protect and conserve fish and game and other natural resources. 1964.
Att'y Gen., No. 10

Alaska Coastal Management Program

The recently approved Alaska Coastal Management Program (ACMP) mandates that all State, Federal and Local government agencies must coordinate all planning and development activities in the State's coastal zone to ensure adequate consideration and protection of Alaska's coastal waters and resources. As the proposed Susitna Hydropower project will occur within Alaska's coastal zone and certainly will directly influence coastal waters all planning and development plans must be consistent with the Coastal Standards and the Mat-Su Borough's District Coastal Plan once it is completed and approved. The Coastal Standards are presently in effect and all State and Federal actions must be consistent with them. Section 6AA C 80.130 states that:

(a) habitats in the coastal area which are subject to the Alaska Coastal Management Program include:

- (1) offshore
- (2) estuaries
- (3) wetlands and tidal flats
- (4) rocky islands and sea cliffs
- (5) barrier islands and lagoons
- (6) exposed high energy coasts
- (7) rivers, streams and lakes
- (8) important upland habitat

These habitats which are specifically defined in the Standards must be identified within the Susitna Hydro Study area during the feasibility studies. In addition, Section (b) states that habitats contained in (a) of this section shall be managed so as to maintain or enhance the biological, physical and chemical characteristics of the habitat which contributes to their capacity to support living resources. Specific guidelines are also provided for each coastal habitat. The Coastal Zone Management consistency requirements are mandated in both the Alaskan and Federal CZM Acts and the Fish and Wildlife Coordination Act. The Question of consistency with CZM standards goes well beyond the FERC licensing requirements and should be treated as a separate step in determining the feasibility of Hydro Power alternatives.

The Alaska Department of Fish and Game has a strong mandate under these laws to insure that adequate planning study and evaluation of the fish and wildlife resources in the Susitna Hydro Project area are completed and become a part of the decision making information used to determine project feasibility. If the project is constructed these studies will be the basis for mitigation plans or the formulation of mitigation studies to offset project impacts. Mitigation as defined in Section 1508.20 of the National Environmental Policy Act Implementation Regulations includes:

- (a) Avoiding the impact altogether by not taking a certain action or parts of an action.
- (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- (e) Compensating for the impact by replacing or providing substitute resources or environments.

ISSUES, PROBLEMS, CONCERNS AND RECOMMENDATIONS
REGARDING THE SUSITNA HYDRO PLAN OF STUDY

Project Review and Interagency Coordination

Because of the magnitude of the Susitna Hydroelectric Feasibility Study, continuous coordination in accord with the Uniform Procedures for compliance with the Fish and Wildlife Coordination Act will be best accomplished through formation of a Susitna Hydroelectric Steering Committee. The function of this committee would be to provide coordinated exchanges of information between the Alaska Power Authority and interested resource management agencies. Through this exchange, the concerns of all agencies involved would be identified early and hopefully prevent unnecessary delays in the progress of the feasibility study.

We propose that the Steering Committee be composed of representatives of resource agencies with responsibilities pertaining to the Susitna Hydroelectric Feasibility Studies (ADF&G, ADEC, ADNR, USFWS, USGS, and NMFS). This committee would provide for interagency coordination through joint review of project related materials and for development, through convening the committee, of more informed and uniform positions representing all resource interests to be transmitted to the applicant. This we believe provides that applicant with a more efficient process for information exchange.

The objectives of this committee are to:

1. develop plans of study which are based upon full agency participation throughout each phase of the planning process;
2. select the resource specialists who will undertake the required studies and investigations;
3. insure that the biological and related environmental studies, their timing, and technical adequacy are planned, implemented, and conducted to provide the quantitative and qualitative data necessary to: a) assess the potential impacts to fish and wildlife resources; b) provide the basis for mitigation and compensation of resource losses, which will result from the project at the time of submission of a FERC license application; and c) select the favored mitigation and/or compensation alternative from the product generated by "b";
4. provide the forum for continued project review to jointly develop all aspects of the studies and to provide for a timely exchange of information and for redirection of studies should the accomplishment of specific objectives be in jeopardy;

5. assure that the studies are conducted in compliance with all state and federal laws, regulations, Executives Orders, and mandates as they apply to fish and wildlife resources; and
6. provide unified agency comments from the committee to the applicant.

The Susitna Hydroelectric Steering Committee should convene on a regular basis as dictated by planning and review requirements. However, it seems appropriate to meet at a minimum on a monthly basis to exchange reports and to be advised of progress toward objectives by the Alaska Power Authority and principle investigators. A record of agreements reached, recommendations and comments provided, and responsibilities assigned in meetings should be distributed to all parties involved.

Progress reports should be submitted to members of the committee quarterly. Comments from the committee to APA would then be submitted at a pre-established time thereafter. Comments provided to the Alaska Power Authority should be appropriately addressed and incorporated into project documents.

The participating members of the committee must have free access to all data collected during the study. In addition, principal project personnel should be accessible to members of the committee in case clarification of any aspect of the field studies is required.

Phase I Studies Initiation

The programs outlined in the work plans are scoped into a 24 month time frame for Phase I field work and one additional month covering Phase I annual report development during January 1982. The completion of several of these studies between January 1980 and January 1982 is not considered feasible.

A large amount of materials, equipment and scientific gear will be required for these studies. Many of these items will require ordering well in advance of the date on which they would be employed in the field. For example, major sonar and radio-telemetry development is anticipated for anadromous adult stock assessment and migrational work. The Bendix Corporation, the supplier of the sonar equipment the Department uses, has indicated a minimum of 18 months from order to delivery of sonar equipment. Also, members of the USFWS who have utilized radio-telemetry in the State have indicated an up to one year delay in the fielding of that equipment until radio frequencies are approved by the FCC.

New State personnel regulations may also affect this Department's timely implementation of studies unless an expedited procedure for employing staff dedicated to these studies is developed. If funds are released on January 1, 1980, several months will be required to obtain the staff needed to begin field work in 1980. These staff are crucial to the continued progress of specific planning and organizational work which

must necessarily begin as close to January as possible or further study delay will be encountered.

Allowance must be made for the impacts of equipment and personnel constraints on the ability of this Department to conduct the proposed fish and wildlife studies. These are realities which must be dealt with and are fundamental determinants of the adequacy of the work we have proposed to do.

Phase II Studies

A major position of the Department for the past several years is that many of the biological studies must be conducted through a five year period to provide the basic cyclical, environmental information needed to evaluate project impacts and the mitigation requirements or alternatives that are available. In the time availed us, we have not been able to provide a specific budget or work plan proposal for the studies that may be required in the years succeeding Phase I into Phase II, and it may not be reasonable to do so at this stage.

An acceptable Plan of Study must insure that studies are continued into Phase II. It is the position of this Department that study continuation and redirection should be based on the outcome of Phase I information. The proposed Susitna Hydroelectric Steering Committee, which has been proposed herein, is an important group, in our opinion, to insure scoping and budgeting of Phase II studies are executed in a consistent and systematic fashion.

Socioeconomic Considerations

Of primary importance to this Department is Objective 4: to determine the economic, recreational, social, and aesthetic values of the existing resident and anadromous fish stocks and habitat.

This objective will enable the Susitna Hydro environmental studies to assess the socioeconomic impacts on commercial, recreational, and subsistence users and industries supporting them. Over half of Alaska's growing population resides in the proximity of the impact area. Not only this population, but commercial fishermen, recreationists, and businesses from throughout the nation and other countries may be affected by the hydroelectric project. The popularity of Denali State Park and nearby Mt. McKinley National Park further attests to the high social, recreational, and aesthetic qualities of the area.

The basic problem in regard to the Susitna Hydro POS is to define and conduct the studies which will adequately evaluate the socioeconomic (monetary and nonmonetary) and cultural values of fish and wildlife and

the habitat that supports them when comparing them with other (more tangible) monetary resource values and uses associated with hydropower development.

It must be emphasized that to ultimately select the best uses of the natural resources of the Susitna Basin from which society will receive the most long term benefit, the net benefits (total benefit minus total costs) must be adequately evaluated. Consequently, values must be assigned to each potential resource use. When monetary terms are inappropriate, agencies will need to devise nonmonetary means of evaluating impacts to fish and wildlife resources. Existing regulations require agencies such as the Corps of Engineers (COE) or the Alaska Power Authority (APA) to search out, develop and follow procedures reasonably calculated to bring environmental factors to peer status with dollars and technology in their decision-making. NEPA directs action agencies to "the fullest extent possible":

identify and develop methods and procedures which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations (42 U.S.C. S4332 (a) (B)).

These methods should quantify habitat values which are equivalent to the extent and type of habitat affected by the planned project and estimate the quantity and quality of habitat needed to be acquired and/or improved to mitigate loss. It can then be determined if the socio-economic impacts of the project can be mitigated and at what cost. Furthermore, the Water Resources Council directs action agencies to devise nonmonetary means of evaluating fish and wildlife impacts:

When effects cannot or should not be expressed in monetary terms, they will be set forth, insofar as is reasonably possible, in appropriate quantitative and qualitative physical, biological or other measures reflecting the enhancement or improvement of the characteristics relevant to the type of effect under consideration (38 F.R. 24797).

As a result, the often-cited excuse that the evaluation of supposedly "intangible" habitat values is difficult or impossible is no longer valid (Horvath 1978; Dwyer 1977; Copeland 1976; Morrow 1979).

Specific data to analyze both the nonmonetary and monetary socioeconomic recreational, social, and cultural values of the Susitna River Basin are lacking. It should also be stressed that an adequate assessment of monetary values by traditional methods must be based on commercial,

recreational, and subsistence use data which are not currently available and not being collected. Designs for this data collection and the data collection itself would best be done by the Department of Fish and Game, the traditional collector of data on these users. Therefore, this Department would like to actively participate in planning those portions pertaining to socioeconomics, recreational, cultural and aesthetic values of the Susitna River Basin.

Administrative Overhead and Time Delays

Overhead costs have not been included in the attached budget. The Alaska Department of Fish and Game (ADF&G) normally charges overhead to cover costs incurred by its Division of Administration. On most outside contracts, this amounts to approximately 10 percent of all costs except equipment. However, overhead is usually not charged on reimbursable service agreements (RSA) between State agencies. Susitna Hydroelectric Project studies will place an additional burden on the Division of Administration particularly during the first year when major equipment purchases and personnel hiring will occur. However, this additional work load is not likely to cost 10 percent of the proposed budget (approximately \$600,000 during 1980 and 1981). Surplus money would presumably revert to the General Fund without accomplishing any purpose.

A more reasonable approach would be for the Division of Administration of the ADF&G, the Alaska Department of Administration, and the Alaska Power Authority to design a realistic program for administering the funds and to have APA reimburse the appropriate agencies for actual costs. These costs should be added to the overall budget.

The time normally required to process purchase requisitions and contracts is likely to create problems with APA's time table. A similar problem developed when the Legislature appropriated Bristol Bay disaster relief funds during 1974 after a failure in the salmon run. The problem was solved by funding a position in the Anchorage office of the Department of Administration to expedite purchasing. This allowed the rapid purchase of items without violating purchasing procedures and without excessively burdening the State's regular administrative staff. A similar approach would be beneficial to the Susitna Program. It is recommended that APA and Administration consider it as an option.

Monitoring & Surveillance

Monitoring and surveillance of Phase I and II project activities to minimize the impact of these activities on fish and wildlife and their habitats will be necessary.

The Susitna Hydro Coordinator will be responsible for assuring that the Department reviews and comments upon the host of State and Federal permit actions which may be required each year for land and water use.

He will be specifically responsible for ADF&G Title 16 permit applications review and development stipulations to protect fish and game.

Estuarine Studies

The Department of Fish and Game has not attempted to detail possible estuarine studies for the preliminary final POS. These studies can be delayed pending the outcome of Phase I studies.

If demonstrable hydrologic and water quality changes near the mouth of the Susitna River are shown or projected (based on the analysis of 1980 or 1981 data), estuarine studies should be initiated to identify the potential for project impacts on that environment.

AQUATIC STUDIES

Introduction

The Susitna River drainage, located north of Cook Inlet, encompasses an area of 19,400 square miles. The free-flowing Susitna River is approximately 275 miles long from its source in the Alaska Mountain Range to its point of discharge into Cook Inlet. The mainstem river and its major tributaries originate in glaciers and carry a heavy silt load during the ice-free months, but there are also many smaller tributaries which are perennially silt-free.

The construction of power dams on the Susitna River will adversely affect portions of the fish and wildlife resources of the Susitna River Basin. The two dam system proposed by the Corps of Engineers (COE) would inundate in excess of 50,500 acres of the Susitna River Basin aquatic and terrestrial habitat upstream of Devil Canyon. Regulation of the mainstem river will substantially alter the natural flow regime downstream. The transmission line corridor, substations, road corridor, and construction pad sites may also impact aquatic and terrestrial communities and their habitat. Historically, the long-and-short-term environmental impacts of hydroelectric dams have adversely altered the extremely delicate balance of ecosystems (Keller 1976; Hagan et al 1973).

Background knowledge of the Susitna River Basin is limited. The proposed hydroelectric development necessitates gaining a thorough knowledge of its natural characteristics and populations prior to final dam design approval and construction authorization in order to protect the aquatic and terrestrial populations from unnecessary losses. All engineering, hydrological, biological, and other project feasibility study activities conducted by the various governmental and private agencies will also have to be monitored and regulated to prevent ecological disturbances.

A survey of the fishery resources should cover complete life history cycles. A 30 month program prior to license application (Phase I), although supplying essential information about the fishery, is inadequate and should be continued through supplemental studies in Phase II. The proposed studies should be conducted for a minimum period of 5 years.

Five species of Pacific salmon (chinook, coho, chum, pink, and sockeye) inhabit the Susitna River drainage during their freshwater life history stages. The majority of chinook, coho, chum, and pink salmon production in Cook Inlet occurs within this drainage. An anadromous smelt, the eulachon, also utilizes the lower reaches of the river.

Cook Inlet is one of the major anadromous fish producing areas in the State of Alaska. The commercial catch of salmon reported for Cook Inlet during the five year period from 1971 to 1975 averaged over a million fish per year, and represented an average of 7.4 percent of the total catch for the State of Alaska. In addition to the commercial catch of

salmon, the recreational fisherery took about 90,000 salmon a year and the personal-use fishery, an additional 10,000 salmon per year. Sockeye, pink, and chum salmon are by far the most important commercial species in the area, making up over 90 per cent of the total catch from Cook Inlet; coho and chinook salmon make up the remainder. Chinook and coho salmon also are the species most favored by the recreational fishermen.

Grayling, rainbow trout, Dolly Varden, burbot, lake trout, and whitefish are some of the important resident fish species common to this system. Approximately 50 percent of the statewide sport fishing effort occurs within the Cook Inlet area. The recreational marine fishery is, however, very limited with the exception of a popular fishery at the vicinity of Deep Creek on Cook Inlet. The majority of the anadromous sport fish harvest occurs as the fish approach their spawning areas. Most, anglers within the Cook Inlet area show a preference for salmon rather than resident game fish when both types of fisheries are available. Resident populations are fished more heavily during fall and spring months during the absence of salmon runs.

Therefore, the proposed Susitna River hydroelectric project will have various impacts on both the indigenous organisms and the natural conditions within the aquatic environment. Potential impacts to fish populations are the most obvious source of concern due to their socioeconomic and recreational importance to the people of Alaska and the Nation.

STUDY PROPOSALS

Individual study proposals are designed to provide the necessary background information to enable proper evaluation of impacts. Six general objectives have been outlined:

1. Determine the relative abundance and distribution of adult anadromous fish populations within the drainage.
2. Determine the distribution and abundance of selected resident and juvenile anadromous fish populations.
3. Determine the spatial and seasonal habitat requirements of anadromous and resident fish species during each stage of their life histories.
4. Determine the economic, recreational, social, and aesthetic values of the existing resident and anadromous fish stocks and habitat.

The Department has not developed a specific work plan for this objective but strongly believes the Acres-American POS must be strengthened to cover fish and wildlife concerns during Phase I.

5. Determine the impact the Devil Canyon project will have on the aquatic ecosystems and any required mitigation prior to construction approval decision. This is the primary objective of both Phase I and II studies. This will be discussed in detail in the Phase II work when it is written.
6. Determine a long-term plan of study, if the project is authorized, to monitor the impacts during and after project completion. This is also an objective of Phase II.

The study areas are generally categorized within the following locations:

- A. Cook Inlet area
- B. Cook Inlet to the Yentna River confluence
- C. Yentna River to the Talkeetna River confluence
- D. Talkeetna River confluence to the Devils Canyon dam site
- E. Devil Canyon dam site to the Tyone River confluence
- F. Proposed transmission line corridor(s), access roads, and construction pad sites

Scaling of the proposed studies with respect to timing, geographic locations, and intensity has been done with consideration of the resource knowledge available for each of the geographic locations identified above.

Title

Stock Assessment of Adult Anadromous Fish Populations

Objectives

To determine the relative abundance and distribution of the anadromous fish populations within the Susitna River drainage.

Background

The Susitna River salmon stocks are major contributors to the Cook Inlet area recreational and commercial fisheries. Determining total escapement into this system is complicated by the glacial conditions of the major streams and the enormity of the area. Management of the northern Cook Inlet salmon stocks has been difficult due to the mixed stock commercial fishery in Cook Inlet and the lack of adequate tools to provide accurate in-season escapement estimates for the drainage.

The major hydroelectric project impacts on the anadromous fish species are expected to be due to changes in habitat. Alteration of the normal flow regimes and the physical and chemical water characteristics will probably be the most critical impacts. It is difficult at this time to determine the distance downstream from the proposed dams that changes will occur. Studies conducted by Townsend (1975) in the Peace River demonstrate that effects were observed 730 miles downstream from the Bennett Dam.

Baseline fisheries inventories were conducted by the Alaska Department of Fish and Game in the upper Susitna River during the 1974-1977 field seasons. Emphasis has been on the inventory of adult and juvenile salmon stocks and habitat assessment. Ongoing Alaska Department of Fish and Game research investigations have concentrated on determining salmon escapement into the Susitna River and the distribution of these escapements. Emphasis has, however, been primarily on sockeye salmon. Successful tag and recovery projects were operated in the lower river during 1975 and 1977 and the feasibility of sonar operation was tested in the mainstem Susitna River approximately 25 miles upstream from Cook Inlet during 1976. Side-scan sonar counters have been utilized to determine escapements into the river since 1977 and are considered the state-of-the-art equipment for determining escapements in glacial river systems in Alaska.

Only through total stock assessment will it be possible to determine what portion of the Susitna River salmon stocks will be affected by the project and determine the level of mitigative measures which will ultimately be required. It is essential to know what portion the affected stocks contribute to the total Susitna River salmon escapement in order to determine potential changes in fish populations and numbers. An evaluation of the contribution of the Susitna River salmon runs to the Cook Inlet fisheries is essential to establishing the importance of the Susitna River salmon to the economy of the Cook Inlet area as a whole.

Ideally, since the Pacific salmon are cyclic in years of return, these studies should continue through at least one complete cycle. Differences do occur between the different year classes. The results obtained prior to license application may show, at least, the degree of variation that might be expected from year-to-year but with wide limits of confidence.

The real danger is, of course, the unpredictable conditions or events that might occur in any one year. For example, any one year could be completely abnormal with respect to weather or other environmental conditions which influence fish productions and would make interpretation of the results very difficult. The studies outlined should therefore continue through Phase II (post-license application). A minimum of five years would be required to complete the studies.

Study Approach

Adult anadromous fisheries studies will be divided into five major geographical areas. All studies, however, will be interrelated. The following outlines baseline studies required for each area and general work plans.

1. Cook Inlet Area. Contribution of the Susitna River salmon stocks to the Cook Inlet fisheries - Quantitative separation of stocks

Objectives

The objectives of this study are to:

1. Identify the proportion of the Susitna River salmon stocks harvested by the commercial and recreational fisheries; and
2. Determine quantitatively that portion of the total catch produced in the Susitna River drainage.

Background

The major area of salmon resource competition is within the Upper Cook Inlet area, i.e., that area north of the latitude of Anchor Point. The Susitna River salmon stocks are intermixed with other large salmon stocks produced from the Kenai Peninsula and west side of Cook Inlet.

All five species of Pacific salmon are harvested in Upper Cook Inlet. The majority of these salmon pass through the area at the same time, thus creating a mixed species and mixed stock fishery. Any feasibility study of the Susitna River project will require an assessment of the contribution of the Susitna River salmon populations to the commercial and recreational fisheries.

Work Plan

Commercial catch data is available through the Alaska Department of Fish and Game. Final statistical runs are available through 1976 and preliminary

data is available through the current years harvest.

Identification and separation of the various stocks of salmon will be by scale pattern analysis and/or electrophoresis. Differences in scale patterns have already been found to exist in sockeye and coho salmon populations in Cook Inlet and the Susitna River stocks have been statistically separated from the other major Cook Inlet stocks. Data is, however, only available for one age class. Chum and pink salmon stocks have not successfully been separated on the basis of scale pattern analysis in other areas, due to the absence of freshwater growth. Electrophoretic techniques would be employed for stock identification of these species. An analysis of length-weight relationships may provide sufficient data for these two species.

The program requires the regular collection of scales and tissue samples from the commercial catch and from the major salmon producing areas (i.e., known escapement samples). Expansion of the on-going Alaska Department of Fish and Game Stock Separation Program would provide the necessary data base for stock assessment of sockeye, coho, and chinook salmon. Cost estimates and design of this program are based on incorporating these studies with ADF&G programs. If a separate program is designed, additional funding would be required for sampling crews and laboratory equipment and analysis.

Sampling design would be divided into two major components: collection of scales and laboratory and computer analysis of scale patterns.

A minimum of 250 scales per species and age class will be obtained during each fishing period. Known escapement samples would be obtained from existing research and management programs. Three additional cannery sampling crews (2 people each) will be required to obtain scale samples. Staff time will be required to design a program for chinook salmon. Existing crews should, however, be adequate to conduct sampling.

The ADF&G scale laboratory would be used to process samples. A supervisor and a second shift would be added to the staff to maximize the use of existing equipment. A digitizing station would have to be added to the existing microcomputer. Additional computer time would be required.

The feasibility of separating pink and chum salmon stocks by electrophoretic techniques probably could be determined after one sampling season. If this technique is unsuccessful it would be discontinued and other methods would be evaluated. Analysis could best be done by the University of Alaska. A minimum of 1,000 fish samples per fishery should be obtained for each species. Known escapement samples will also have to be collected. Three sampling crews would be required.

2. Cook Inlet/Susitna river confluence to the Yentna River confluence.
Stock assessment of the adult salmon populations

Objectives

The objectives of these studies are to provide:

1. escapement data, by salmon species, into the lower Susitna River;

2. differentiation of the Susitna and Yentna river stock contribution;
3. timing of the salmon migrations;
4. movements as related to stream flow and water quality; and
5. utilization of the mainstem river for spawning.

Background

Total escapement information for the Susitna River drainage is generally lacking. Various methods have been utilized by the Alaska Department of Fish and Game since 1974. Recent developments in side-scan sonar have provided the most valuable tool, to date, for evaluating in-season escapement by species. Emphasis has, however, been on sockeye salmon.

Work Plan

Commercial Fisheries Division of the Alaska Department of Fish and Game currently operates an escapement project in the vicinity of Susitna Station as a part of their on-going sockeye salmon research program. Expansion of this program would provide the necessary escapement data required for the Susitna Hydro-Project baseline studies. Sonar counters and fishwheels would be operated from May through mid-October to determine escapement by species. This would require funding of the existing project beyond its normal operating dates. Data from this program would be correlated to the Stock Separation program within Cook Inlet and additional escapement studies in the upper Susitna River.

A sonar escapement enumeration program would be required in the lower Yentna River to differentiate between Yentna and Susitna river production. Comparative analysis of the Yentna River escapement data and the mainstem Susitna River sonar data would be made to determine stock contribution of each system. Two side-scan sonar counters and two fishwheels (for species apportionment) would be deployed on the Yentna River.

Migrational timing data would be obtained from fishwheel catch data at the sonar site.

Scale samples will be obtained from the fishwheel catch to provide a known data base for Cook Inlet stock separation studies. A minimum of 40 samples per day will be required for each species.

Radiotelemetry will be used to locate critical salmon habitat and define major migrational corridors of adult salmon in the Susitna River. This technique has been used successfully in other glacial river systems within Alaska, but the feasibility of this technique will have to be further evaluated for the Susitna River. Conductivity data will have to be compiled from various locations within the drainage, both within the mainstem river and clearwater tributaries.

Migrational characteristics may vary greatly for each salmon species and must therefore be determined for each separately. Data obtained from these studies may also be useful in the final selection of proposed sonar projects and deployment of gear.

Federal law requires obtaining an FCC license for transmitting. License application approval may require up to one year.

Feasibility studies will include testing of equipment and tags from major companies. Various companies will be contacted regarding the possibility of leasing equipment. If radiotelemetry is a successful technique in the Susitna River, equipment will be purchased for the second field season and the program will be expanded. Emphasis will be on one species during the testing period. Chinook salmon are suggested as the first year target species.

Fish will be tagged at the Susitna Station of the "Deshka" site and tracking will be conducted daily by boat and bi-weekly by aircraft. A statistically valid sample size probably will not be attained during the first year of feasibility studies, but evaluations of equipment will be made. If deemed feasible, a maximum of 50 fish a season will be tagged in subsequent years.

Coordination with and assistance from USF&WS Research Section will be required throughout the project.

Eulachon, an anadromous smelt, utilize the lower mainstem Susitna and Yentna rivers for spawning. The extent of utilization of the mainstem river will be documented and evaluation of the populations will be made.

3. Yentna River confluence to Talkeetna. Stock Assessment of adult salmon populations

Objectives

The objectives of these stock assessment studies are to determine the:

1. numbers of adult salmon utilizing this area for migration and spawning;
2. migrational timing of the adult salmon;
3. recreational utilization of these stocks; and
4. movement of salmon as related to stream flow and water quality.

Background

Many of the important recreational use areas occur within this area of the river. These areas have road access on the east side of the river

and receive high use via aircraft transportation on the west side. All five species of adult salmon utilize this area for spawning and migration. Due to the braided nature of the Susitna River in this area many impacts are expected to be seen due to alterations of stream flow.

Work Plan

Two side-scan sonar projects will be established within this area of the river. Seasonal apportioned counts by species will be compared to the lower Susitna and Yentna river sonar projects to determine importance of this area to the entire drainage. Fishwheels and possibly other sampling gear will be used to apportion sonar counts.

One sonar project will be located between the Yentna River confluence and the Deshka River and a second sonar project will be located in the vicinity of Sunshine. These programs will provide information on: 1) the importance of this area of the river for spawning; 2) the extent to which this area is used for migration to spawning areas upstream of Talkeetna; and 3) the contribution of these salmon stocks to the total Susitna River drainage. A total of 4 side-scan sonar counters and 6 fishwheels will be required.

All salmon captured in the fishwheels at the "Sunshine site" will be marked with a color- and number-coded Peterson disc tag. Marked fish will be recaptured upstream to provide an assessment of stocks utilizing this area.

Migrational timing will be determined by fishwheel catches at the sonar projects and survey crews.

Recreational utilization of these salmon stocks will be determined partially by on-going ADF&G creel census programs. Expansion of these programs will be required to adequately monitor all species. The creel-census programs will also provide data on migrational timing and tag recoveries.

Movement of salmon through this geographic area will be monitored by remote sensing devices for radio tagged fish. Sonar counters may also provide horizontal distribution data for that particular area.

Alaska Department of Fish and Game survey data will be used to determine chinook salmon escapements into major tributaries. These surveys may have to be expanded to assure adequate coverage of major tributaries.

4. Talkeetna to Devil Canyon Dam Site. Stock assessment of adult salmon populations

Objectives

The objectives within this study area are to determine the:

1. abundance of adult salmon;

2. stock assessment of the Susitna-Chulitna-Talkeetna stocks;
3. migrational timing of the salmon stocks;
4. recreational utilization;
5. movement of salmon stocks through this area as related to stream flow and water quality.

Background

Population estimates of salmon species utilizing the Susitna River above the Chulitna River confluence were estimated during the 1974, 1975, and 1977 field seasons based on tagging and subsequent recovery of fish. These studies indicate a portion of the salmon tagged are not destined to spawn above the tagging site, but rather below it. The importance and extent of this milling behavior in the upper river areas requires definition. The alterations in flow and water quality in the mainstem river after project completion could significantly affect this behavior and consequently spawning success.

Observations of spawning areas between the Chulitna and Susitna river confluence upstream to Portage Creek during fall surveys indicate that a reduction in flow to proposed post-construction levels would prevent access to many important spawning areas.

Work Plan

Salmon escapement estimates will be determined by a tag and recovery program in this area. Fish marked at the "Sunshine site" will be recovered by ground survey crews upstream from the Chulitna River confluence.

Surveys of major spawning areas between Talkeetna and the Devil Canyon dam site will be conducted in conjunction with juvenile studies to determine distribution.

Escapement estimates will be compared to sonar project located in the lower river, primarily the "Sunshine site," and will provide information on importance of the upper river for spawning and also contribution of the Talkeetna and Chulitna river salmon stocks to the entire drainage.

Migrational timing of salmon stocks utilizing this area will be determined by stream surveys.

Recreational use within this area will be determined by a creel-census program.

Movement of salmon stocks through this area will be determined by the radio tagging program. Radio tags may be implanted in adults at the Sunshine site and movements monitored upstream. Data will be used to

determine areas where habitat utilization studies should concentrate (i.e., stream flow and water quality monitoring).

5. Devil Canyon dam site to the Tyone River confluence. Stock Assessment of adult salmon populations

Objective

To determine if salmon utilize that area of the Susitna River above Devil Canyon.

Background

Studies conducted during the late 1950's indicate that Cook Inlet salmon stocks are unable to ascend the Susitna River beyond Devil Canyon, the latter being a natural water velocity barrier to migration (U.S. Department of the Interior, 1957). Reports from local residents of salmon observations above Devil Canyon indicate that this should be investigated further.

Work Plan

Surveys and escapement sampling will be conducted in the proposed impoundment areas between the Denali Highway and Devil Canyon during periods of peak adult salmon abundance. Initial observations will be conducted by aerial surveys to document the presence or absence of adult salmon. Surveys will be done in conjunction with resident fish investigations. Data obtained will be utilized to determine necessary mitigation measures.

Title

Stock Assessment of Adult Resident Fish and Juvenile Resident and Anadromous Fish Populations

Objectives

To determine the relative abundance and distribution of adult and juvenile resident fish and juvenile anadromous fish populations.

Background

Some resident game fish species make major migrations from lake and tributary systems into the mainstem Susitna for purposes of overwintering. The importance of this intra-system migration and the role of the mainstem Susitna River is not fully understood at this time. Surveys conducted between 1974 and 1977 document that a high quality sport fishery is provided by the Susitna River, its tributaries, and nearby lakes. These intra-system movements and periods of seasonal availability must also be better understood in terms of dependence upon mainstem hydrologic conditions.

Previous studies have defined important clearwater streams and spring fed sloughs within the Susitna River drainage which support juvenile anadromous fish species. Investigations have, however, concentrated primarily on summer rearing areas. Surveys indicate these populations are not static, but vary in abundance and distribution. Studies previously conducted indicate juvenile anadromous species also utilize the mainstem Susitna River during the critical winter period.

Data collected since 1974 provide only baseline information. Generalizations may be made, but sufficient information is not available to determine specific impacts of dam construction and operation on incubating and rearing anadromous species.

Study Approach

Adult and juvenile resident fisheries studies will be divided into three major geographical areas. All studies, however, will be interrelated. The following outlines baselines studies required for each area and general work plans.

1. Cook Inlet/Susitna River confluence to the Talkeetna River confluence. Stock assessment of the resident and juvenile anadromous fish populations.

Objectives

The objective of these studies are to:

1. Determine specific occurrence and species composition of resident and juvenile anadromous stocks throughout the year

within the Susitna River mainstem and within the reaches of tributary streams regularly influenced by the Susitna River. of particular importance to this study are the Alexander Creek, Flat Horn Lake, Deshka River, Willow Creek, Iron Creek, and Rabideux Creek tributary systems;

2. Define any apparent seasonal changes in occurrence and relative abundance of resident and juvenile anadromous species at the confluence of tributary systems and the Susitna mainstem;
3. Develop suitable sampling techniques for the collection and determination of relative abundance of resident and juvenile anadromous species in the Susitna mainstem throughout the year;
4. Define and describe habitat type utilization by resident and juvenile anadromous species throughout the year and at varying hydrologic conditions;
5. Determine migratory directions and timing of fish species at Iron Creek;
6. Survey other tributary systems, particularly Rabideux Creek, for the purpose of establishing a weir.

Background

This reach of the Susitna River encompasses many important fish producing and recreational fishing tributaries and is an area of critical environmental concern because of the possible seasonal use and migration between clearwater tributaries and the Susitna River. Studies of these seasonal migrations and the distribution of resident and juvenile anadromous fish in and to habitats in the Susitna River are essential. The studies would be initiated for selected streams and for a prescribed distance: upstream throughout the year. Expansion or retirement of these studies would depend on confirmation for migration and habitat use by resident and juvenile anadromous fish in the Susitna River. If confirmation of these movements and distribution to the Susitna is positive, the basic inventory will, in conjunction with the study task on habitat evaluation, identify specific year to year study locations for ongoing programs required to determine fishery impacts on the fish populations.

While the time frame allotted for accomplishment of these six objectives is 30 months we feel that these same objectives should remain ongoing through the termination of the project with appropriate adjustment and redirection being made as resultant data are analyzed.

Also we see that it is imperative to incorporate the hydrologic studies as an integral component in achieving our stated study goals.

Work Plan

The initial year of this study, 1980 will be comprised of essentially three field operations, a summer and winter program on the Susitna River and a weir established on Iron Creek.

A crew of three biologists, utilizing a riverboat as their primary means of transportation, will operate in the Susitna mainstem and tributary systems during the ice free months, May through October. Their responsibilities will include:

1. Sampling using established techniques and their adaptations including gill nets, minnow traps, adult traps, angling, seines, and electrofishing.
2. Developing suitable techniques for sampling the Susitna mainstem. Particular emphasis will be placed on the design of an effective stationary fish trap.
3. Classifying in terms of depth, velocity, turbidity, and substrate types in conjunction with the sampling of resident populations. It is essential that close cooperation is maintained between hydrologic and fisheries research.
4. Tag adult resident fish and note species, size, date and location of capture.

A crew of four biologists will carry out fisheries research during the winter months. This facet of the field operations will be based on road access until such time as the mainstem Susitna ice condition has stabilized sufficiently to provide safe transportation via snowmachine. This crew will:

1. Survey in the proximity of areas surveyed during the previous summer using established sampling techniques such as gill nets and minnow traps. As ice conditions improve and data is analyzed this effort will be expanded to include as much of the study area as possible.
2. Design an effective resident species adult trap for use in this study area as established sampling techniques meet with limited success when applied under a cover of ice in the river environment.
3. Classify habitat in terms of ice cover, depth, velocity turbidity, and substrate in conjunction with sampling of resident populations.

A weir will be installed on Iron Creek as early in the spring as is feasible and will operate throughout the ice free months (May-October). This facility will be operated by a crew of three biologists, who will be responsible for:

1. Operation of the Iron Creek weir. The Iron Creek weir will be designed to capture both adults and juveniles and both immigrants and emigrants.
2. Conducting a tagging study utilizing adults captured in the weir. A reward will be offered to encourage the return of tags and data from the sport fishermen.
3. Utilizing minnow traps, gill nets, seines, and electro shocking devices, in addition to the weir to sample the resident population and recovering tagged fish in Iron Creek.
4. Conducting surveys on Rabideux Creek to determine the advisability of installing a weir in there in 1981.

A project leader position assisted by a Tech III is included in this segment. Responsibilities will include:

1. Organizational functions and oversight of entire Susitna Basin study.
2. Analysis of data and report preparation.

Following the first season's determination of resident and juvenile anadromous fish occurrence, areas of greatest availability and suitable methods of capture, the 1981 program will be directed to largely the same areas and intensified with respect to relative abundance and preferred habitat utilization. The 1981 study plan will again consist of three segments, summer field operations, winter field operations, and a crew operating the Iron Creek weir and possibly an additional weir facility located at Rabideux Creek.

A crew of three biologists utilizing a riverboat as their primary means of transportation will operate in the Susitna mainstem and tributary systems during the ice free months to:

1. Confirm previous seasons data base with regard to occurrence and species composition.
2. Determine relative abundance of resident stocks in predetermined locations by seasonal period and further establish patterns of intrasystem migration.
3. Further define preferred habitat parameters.
4. Continue to tag adult resident fish and note any recaptures from previous year.

A crew of four biologists will carry on the initial year's study from January through April. This four man crew will begin the second field season in December of 1981 and following the first season's determinations the program will:

1. be expanded to include additional areas;
2. be intensified at one or two predetermined locations; and
3. continue to determine habitat requirements.

The weir facility at Iron Creek will be reinstalled and operated by a crew of two biologists from May through October. Second year activities will include:

1. Continuation of first year activities.
2. Recovery of tagged fish.
3. Description of Iron Creek habitat utilized by seasonally present resident fish.

Closely associated with the Iron Creek weir will be a more temporary weir to be constructed in spring 1981 on Rabideux Creek pending results of the first years study. This weir and associated tributarial sampling will be carried out by a crew of two biologists who will be responsible for:

1. Construction and operation of a temporary weir on Rabideux Creek.
2. Sampling Rabideux Creek and that portion of the Susitna mainstem adjacent to Rabideux Creek, on a regular basis using established sampling techniques.
3. Conducting a tagging program on resident fish.

A project leader position assisted by a Fishery Tech III will continue through 1981. Responsibilities will include:

1. Coordination of field activities.
2. Data analysis and report writing.
2. Talkeetna River confluence to Devil Canyon. Stock assessment of the resident and juvenile anadromous fish populations.

Objectives

The objectives of programs within this study area are to:

1. Determine specific occurrence and species composition of resident and anadromous stocks utilizing the mainstem Susitna River and it's major tributaries;

2. Define seasonal changes in occurrence and abundance of resident and anadromous species within the mainstem Susitna River and its tributaries;
3. Define habitat types utilized by resident anadromous fish species, seasonally throughout this year, at varying hydrologic conditions, both within the mainstem Susitna River and the major tributaries; and
4. Establish the impacts of flow regulation upon the habitat which currently meets seasonal requirements of resident and anadromous fish stocks within the study area.

Background

This study area includes the mainstem Susitna River and a number of important clearwater tributaries which have indigenous populations of resident game fish and provide spawning and rearing habitat for anadromous species. Several of the more important lateral tributaries are Portage Creek, Indian River, Gold Creek, and Fourth of July Creek. All are located in the upper reaches of the study area and in the general vicinity of the railroad crossing at Gold Creek.

Five species of Pacific salmon, chinook, coho, sockeye, pink and chum are native to this portion of the study area. The most important resident fish species within this area are Arctic grayling and rainbow trout; however, burbot, whitefish, Dolly Varden, and various other species are also present.

While a higher degree of reliability in knowledge of possible flow, water quality, and stream morphology changes exists in this reach because of previously collected baseline data, baseline studies on resident and juvenile anadromous fish must be initiated to better detail specific occurrence, distribution, and seasonal migration and habitat use of the Susitna River as well as document the population sizes of resident fish.

Work Plan

Due to limited access to much of the Susitna River upstream of Talkeetna, and related high cost of transportation, work proposed for 1980 is limited to the Indian River - Portage Creek - Gold Creek area. This area is accessible by railroad and can be investigated by a single field crew located in the Gold Creek area. These investigations will be extended downstream into other areas in the second and third years of study.

A four man crew will be located in the Gold Creek or Indian River area housed in a local cabin or tent camp, and provided with a river boat and Zodiac type raft to conduct the following activities:

1. Establish the occurrence and species composition of resident and anadromous fish stocks utilizing the mainstem Susitna River during the period May through October of 1980. This

work will entail intensive netting, electro-shocking, trapping, or use of set lines or other suitable collection methods within the mainstem reach from Fourth-of-July Creek upstream to Portage Creek. Some of these collection devices are expected to require modification and/or development as the season progresses.

2. Perform similar sampling by net, electro-shock, trap or angling within the Indian River, Portage Creek, Gold Creek, and Fourth-of-July Creek tributaries. A program of fish tagging will be implemented to define intra-system movement.
- 3.) Creel census anglers utilizing these four streams to determine harvest of resident fish by: a) species, b) age class, c) size, d) seasonal period, and e) area of availability. The creel census will also help with recovery of tagged fish.
4. Conduct the adult anadromous studies in this area in cooperation with the anadromous program.

Following the first seasons determinations of resident and anadromous fish occurrence, areas of greatest availability, and suitable methods of capture, the 1981 program will be directed to largely the same areas and intensified to include population estimations and preferred habitat utilization.

A similar two man crew will be located in the Indian River or Gold Creek area, depending upon which seems more appropriate as a result of the first year study. The same equipment will be utilized. Study objectives for 1981 will be as follows:

1. Determine relative abundance of resident and anadromous fish stocks in Indian River and Portage Creek, at predetermined locations, by seasonal period, and further define intra-system movements and migrations. These studies will necessitate an intensified tag and recovery program to provide instantaneous population estimates at specific seasonal periods and also numerous aerial surveys. While the methods with which to accomplish this work may be more apparent after the first years efforts, it is at this time considered likely that trapping devices or a statistically designed angling scheme may be most appropriate.
2. Conduct similar studies in appropriate sections of the mainstem river and side channels during spring, summer, and fall. Techniques for this work segment will be similar to objective No. 1.
3. Define habitat utilization of resident and anadromous species both within the mainstem and the Gold Creek, Fourth-of-July

Creek, Indian River, and Portage Creek tributaries as related to hydrologic conditions.

Areas of resident and anadromous fish preference will be surveyed in terms of flow, substrate, turbidity, depth, etc. to determine if these parameters are responsible for instream movements and distribution. These data will be correlated with historical climatological data and mainstem flows. Particular emphasis will be placed upon this facet during periods when mainstem flows approach the proposed regulated flow.

4. Determine mid-winter occurrence and distribution of resident and juvenile anadromous fish species both in Indian River and the mainstem Susitna River.

As Indian River is the only major accessible upper tributary stream during mid-winter, these studies will be limited to it.

The mainstem river is characterized as being extremely dangerous to work in mid-winter due to poor ice conditions. As deemed possible, netting, trapping, and set lines will be utilized to determine occurrence and distribution of resident species during the winter months and to recapture fish tagged earlier in the year.

Winter sampling of both the tributary and mainstem will be conducted during November and December on a field trip basis, on a monthly schedule. No permanent camp is contemplated.

It is expected that by the end of the 1981 field season estimates of the magnitude of intra-system migrations will be possible, by time; as will be population estimates of resident fish available at the mouths of the two tributaries throughout the seasonal period when sport angling occurs. Population estimates will also be formulated for the two years runs of salmon. It is further expected that habitat requirements or needs dictating spring/fall migrations of resident and juvenile anadromous fish will be definable, as will the role played by the mainstem Susitna River.

3. Devil Canyon to the Tyone River confluence. Stock assessment of resident and anadromous fish Populations

Objectives

The objectives in this study area are to:

1. Determine specific occurrence and species composition of fish stocks utilizing the mainstem Susitna River and it's major tributaries;

2. Define seasonal changes in occurrence and abundance of fish species within the mainstem Susitna River and tributaries;
3. Define habitat types utilized by fish species, seasonally throughout the year, at varying hydrologic conditions; both within the mainstem Susitna River and major tributaries;
4. Establish the impacts of inundation upon the aquatic habitat of the clearwater tributaries, necessary to sustain the indigenous fish species; and
5. Conduct complete hydrological surveys at the tributary mouths and at predetermined locations on each tributary.

Background

This area of study includes the more than fifty miles of the mainstem Susitna River and tributary streams, which will be either totally or partially inundated by construction of the Devil/Watana Hydroelectric Complex.

This portion of the Susitna River drainage lies in a truly wilderness setting, is roadless, is inaccessible except by boat or light aircraft, and is only moderately utilized by recreational anglers at this time. Angling in this reach of the Susitna River system can be termed a "quality experience."

This area has obvious identifiable habitat and biological impacts due to eventual inundation of segments of the clearwater tributaries feeding the impoundment. Critical habitat needs, as well as recreational fishing opportunities, are provided primarily at the mouths of these respective tributaries.

Workplan

A three man crew will work in the proposed impoundment area during the ice free months, utilizing helicopter and light aircraft for transportation throughout the study area. The study crew will be housed in a temporary/ portable field camp. Investigations will be directed to:

1. Conduct extensive on-the-ground surveys of Goose, Jay, Kosina, Watana, Deadman, Tsusena, and Fog creeks, and the Oshetna River. These investigations will include hydrological surveys and will determine the types of aquatic habitat currently available to resident species.
2. Determine the types, magnitude of, and location of aquatic habitats which will be lost upon inundation, by respective stream. Geographical features blocking upstream migration will be noted. Conversely, stream areas which will benefit in terms of improved access to fish stocks, upon impoundment, will be recorded.

3. Extensive netting, trapping, and fish collection will be conducted to determine the specific occurrence, and composition of resident species occupying these eight tributarial waters. As possible, efforts will be directed to determine the extent of seasonal intra-seasonal migrations.
4. To tag any and all adult fish captured for determination of intra-system movement and migrations.

Upon completion of the first year's (CY-81) assessment of aquatic habitats, and biological distribution of fish species within the impoundment area tributaries, investigations will be directed to the upland lake areas and the mainstem Susitna proper.

A two man field crew will again operate with a transportable field camp, utilizing helicopter and light aircraft for transportation. Investigations will begin as soon as "ice-out" occurs in the spring and continue until freeze up in the fall.

Studies in CY-1981 will be directed to:

1. Surveys of fish utilizing selected tributarial stream mouths throughout the season to determine intra-system movements of resident fish, and their reliance upon the mainstem river during the critical winter months. Tentative stream selections are Kosina, Jay, and Watana creeks.

A semi-permanent camp will be located in the vicinity of these stream mouths, and the individual streams sampled for fish occurrence on an established sampling schedule throughout the season.

2. Conduct surveys of upland lakes associated with mainstem Susitna River tributary streams for fish population and related biological data. Habitat information will also be collected from inlet and outlet streams, and be used later in determining the impacts to seasonal migrations and biological requirements of resident fish as a result of impoundment, road construction, and transmission corridor placement.
3. To determine resident fish occurrence and distribution within the mainstem Susitna River throughout the spring-summer-fall periods. This work will be accomplished by the same field crew utilizing a chartered boat for transportation on a pre-determined sampling schedule. Nets, trot lines, traps, etc. will be used to determine fish presence.
4. To continue to collect complete hydrological data.

It is anticipated the single two man crew will be capable of performing all the above tasks. Determination of mainstem fish occurrence and

distribution (#3) will be accomplished by two or three scheduled week long trips through the impoundment area.

The upland lake surveys will be accomplished during "non-sample" periods at the tributary mouths. Close coordination will be necessary, as will helicopter support at frequent intervals.

Title

Seasonal and Spatial Habitat Study

Objectives

Determine the spatial and seasonal habitat requirements of anadromous and resident fish species during each stage of their life histories.

Background

The proposed Susitna River hydroelectric project will have various impacts on the aquatic environment. Habitat studies will not be limited to the fishery resource alone due to the complex interrelationships between all biological components of, and within, the aquatic community and the associated habitat. The majority of the impacts on fish species will likely result from changes in the natural regimes of the river rather than direct impacts on the fish in the vicinity. Primary areas of concern are modification of seasonal instream flows, increased turbidity levels during winter months, and variation of thermal and chemical parameters. Preliminary studies indicate that alterations of the habitat may adversely affect the existing fish populations and render portions of the drainage either nonproductive or unavailable in future years (ADF&G 1978; 1979).

Continuously moving water, or current, is the distinguishing physical habitat feature of the Susitna River and its tributaries. The Susitna River and the major rivers entering Knik Arm represent approximately 70-80% of the total freshwater entering Cook Inlet (Rosenberg 1967). The flow of water which appears in the Susitna River channel at a given time constitutes the "instream flow". This flow is closely related to, but different from, the underflow moving through permeable deposits immediately underlying the stream channel. The instream flows of the Susitna and its tributaries erode, transport, and deposit sediments and other materials and can, have profound effects on the surrounding environment as far downstream as the Cook Inlet Estuary.

A variety of physical parameters interact to create particular aquatic environments in the Susitna River Basin. The most important of these physical parameters are: flow regime (volume, velocity, and temporal variation of flows), channel morphology (size, shape, gradient, and geologic material of channel), water quality (temperature, turbidity, dissolved gases, etc.), and stream load (bed load, suspended solids, and other materials, such as watershed inputs, in transport).

The Susitna River and its tributary system are continually working to establish equilibrium among these parameters. Induced change in any one of these factors may initiate readjustment in others. For example (during the winter months), the controlled flow regimes of the dams may increase erosion and consequently increase the amount of sediment entering the downstream river system. The river system becomes overloaded (unable

to transport all of the material entering the channel), and begins to deposit sediments. Over time, this deposition process leads to changes in channel slope and hence stream velocity. Eventually channel slope will increase until the velocity of stream flow produces just enough energy to transport the amount of material entering the stream, and an equilibrium will be achieved.

Analogous chains of events follow any alterations of instream flow. The altered stream will attempt to establish equilibrium conditions; and this dynamic process may lead to substantial changes in flow regime, channel shape, wetted area, substrate characteristics, water quality, etc. Moreover, these changes will most likely be felt as far downstream from the dams as Cook Inlet (Bishop 1975). Channel geometry and discharge patterns in the lower reaches and mouths of tributaries to the Susitna River will also be altered by the flow regimes of the dams. The Susitna impoundments will also result in upstream readjustments. The Susitna dam reservoirs may, for example, reduce the stability of underlying and adjacent geologic materials by increasing hydrostatic pore pressure and lubricating joints and fractures, therefore, initiating tremendous readjustments in the physical environment (Keller 1976). Mouths and lower reaches of tributaries in the impoundment area will be inundated.

It is important to remember that the complexity of the physical interactions outlined above is compounded by the fact that natural flows fluctuate with seasonal and climatic variations. As a result, impacts produced by the dams will stem not only from the amount of flow modification but also from the timing of the modification in relationship to normal seasonal flow fluctuations. Certain periodic high flows (e.g. bankfull discharge) for example are responsible for maintaining channel morphology by flushing sediments, transporting bed load, etc. Reduction, elimination, or rescheduling of these naturally recurring high flows can have serious consequences on channel characteristics. An increase in flow can also induce profound changes in the lotic environment during naturally occurring low flows.

The physical conditions and interactions within the Susitna River Basin discussed above, provide essential habitats for aquatic, riparian, and other organisms. As a result, any alteration in the physical environment also affects the associated biological populations. Although our emphasis is on fisheries, it should be apparent that instream flows exert similar profound effects on other aquatic organisms, as well as on riparian and terrestrial wildlife, navigation and other instream flow related uses (Erickson 1977; Elser et al 1977; Hinz 1977; Newell 1977; Martin 1977; Klarich et al 1977; Fraser 1975; Judy et al 1978; American Fisheries Society et al 1976 a, b); Townsend 1975).

There are three major physical components of the Susitna River system related to instream flows which determine the productivity of the associated fisheries (Stalnaker 1979):

1. water quality (e.g. temperatures, dissolved solids, dissolved gases, sediments, particulate organic matter and nutrients, etc.);

2. flow regime (i.e. volume, wetted perimeter, stage, velocity, and timing of flows); and
3. physical habitat structure (channel form, substrate characteristics, and riparian vegetation).

Each of these components is intimately related to instream flows. Instream flow may, therefore, be considered one of the most essential determinants of aquatic habitat and hence fisheries productivity. Modifications of naturally occurring seasonal instream flows will produce a variety of changes in critical habitat areas such as spawning, incubation, rearing, overwintering, and passage habitats. Decreased flows in the spring and summer may for example lead to silt deposition, oxygen reduction in gravel redds, dewatering of sloughs, and may, result in suffocation of incubating eggs and pre-emergent fry. Increased flows in the winter may wash away spawning substrate or destroy sheltering areas. Decreases and increases in flows which alter stream productivity will modify food availability in rearing and overwintering habitats.

In addition to modifying essential habitats, alterations to the Susitna flow regimes may affect the seasonal behavior of fish species. Hynes (1970) presents the following examples of the important interrelationships between seasonal flow regimes, fish movement, and human alterations of lotic environment.

Most fish are stimulated to move by rising water, and when the movement is to be upstream this enables them to pass over riffles with greater safety, because the increased width at such points spreads out the discharge and provides zones of slower water which are nevertheless deep enough to swim through.

Descending fish, such as smolts ..., are also stimulated to move by rising water ... Under normal circumstances, descending fish readily overcome obstacles, and the cushioning of the water prevents damage at falls, or at any rate at falls which are small enough for them or their parents to have ascended. But descending fishes follow the bottom contour, not the surface.

The complex interrelationship between instream flows and seasonal behavior of fish species is compounded by the fact that seasonal variations in flows required by particular species may have to be quite large. Returning salmon species for example may need 30 - 50 percent of the mean annual flow to ascend the lower and middle reaches of a river system, and even more flow to ascend the headwaters (Hynes 1970). As a result, the protection of fisheries resources requires not only that certain volumes of instream flow be maintained, but also that specific flows be available at particular times of the year. Tennant (1975) discusses average percentages of seasonal stream flows required to maintain particular levels of aquatic resources. The U.S. Fish and Wildlife Service Instream Flow Group (Bovee 1978; Cooperative Instream Service Group 1979) has developed sophisticated electivity curves defining

the relationships between instream flows and life history stages of selected fish species. These curves are continually refined as new data become available. Recognizing the physical differences between and individual habitat requirements of various stocks of the same fish species, the Alaska Department of Fish and Game and Alaska Department of Natural Resources initiated a pilot instream flow study in 1979 using field and computer analysis techniques developed by the U.S. Fish and Wildlife Service Instream Flow Group, John F. Orsborn (1974; 1979), and the U.S. Geological Survey.

In summary, seasonal fluctuations in the physiochemical composition of the aquatic habitat are apparently the major factors influencing distribution of fish within the drainage. Any alterations resulting from the hydroelectric related project activities which restrict or reduce quality or quantity of required habitat will also reduce fish populations and associated members of the aquatic community.

Study Approach

Spatial and seasonal habitat studies will be divided into three major geographical areas. Sampling upstream of the Susitna-Talkeetna river confluence will be conducted primarily by fisheries study groups. Design of sampling programs will be done by the habitat studies supervisor. These studies will be performed in addition to work proposed by DNR, but will be done in close cooperation and coordination with that agency and other tasks performed by consultants as a part of the overall Susitna Hydro-feasibility study. If the DNR instream flow study (see Attachment I) is not funded, ADF&G will need to increase its budget in the amount that DNR requested in order to perform the required work. It is anticipated that other agencies such as the USGS and USFWS will also provide support for these instream flow studies.

The following outlines baseline studies required for each study area:

1. Cook Inlet to the Talkeetna-Susitna river confluence.* Spatial and seasonal habitat requirements of fish populations.

Objectives

The objectives within this study area are to:

1. define essential seasonal habitat requirements for incubation, rearing, spawning, and passage of anadromous and resident fish populations;
2. define the seasonal relationships between flow regimes and essential physical and biological habitat characteristics;

* Habitat study plans for the estuarine area will be based upon the findings of Phase I studies and initiated in the Phase II biological studies.

3. define the relationships between the tributary and slough physiochemical and biological habitats with the mainstem Susitna River at various flow regimes;
4. develop state-of-the-art capabilities to evaluate habitat characteristics in this difficult reach of river; and
5. generate data essential for evaluating the effects of various flow regimes on terrestrial and riparian habitat.

Background

This reach of the Susitna River provides important habitat for rearing, incubating, spawning, and migrating resident and anadromous fish species. Unfortunately, its physical characteristics also make it one of the most difficult to evaluate. Studies of seasonal habitat characteristics will be coordinated on an annual basis with the life history and distribution fish studies (both anadromous and resident).

Expansion or termination of these studies will depend upon determination and confirmation of:

1. The seasonal habitat requirements between various life history stages of the resident and anadromous fish.
2. The relationship of seasonal habitat to various discharges.

If positive confirmation is provided by the habitat study in conjunction with other biological studies, specific year to year study locations should be identified for ongoing programs to determine the effects of the project on the fish and wildlife resources in this portion of the basin.

Work Plan

The initial year of this study will be comprised of essentially three field operations:

1. mainstem seasonal instream flow measurements;
2. tributary seasonal instream flow measurements; and
3. collection of other physiochemical and biological habitat data.

A crew of two biologists utilizing a customized riverboat as their primary means of transportation will operate in the mainstem and selected tributary systems during the ice-free months May through October to:

1. Procure equipment.
2. Establish and refine large river instream flow measurement techniques.

3. Collect instream flow data in terms of depth, velocity, wetted perimeter, and substrate.
4. Collect water quality data as related to discharge.

It is essential that items 2 and 3 be coordinated with other fishery related and hydrological studies.

The Alaska Department of Natural Resources has submitted an instream flow proposal which will generate other required essential data. If their proposal is rejected the ADF&G will need to increase its budget requirements by \$187,861 the first year and \$110,000 each year after that to collect the data DNR was not funded to collect.

2. Talkeetna River confluence upstream to Devil canyon. Spatial and seasonal Habiata requirements of fish populations

Ice Resident Fish Study Proposal.

3. Devil Canyon damsite upstream to the Tyone River confluence. Spatial and Seasonal habitarequirements of fish populations.

Ice Resident Fish Study Proposal.

GENERAL SAMPLING SCHEDULE^{1/}

Species	January	February	March	April	May	June	July	August	September	October	November	December
<u>Sockeye</u>												
Migration												
Spawning												
Incubation												
Rearing												
<u>Pink</u>												
Migration												
Spawning												
Incubation												
Rearing												
<u>Chum</u>												
Migration												
Spawning												
Incubation												
Rearing												
<u>Coho</u>												
Migration												
Spawning												
Incubation												
Rearing												
<u>Chinook</u>												
Migration												
Spawning												
Incubation												
Rearing												

^{1/} Lines represent months that sampling will be conducted.

REFERENCES

- Alaska Department of Fish and Game. 1978. Preliminary environmental assessment of hydroelectric development on the Susitna River. Anchorage. 172 pp.
- _____. 1979. Susitna hydro biological investigations. March. Anchorage. 21 pp.
- American Fisheries Society and American Society of Civil Engineers. 1976a. Instream flow needs. Volume I. (Edited by J.F. Orsborn and C.H. Allman). American Fisheries Society. Bethesda, Maryland. 551 pp.
- _____. 1976b. Instream flow needs. Volume II. (Edited by J.F. Orsborn and C.H. Allman). American Fisheries Society. Bethesda, Maryland. 657 pp.
- Bishop, D.M. 1975. A hydrologic reconnaissance of the Susitna River below Devils Canyon. A report prepared for Nat. Marine Fish. Serv. of NOAA, Contract no. 03-4-208-302. Environaid, Juneau, Alaska. 54 pp.
- Bovee, K.D. 1978. Probability of use criteria for the family salmonidae. Instream flow information paper no. 4. Cooperative Instream Flow Service Group. FWS/OBS-78/07. Ft. Collins, Colorado. 80 pp.
- Cooperative Instream Flow Service Group. 1979. Incremental Methodology. (pamphlet). Office of Biological Services. np.
- Copeland, M.D., R.L. Stroup, and R.R. Rucker. 1976. Problems in estimating the fish, wildlife, and recreational value of the Yellowstone River. Montana State Univ. Bozeman. 42 pp.
- Dailey, T.E. 1976. Research on recreational and management aspects of sport fishing: an annotated bibliography. Pacific Northwest Forest and Range Experiment Station. Seattle. 56 pp.
- Dwyer, J.F., J.R. Kelly, and M.D. Bowes. 1977. Improved procedures for valuation of the contribution of recreation to national economic development. Univ. of Ill. Water Resources Center Research Report. (128):1-218.
- Elser, A.A., R.C. McFarland, and Dennis Schwehr. 1977. The effect of altered stream flow on the fish of the Yellowstone and Tongue rivers, Montana. Technical report no. 8. Yellowstone Impact Study. Montana Dept. of Natural Resources and Conservation. Helena. 180 pp.
- Erickson, M.L. 1977. The effect of altered stream flow on water based recreation in the Yellowstone River Basin, Montana Yellowstone Impact Study. Technical Report no. 10. Montana Dept. of Natural Resources and Conservation. Helena. 125 pp.
- Fraser, J.C. 1975. Determining Discharges for Fluvial Resources. California Dept. of Fish and Game. FAO Fisheries Technical Paper No. 143. 102 pp.
- Freudenburg, W.R. 1976. Memorandum to ISPS mapping project on energy and the social sciences. Social science perspectives on the energy boomtown. Yale University. July 7. 51 pp.

- _____. 1978. Toward ending the inattention: a report on the social impacts and policy implications of energy boomtown developments. Prepared for the 144th national meeting of the American Assoc. for the Advancement of Science. Washington State Univ. Pullman. Feb. 13. 39 pp.
- Gottschalk, J.A. 1977. Wildlife habitat - the "priceless" resource base. Trans. 42nd. N. Amer. Wildl. and Nat. Res. Conf. Wildlife Management Inst. Washington, D.C. pp. 237-245.
- Hagan, R.M., and E.B. Roberts. 1973. Ecological impacts of water storage and diversion projects. Environmental quality and water development. (Edited by Goldman, C.R., McEvoy III, Games, Richerson, and Peter G.). W.H. Freeman Co. San Francisco, Cal.
- Hinz, T. 1977. The effect of altered stream flow on migratory birds of the Yellowstone River Basin, Montana. Yellowstone Impact Study. Technical Report no. 7. Montana Dept. of Natural Resources and Conservation. Helena. 107 pp.
- Horvath, J.C. 1974. Economic survey of southeastern wildlife and wildlife oriented recreation. Trans. 39th N. Amer. Wildl. and Nat. Res. Conf. Wildlife Management Inst. March 3-April 3. Washington D.C.
- Hynes, H.B.N. 1970. The ecology of running waters. University of Toronto Press, Toronto, Canada. 555 pp.
- Judy, R.D. and J.A. Gore. nd. A predictive model of benthic invertebrate densities for use in instream flow studies. Cooperative Instream Flow Service Group. Ft. Collins, Colorado. np.
- Keller, E.A. 1976. Environmental Geology. Charles E. Merrill Publishing Co. Columbus, Ohio. 488 pp.
- Klarich, D.A. and J. Thomas. 1977. The effect of altered stream flow on the water quality of the Yellowstone River Basin, Montana. Yellowstone Impact Study. Technical Report no. 3. Montana Dept. of Natural Resources and Conservation. Helena. 393 pp.
- Krutilla, J.V. 1967. Conservation reconsidered. American Economic Review. Espt. pp. 777-786.
- Long, Bill. 1978. How much is it worth? Down to Earth. Environmental Information Center. Helena. March. pp. 20, 21, 30.
- Martin, P.R. 1977. The effect of altered stream flow on furbearing mammals of the Yellowstone River Basin, Montana. Yellowstone Impact Study. Technical Report no. 6. Montana Dept. of Natural Resources and Conservation. Helena. 79 pp.
- Montana Department of Natural Resources and Conservation. 1977. The economics of altered stream flow in the Yellowstone River Basin, Montana. Yellowstone Impact Study. Technical Report no. 11. Montana Dept. of Natural Resources and Conservation. 81 pp.
- Morrow, J.E. 1979. Personal communication. Georgia State Univ. Atlanta. 11 pp.

- National Park Service (NPS). 1949. The economics of public regulation: an economic study of the monetary evaluation of recreation in the national parks. NPS. Washington, D.C. np.
- Newell, R.L. 1977. Aquatic invertebrates of the Yellowstone River Basin, Montana. Yellowstone Impact Study. Technical Report no. 5. Montana Dept. of Natural Resources and Conservation. Helena. 109 pp.
- Orsborn, J.F. 1974. Determining stream flows from geomorphic parameters. Journal of the Irrigation and Drainage Division. ASCE. Vol. 100. no. IR4. Proc paper 10986. Dec. 1974. pp. 455-475.
- _____, and F.D. Deane. 1976. Investigation into methods for developing a physical analysis for evaluating instream flow needs. OWRT project no. A-084-WASH. OWRT Agreement no. 14-31-0001-6050. Allotment period July 1, 1975-June 30, 1976. Washington State Univ. Pullman. 112 pp.
- _____, and F.I. Watts. 1979. Manual for a short course on hydraulics and hydrology for fishery biologists. U.S. Dept. of Interior. np.
- Rosenberg, D.H., S.C. Burrell, K.V. Matarajan, and D.W. Hook. 1967. Oceanography of Cook Inlet with special reference to the effluent from the Collier Carbon and Chemical Plant. Institute of Marine Science. University of Alaska, Fairbanks. Report No. R67-5. 80 pp.
- Stalnaker, C.B. 1979. Instream flow methodologies and water management uncertainty. Idaho's Water 6(2):1-3.
- Tennant, Donald L. 1975. Instream flow Regimes for Fish, Wildlife, Recreation and Related Environmental Resources. U.S. Fish and Wildlife Service, 711 Central Avenue, Billings, Montana. 59102. 30 pp.
- Townsend, G.H. 1975. Impact of the Bennett Dam on the Peace - Athabasca Delta. J. Fish. Res. Board. Canada. 32:171-176 pp.
- Utah State University. 1976. Methodologies for determination of stream resource flow requirements: an assessment. (Edited by C.B. Stalnaker and J. L. Arnette). Prepared for U.S. Fish and Wildlife Service. Logan, Utah. 199 pp.
- White House. 1978. Remarks of the President on water policy. June 6. Washington, D.C. np.

BUDGETS - SUSITNA HYDRO FISHERIES STUDIES

Administration and Support

CY 80

CY 81

Jan. 82

Line 100 - Personal Services

FB IV at C step 12 mm @ 3,873/mol/	46,476.00	46,476.00	3,873.00
Biometrician III 12 mm @ 4,053/mo	48,636.00	48,636.00	4,053.00
Biometrician II 24 mm @ 3,536/mo	42,432.00	42,432.00	3,536.00
Admin Asst. I 12 mm @ 2,181/mo	26,172.00	26,172.00	2,181.00
Publications Spec II 12 mm @ 2,841/mo	34,092.00	34,092.00	2,844.00
Clerk Typist III 12 mm @ 1,726/mo	20,712.00	20,712.00	1,726.00
Clerk Typist II 36 mm @ 1,636/mo	58,896.00	58,896.00	1,636.00
Maintenance Mechanic II 12 mm @ 2,730/mo	32,766.00	32,766.00	
Cartographer II @ 2,187/mo		13,123.00	2,187.00
Total	310,182.00	323,305.00	22,033.00

Line 200 - Travel

Travel and Per Diem	10,000.00	10,000.00	850.00
Total	10,000.00	10,000.00	850.00

Line 300 - Contractual Services

Office space for 12 mo 3,000 sq ft @ 1.25 sq ft/mo	45,000.00	45,000.00	3,750.00
Warehouse for 12 mo 1,000 sq ft @ .75 sq ft/mo	9,000.00	9,000.00	
Maintenance shop for 12 mo 1,000 sq ft @ .75 sq ft/mo	9,000.00	9,000.00	
Storage yard for 12 mo 20,000 sq ft @ .50 sq ft/mo	120,000.00	120,000.00	
Communications for 12 mo @ 400/mo	4,800.00	4,800.00	400.00
Professional services for 12 mo @ 400/mo	4,800.00	4,800.00	400.00
Equipment repair for 12 mo @ 100/mo	1,200.00	1,200.00	200.00
Freight and transportation for 12 mo @ 200/mo	2,400.00	2,400.00	
Air charter			
Fixed wing 30 hrs @ 150/hr	4,500.00	4,500.00	
Office equipment leases 4 mag card II's and xerox for 12 mo @ 1,500/mo	18,000.00	18,000.00	1,500.00
Vehicle rental 3 vehicles @ 750/mo	9,000.00	9,000.00	750.00
Total	227,700.00	227,700.00	7,000.00

Line 400 - Commodities

Institutional supplies; clothing	500.00	500.00	
Structural materials and supplies	2,000.00	2,000.00	
Equipment parts and supplies	5,000.00	5,000.00	
Professional and scientific supplies	3,000.00	3,000.00	750.00
Office and library supplies @ 500/mo	6,000.00	6,000.00	500.00
Other operating supplies @ 100/mo	1,200.00	1,200.00	100.00
Total	17,700.00	17,700.00	1,350.00

Administration and Support (cont.)

Line 500 - Equipment

Desks, chairs, file cabinets, 21 office units @ approximately 750 each	15,250.00		
Optical and photographic Twelve 35 mm cameras @ 150/each	1,800.00		
Shop plant and industrial equipment	5,000.00	2,000.00	
Replacement, lost, damaged or stolen equipment to cover all project segments		<u>36,000.00</u>	
Total	<u>22,050.00</u>	<u>38,000.00</u>	<u>0.00</u>
GRAND TOTAL	\$587,632.00	\$616,705.00	\$31,233.00
+ 10% CY 812/ + 20% CY 822/		\$678,375.00	\$37,480.00

- 1/ This position is the Susitna Hydro Fisheries Study Coordinator
- 2/ Percentage increases cover possible state employee wage increases under new contracts, merit increases, and inflation of costs of other items and services.

Anadromous Adult - Stock Assessment

Task #1. Cook Inlet Stock Assessment

<u>Scale Pattern Analysis</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 100 - Personal Services</u>			
10.5 mm FT II @ 1,826	19,173.00	19,173.00	
21.0 mm FT III @ 2,056	43,176.00	43,176.00	
10.5 mm FB I @ 2,471	25,946.00	25,946.00	
Total	88,295.00	88,295.00	0.00
<u>Line 200 - Travel</u>			
Travel/per diem	1,000.00	1,000.00	
Total	1,000.00	1,000.00	0.00
<u>Line 300 - Contractual Services</u>			
Contractual services (computer time)	5,000.00	5,000.00	
Aircraft charter (10 hrs C185 @ 150/hr)	1,500.00	1,500.00	
Vehicle rental (3 @ 250/mo and 3,000 miles)	2,040.00	2,040.00	
Total	8,540.00	8,540.00	0.00
<u>Line 400 - Commodities</u>			
Scientific supplies (500/field crew)	1,500.00	1,500.00	
Food (312 days @ 40/day)	3,120.00	3,120.00	
Gill nets	1,000.00		
Housing (650/mo)	1,300.00	1,300.00	
Clothing (200/person)	1,200.00	1,200.00	
Total	8,120.00	7,120.00	
<u>Line 500 - Equipment</u>			
Digitizer (Omega computer)	8,200.00		
Total	8,200.00	0.00	0.00
Total for Scale Pattern Analysis	\$114,155.00	\$104,955.00	0.00

Task #1. Cook Inlet Stock Separation

Electrophoresis

Line 100 - Personal Services

8 mm FT II @ 1,826	14,608.00	14,608.00	
Total	14,608.00	14,608.00	0.00

Anadromous Adult - Stock Assessment (cont.)

<u>Electrophoresis (cont.)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 200 - Travel</u>			
Travel/per diem	1,000.00	1,000.00	
Total	<u>1,000.00</u>	<u>1,000.00</u>	<u>0.00</u>
<u>Line 300 - Contractual Services</u>			
Contractual services (graduate student) includes all analysis of samples	15,000.00		
Aircraft charter (10 hrs C185 @ 150/hr)	1,500.00	1,500.00	
Vehicle rental (2 @ 250/mo and 2,000 miles)	1,360.00	1,360.00	
Total	<u>17,860.00</u>	<u>2,860.00</u>	<u>0.00</u>
<u>Line 400 - Commodities</u>			
Scientific supplies	1,000.00	1,000.00	
Food (208 days @ 10/day)	2,080.00	2,080.00	
Housing (650/mo)	1,300.00	1,300.00	
Clothing	800.00	800.00	
Total	<u>5,180.00</u>	<u>5,180.00</u>	<u>0.00</u>
<u>Line 500 - Equipment</u>	0.00	0.00	0.00
Total for Electrophoresis	38,648.00	23,648.00	0.00

Anadromous Adult - Stock Assessment

Task #2. Susitna River Mouth to Yentna River

<u>Susitna Station (May 15 - October 15)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 100 - Personal Services</u>			
10 mm FB I @ 2,471	24,710.00	24,710.00	
Total	24,710.00	24,710.00	0.00
<u>Line 200 - Travel</u>			
Travel/per diem	200.00	200.00	
Total	200.00	200.00	0.00
<u>Line 300 - Contractual Services</u>			
Aircraft charter (18 hrs C185 @ 150)	2,700.00	2,700.00	
Freight (barge charter)	500.00	500.00	
Repairs of maintenance	1,200.00	1,200.00	
Total	4,400.00	4,400.00	0.00
<u>Line 400 - Commodities</u>			
Food (552 days @ 10/day)	5,520.00	5,520.00	
Scientific supplies	300.00	300.00	
Gas and O/B oil (15 barrels @ 75)	1,125.00	1,125.00	
Camp supplies	500.00	300.00	
Clothing	400.00	400.00	
Total	7,845.00	7,645.00	0.00
<u>Line 500 - Equipment</u>			
2 side scan sonar counters	78,000.00		
2 recorders	600.00		
Oscilloscope	900.00		
Total	79,500.00	0.00	0.00
Total for Susitna Station	\$116,655.00	\$36,955.00	0.00
<u>Yentna Sonar</u>			
<u>Line 100 - Personal Services</u>			
10 mm FB I @ 2,471	24,710.00	24,710.00	
10 mm FT II @ 1,826	18,260.00	18,260.00	
600 hrs overtime @ 18.25/hr	10,950.00	10,950.00	
Total	53,920.00	53,920.00	0.00

Anadromous Adult - Stock Assessment

<u>Yentna Sonar (cont.)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 200 - Travel</u>	0.00	0.00	0.00
<u>Line 300 - Contractual Services</u>			
Freight (barge charter)	600.00	600.00	
Aircraft charter (35 hrs @ 150/hr)	5,250.00	5,250.00	
Repairs and maintenance	1,500.00	1,500.00	
Total	<u>7,350.00</u>	<u>7,350.00</u>	<u>0.00</u>
<u>Line 400 - Commodities</u>			
Food (616 days @ 10/day)	6,160.00	6,160.00	
Camp supplies	1,500.00	1,000.00	
Parts	1,500.00	1,500.00	
Tools	500.00	300.00	
Gas and O/B oil (45 barrels @ 75)	3,375.00	3,375.00	
Scientific supplies	300.00	300.00	
Fishwheels (2 - parts and labor)	2,400.00	500.00	
Clothing	800.00	800.00	
Total	<u>16,535.00</u>	<u>13,935.00</u>	<u>0.00</u>
<u>Line 500 - Equipment</u>			
2 boats	4,000.00		
Four 25 hp outboards	2,976.00		
2 side scan sonar counters	78,000.00		
Generator	350.00		
Compressor	350.00		
2 tape recorders (sonar)	600.00		
Oscilloscope (sonar)	900.00		
2 shotguns (bear protection)	400.00		
SSB radio	1,600.00		
Total	<u>89,176.00</u>	<u>0.00</u>	<u>0.00</u>
Total for Yentna Sonar	\$166,981.00	\$75,205.00	0.00
<u>Radiotelemetry</u>			
<u>Line 100 - Personal Services</u>			
5 mm FB I @ 2,471	12,355.00	12,355.00	
2.5 mm FT II @ 1,826	4,565.00	4,565.00	
9 mm FB I @ 2,471		22,239.00	
Total	<u>16,920</u>	<u>39,159.00</u>	<u>0.00</u>

Anadromous Adult - Stock Assessment

<u>Radiotelemetry (cont.)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 200 - Travel</u>			
Travel/per diem	1,000.00	1,500.00	
Total	<u>1,000.00</u>	<u>1,500.00</u>	<u>0.00</u>
<u>Line 300 - Contractual Services</u>			
Aircraft charter (75/hrs C185 @ 150/hr)	11,250.00	11,250.00	
Equipment repair and maintenance	1,500.00	1,500.00	
Equipment rental (radio gear)	1,500.00		
Total	<u>14,250.00</u>	<u>12,750.00</u>	<u>0.00</u>
<u>Line 400 - Commodities</u>			
Food (228 days @ 10/day)	2,280.00	5,050.00	
Gas and O/B oil (20 barrels @ 75)	1,500.00	3,000.00	
Scientific supplies	300.00	300.00	
Miscellaneous equipment	500.00	500.00	
Camp equipment	800.00	1,200.00	
Radio tags	1,500.00	5,000.00	
Clothing	800.00	1,000.00	
Total	<u>7,680.00</u>	<u>16,050.00</u>	<u>0.00</u>
<u>Line 500 - Equipment</u>			
Boat	2,500.00	2,500.00	
Motors (2 - 35 hp)	1,752.00	1,752.00	
Radio	1,200.00		
Shotgun	200.00		
Radiotelemetry equipment		29,000.00	
Total	<u>5,652.00</u>	<u>33,252.00</u>	<u>0.00</u>
Total for Radiotelemetry	\$45,502.00	\$102,711.00*	0.00

* If technique is feasible.

Anadromous Adult - Stock Assessment

Task #3. Yentna River to Talkeetna

<u>Deshka Sonar Site</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
Same as Yentna Sonar			
Total	166,981.00	36,955.00	
<u>Sunshine Sonar Site</u>			
<u>Line 100 - Personal Services</u>			
10 mm FB I @ 2,471	24,710.00	24,710.00	
20 mm FT II @ 1,826	36,520.00	36,520.00	
Overtime 1,200 hrs @ 18.25	21,900.00	21,900.00	
Total	83,130.00	83,130.00	0.00
<u>Line 200 - Travel</u>	0.00	0.00	0.00
<u>Line 300 - Contractual Services</u>			
Vehicle rental (250/mo and 2,500 miles)	1,700.00	1,700.00	
Repairs and maintenance	1,500.00	1,500.00	
Total	3,200.00	3,200.00	0.00
<u>Line 400 - Commodities</u>			
Food (924 days @ 10/day)	9,240.00	9,240.00	
Camp supplies	1,500.00	1,000.00	
Parts	1,500.00	1,500.00	
Tools	500.00	300.00	
Gas and O/B oil (45 barrels @ 75)	3,375.00	3,375.00	
Scientific supplies	300.00	300.00	
Fishwheels (4 - parts and labor)	4,800.00	500.00	
Fish tags (10,000)	7,000.00	7,000.00	
Clothing	1,200.00	1,200.00	
Total	29,415.00	24,415.00	0.00
<u>Line 500 - Equipment</u>			
2 boats	4,000.00		
4 outboards	2,976.00		
2 side scan sonar counters	78,000.00		
Generator	350.00		
Compressor	350.00		
2 tape recorders	600.00		
Oscilloscope	900.00		
2 shotguns	400.00		
SSB radio	1,600.00		
2 boat trailers	3,400.00		
Total	92,576.00	0.00	0.00
Total for Sunshine Sonar Site	\$208,321.00	\$110,745.00	0.00

Anadromous Adult - Stock Assessment

<u>Creel Census</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 100 - Personal Services</u>			
9 mm FT II @ 1,826	16,434.00	16,434.00	
Overtime 450 hrs @ 18.25	8,213.00	8,213.00	
Total	24,647.00	24,647.00	0.00
<u>Line 200 - Travel</u>	0.00	0.00	0.00
<u>Line 300 - Contractual Services</u>			
Vehicles (2 @ 250/mo and 2,000 miles)	860.00	860.00	
Total	860.00	860.00	0.00
<u>Line 400 - Commodities</u>			
Food (276 days @ 10/day)	2,760.00	2,760.00	
Housing (500/mo)	750.00	750.00	
Gas and O/B oil	1,000.00	1,000.00	
Total	4,510.00	4,510.00	0.00
<u>Line 500 - Equipment</u>	0.00	0.00	0.00
Total for Creel Census	\$30,017.00	\$30,017.00	0.00
Task #4. Budget is included in juvenile studies.			
Task #5. Budget included in resident fisheries studies.			
<u>Program Supervisors</u>			
Sonar Project Leader FB II @ 2,841/mo	34,092.00	34,092.00	2,841.00
Radiotelemetry Project Leader FB II @ 2,841/mo	34,092.00	34,092.00	2,841.00
Anadromous Fisheries Studies Supervisor			
@ 3,246/mo	38,952.00	38,952.00	3,246.00
Total	107,136.00	107,136.00	8,928.00
Grand Total	994,396.00	666,300.00	8,928.00
CY 81 + 10%1/		732,900.00	
CY 82 + 20%			10,700.00

1/ See explanation under Administration and Support

Resident and Juvenile Anadromous Fishery Study

<u>Devil Canyon to Tyone River Impoundment</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 100 - Personal Services</u>			
3 FB I's @ 2,471 x 6 mos.	44,478.00	44,478.00	
Total	44,478.00	44,478.00	0.00
<u>Line 200 - Travel</u>			
Transportation (train)	750.00	750.00	
Private vehicle mileage @ .25/mile	125.00	150.00	
Per diem 15 days @ 55	825.00	825.00	
Total	1,700.00	1,725.00	0.00
<u>Line 300 - Contractual Services</u>			
Communications	200.00	200.00	
Professional Services	300.00	200.00	
Repairs	500.00	500.00	
Freight and transportation	500.00	200.00	
Air charter			
Fixed wing @ 150/hr	3,000.00	6,000.00	
Helicopter @ 350/hr	28,000.00	14,000.00	
Watercraft charter @ 300/day	1,000.00	6,000.00	
Vehicle lease @ 200/mo	1,000.00	1,000.00	
Miscellaneous	500.00	500.00	
Total	35,000.00	28,600.00	0.00
<u>Line 400 - Commodities</u>			
Clothing	750.00	750.00	
Subsistence @ 15/day (4,300 days)	4,500.00	4,500.00	
Outboard fuels @ 1.10/gal	55.00	200.00	
Camp materials, supplies, tents, stoves, heaters, etc.	700.00	500.00	
Trap and net materials	1,400.00	1,200.00	
Miscellaneous	500.00	1,000.00	
Total	7,905.00	8,150.00	0.00
<u>Line 500 - Equipment</u>			
Inflatable boat	2,000.00		
Outboard (15 hp)	1,000.00		
Radio	1,500.00		

Resident and Juvenile Anadromous Fishery Study

<u>Devil Canyon to Tyone River Impoundment (cont.)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
Electroshocker	1,200.00		
Guns (2)	500.00		
Thermographs @ 300 each	3,600.00		
DO meter	600.00		
Conductivity meter	600.00		
pH meter	200.00		
Total	11,200.00	0.00	0.00
Total for Devil Canyon to Tyone River	\$100,283.00	\$82,953.00	0.00
<u>Talkeetna River to Devils Canyon</u>			
<u>Line 100 - Personal Services</u>			
3 FB I's @ 2,471 x 6 mos	44,478.00	44,478.00	
1 FB II @ 2,841 x 12 mos	34,092.00	34,092.00	
Total	78,570.00	78,570.00	0.00
<u>Line 200 - Travel</u>			
Transportation (train)	1,600.00	2,000.00	
Private vehicle mileage	300.00	500.00	
Per diem @ 55/day	1,100.00	1,100.00	
Total	3,000.00	3,600.00	0.00
<u>Line 300 - Contractual Services</u>			
Communications	250.00	300.00	
Professional services	150.00	150.00	
Repairs	750.00	1,000.00	
Freight and transportation (train)	1,000.00	1,100.00	
Air charter			
Fixed wing @ 150/hr	1,350.00	900.00	
Helicopter @ 350/hr	2,800.00	2,100.00	
Watercraft charter	500.00		
Cabin rental @ 150/mo	750.00	975.00	
Miscellaneous	500.00	500.00	
Total	8,050.00	7,025.00	0.00
<u>Line 400 - Commodities</u>			
Clothing (boots, waders, etc.)	1,000.00	1,200.00	
Gill nets @ 150 each	1,200.00	1,200.00	
Seines 2 @ 150 each for CY 80			
CY 81 includes minnow traps	300.00	650.00	

Resident and Juvenile Anadromous Fishery Study

<u>Talkeetna River to Devils Canyon (cont.)</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
Subsistence food @ 15/day	6,000.00	6,000.00	
Outboard fuel @ 1.10/gal	2,200.00	2,400.00	
Marine oils, lubes, etc.	200.00	250.00	
Building materials	500.00	500.00	
Trap materials, net frames, bouys, etc.	500.00	500.00	
Miscellaneous	600.00		
Camp gear, stove, lantern, etc.	300.00	600.00	
Total	<u>12,800.00</u>	<u>13,300.00</u>	<u>0.00</u>

Line 500 - Equipment

Riverboat	2,500.00		
Thermographs @ 300 each	6,000.00	1,200.00	
DO meter	600.00		
Conductivity meter	600.00		
pH meter	200.00		
Outboard motors @ 2,750 each	5,500.00		
Jet units @ 600 each	1,200.00		
Rubber raft	3,500.00		
Outboard 25 hp	1,400.00		
Radio	1,200.00		
Snowshoes @ 25 each	300.00		
Guns 2 @ 250	500.00		
Snowmachines 2 @ 1,600		3,200.00	
Snowmachine sleds (2)		150.00	
Ice auger	300.00		
Electroshocker	1,200.00		
Total	<u>25,000.00</u>	<u>4,550.00</u>	<u>0.00</u>

Total for Talkeetna River to Devils
Canyon

\$127,420.00 \$107,045.00 0.00

Cook Inlet to Talkeetna

Line 100 - Personal Services

7 FB I's for 43/mos for CY 80			
8 FB I's for 65/mos for CY 81	106,253.00	160,615.00	
1 FB III for 12 mos	38,952.00	38,952.00	
1 FT III for 4 mos	8,224.00	8,224.00	
Total	<u>153,429.00</u>	<u>207,791.00</u>	

Line 200 - Travel

110 days per diem @ 55/day for CY 80			
220 days per diem @ 55/day for CY 81	6,050.00	12,100.00	
Miscellaneous (pickup mileage)	600.00	1,000.00	
Total	<u>6,650.00</u>	<u>13,100.00</u>	<u>0.00</u>

Resident and Juvenile Anadromous Fishery Study

Cook Inlet to Talkeetna

CY 80

CY 81

Jan 82

Line 300 - Contractual Services

Air charter @ 150/hr	9,600.00	12,000.00	
Vehicle @ 250/mo	5,250.00	10,250.00	
Engine repair	700.00	2,600.00	
Equipment rental	700.00	1,000.00	
Communications	700.00	1,000.00	
Total	16,950.00	26,850.00	0.00

Line 400 - Commodities

Food @ 15/day	11,850.00	19,500.00	
Clothing	2,000.00	2,000.00	
Building materials	3,800.00	2,900.00	
Camp gear	600.00		
Net gear	4,300.00	4,000.00	
Fuel	4,700.00	7,540.00	
Oil	650.00	1,000.00	
Marine supplies	500.00	500.00	
Snowmachine supplies	500.00	400.00	
Miscellaneous	3,400.00	1,900.00	
Total	32,300.00	39,740.00	0.00

Line 500 - Equipment

Riverboat	1,600.00		
75 hp outboard	2,700.00		
25 hp outboard	1,200.00		
Jet unit	600.00		
Trailer boat	500.00		
Radio	1,000.00		
Rifle	300.00		
4 snowmachines	6,400.00		
2 trailers (SM)	1,000.00		
2 ice augers	600.00		
2 chainsaws	600.00		
Canoe	600.00		
Backback shocker	1,200.00		
Total	18,300.00	0.00	0.00

Total for Cook Inlet to Talkeetna	\$227,629.00	\$287,481.00	0.00
-----------------------------------	--------------	--------------	------

Grand Total	\$455,332.00	\$477,479.00	0.00
CY 81 + 10%		\$525,226.00	

Resident and Juvenile Anadromous Fishery Study

CY January 1982

Line 100 - Personal Services

1 Bio II for 1 mo	2,841.00
1 Bio III for 1 mo	3,246.00
2 Bio I's for 1 mo	4,942.00
Total	<u>11,029.00</u>

Line 200 - Travel

Travel and per diem (1,000 each)	2,000.00
Total	<u>2,000.00</u>

Line 300 - Contractual Services

Communications	250.00
Printing and professional services	750.00
Equipment rental	250.00
Vehicle lease @ 250/mo	250.00
Total	<u>1,500.00</u>

Line 400 - Commodities

Office supplies	500.00
Miscellaneous	250.00
Total	<u>750.00</u>

<u>Line 500 - Equipment</u>	0.00
-----------------------------	------

Total for CY January 1982	\$15,279.00
---------------------------	-------------

Spatial and Seasonal Habitat Studies

The Alaska Department of Natural Resources has submitted an instream flow proposal which is coordinated with the Alaska Department of Fish and Game's spatial and seasonal habitat instream flow studies and designed to generate other essential depth and velocity data we require. If their proposal is rejected we will need to increase our budget requirements by \$187,861 the first year and 110,000 each year after that to collect the data they were not funded to collect.

It should be noted that the scope of these studies is based upon the assumption that other essential hydrological data will be generated and be available on a timely basis. A final determination as to the adequacy of the other proposed hydrological and habitat related studies prepared by Acres cannot and will not be made until the U.S. Geological Survey and other resource agencies also evaluate the entire revised draft proposal Acres or the Corps of Engineers is selected to prepare in November, 1979.

<u>Cook Inlet to Portage Creek</u>	<u>CY 80</u>	<u>CY 81</u>	<u>Jan 82</u>
<u>Line 100 - Personal Services</u>			
1 FB III Step B @ 3,359.00 for 12 mo	40,308.00	40,308.00	3,359.00
1 Hydrologist III Step B @ 3,359 for 12 mo	40,308.00	40,308.00	3,359.00
2 FB I/II's @ 2,841 for 12 mo	68,184.00	68,184.00	4,562.00
3 FB I's @ 2,471 (9 mo for CY 80)	66,717.00	88,956.00	7,413.00
Total	215,517.00	237,756.00	18,693.00
<u>Line 200 - Travel</u>			
240 days per diem @ 55/day	13,200.00	13,200.00	
2 trips to Ft. Collins @ 800 x 2 people	3,200.00	3,200.00	
Miscellaneous			800.00
Total	16,400.00	16,400.00	800.00

Spatial and Seasonal Habitat Studies

Cook Inlet to Portage Creek (cont.)

CY 80

CY 81

Jan 82

Line 300 - Contractual Services

Air charter

15 hrs/mo for 7 mo @ 150/hr

15,750.00

15,750.00

Vehicle 12 mo @ 250/mo

3,000.00

3,000.00

Engine repair and maintenance

1,000.00

1,000.00

Equipment rental

300.00

300.00

Communications

3,600.00

3,600.00

350.00

USGS, Instream Flow Group

consultation and analysis

12,000.00

18,000.00

Boeing computer analysis

10,000.00

25,000.00

2,000.00

Miscellaneous

500.00

500.00

1,000.00

Total

46,150.00

67,150.00

3,300.00

Line 400 - Commodities

Food: CY 80 700 days @ 15/day

CY 81 & 82 980 days @ 15/day

10,500.00

14,700.00

Clothing; boots, life jackets, tents,
sleeping bags, etc.

4,500.00

1,000.00

Fuel; 20 wks 200 gal/wk @ 1.25/gal

5,000.00

5,000.00

Oil, lube, etc.

700.00

700.00

Marine supplies

1,500.00

1,500.00

Miscellaneous

1,800.00

1,800.00

600.00

Snowmachine supplies

200.00

200.00

Total

24,200.00

24,900.00

600.00

Line 500 - Equipment

3 level lietz B-2 @ 1,600 each

4,800.00

3 tripods (dome) @ 150 each

450.00

Survey stakes

300.00

2 measuring tapes and holders 300' @ 150 each

300.00

Two 35 mm SLR cameras, (macro lens and
polarized filter) @ 350 each

700.00

Electronic surveying equipment, angle
measurements, range measurements,
field computer

20,500.00

2 rifles @ 250 each

500.00

5 current meters (AA) @ 350 each

1,750.00

3 current meters (pygmy) @ 400 each

1,200.00

3 Marsh McBirney flow meters,

digital readout @ 1,600 each

4,800.00

11 top setting wading rods @ 200 each

2,200.00

Suspended flow support system

400.00

2 boat mounted flow metering systems
@ 1,600 each

3,200.00

Spatial and Seasonal Habitat Studies

Cook Inlet to Portage Creek (cont.)

CY 80

CY 81

Jan 82

Sonar narrow beam system	3,000.00		
8 headsets @ 50 each	400.00		
Two 2-way radio walkie talkie @ 1,000 each	2,000.00		
2 compasses @ 50 each	100.00		
Rebar	100.00		
4 leveling rods @ 150 each	600.00		
4 cable tagliners 300' @ 150	600.00		
Tools for repair	175.00		
20' Wooldridge boat (capable of performance in Portage area)	4,000.00		
13' Avon riverboat	1,800.00		
85 hp (jet foot)	3,800.00		
25 hp (kicker)	1,200.00		
25 hp (for Avon)	1,200.00		
Boat trailer	2,000.00		
3 field calculators @ 70 each	210.00		
Desk calculator	700.00		
Office equipment	1,300.00		
5 DO meters @ 600 each	3,000.00		
5 conductivity meters @ 600 each	3,000.00		
5 pH meters @ 200 each	1,000.00		
15 thermometers @ 25 each	375.00		
40 thermographs @ 350 each	14,000.00		
400 Leupold staff gages @ 11.00	4,400.00		
Total	90,060.00	0.00	0.00

Total for Cook Inlet to Portage Creek	\$392,327.00	\$346,206.00	\$23,393.00
---------------------------------------	--------------	--------------	-------------

Spatial and Seasonal Habitat Studies

Portage Creek to Tyone River

CY 80

CY 81

Jan 82

Line 100 - Personal Services

See resident studies

Line 200 - Travel

See resident studies

Line 300 - Contractual Services

Air charter

6 hrs/mo for 6 mos @ 150/hr

5,400.00

5,400.00

Helicopter 5/hrs for 4 mos @ 350/hr

7,000.00

7,000.00

Total

12,400.00

12,000.00

0.00

Line 400 - Commodities

See resident studies

Line 500 - Equipment

DO meter

600.00

Conductivity meter

600.00

pH meter

200.00

3 thermometers @ 25 each

75.00

Marsh McBirney meter

1,600.00

AA meter

350.00

Pygmy meter

400.00

2 measuring tapes 300' @ 150 each

300.00

2 topsetting wading rods @ 200 each

400.00

2 headsets @ 50 each

100.00

35 mm camera, (macro lens and polarized filter) @ 350

350.00

25 Leupold staff gages @ 11.00

275.00

Total

5,250.00

0.00

0.00

Grand Total

\$409,977.00

\$358,206.00

\$23,393.00

CY 81 + 10%

35,821.00

CY 82 + 20%

4,679.00

\$394,027.00

\$28,072.00

WILDLIFE STUDIES

Introduction

The Susitna River drainage contains a diverse array of terrestrial habitat types which support major concentrations of wildlife. The variety of species inhabiting this area is probably equal to any other northern terrestrial system in the world. Much of the area is only sparsely developed but is relatively accessible to Alaska's major human population centers. As a result this area is among the most popular wildlife use areas providing opportunities for both consumptive and non-consumptive users. While wildlife uses in the area are primarily recreational, subsistence and commercial uses are also important.

Development of the Susitna River's hydroelectric potential is likely to affect many wildlife species. A number of mechanisms of impact are possible, some direct and obvious and others indirect and subtle. The primary mechanisms that have been identified include total loss of habitat in impoundments, alteration of habitat downstream through vegetation changes, restriction of movement patterns leading to altered habitat use patterns, changes in interspecific relationships such as changes in prey availability to predator populations, and increased accidental mortality from hazards such as ice shelves and mud flats.

Probable impacts vary from species to species and area to area. In some cases enough information is presently available to predict that adverse impacts will occur. An example is the inundation of moose winter range. In such cases studies are needed to quantify predictions and identify secondary impacts. In other cases such as those involving alteration of vegetation downstream, a possibility of significant impacts can be perceived but too little is known to predict with certainty whether actual impacts will occur. In these cases it is necessary to both identify impact mechanisms and quantify them.

Assessment of impacts on wildlife requires more than information on wildlife populations. Strong supporting data on wildlife habitat and environmental conditions are needed. Therefore a coordinated multi-disciplinary approach is required from the outset. The Alaska Department of Fish and Game will be conducting studies directed at certain large mammal species. These studies are only pieces of the terrestrial impact assessment puzzle. Other pieces such as studies of other wildlife, vegetation, climatology, hydrology socio-economics, etc., will be produced by other agencies or firms. It is essential that a broad study approach be laid out before studies begin to ensure that the pieces fit together to form a satisfactory impact assessment.

Title

Moose distribution, movements and habitat use in the vicinity of proposed impoundments.

Objectives

To identify moose subpopulations using habitat that will be inundated by proposed impoundments.

To determine the seasonal distribution, movement patterns, size and trends of those subpopulations.

To determine the timing and degree of dependency of those subpopulations on habitat to be impacted by the Susitna Hydroelectric Project.

Background

Preliminary studies indicated that several loosely defined subpopulations of moose inhabit proposed impoundment areas for all or part of the year. Most moose studied exhibited altitudinal migration patterns, spending summers at higher elevations often outside of the proposed impoundment areas and winters at lower elevations often within or adjacent to impoundment areas. Therefore the most severe impacts of the Susitna Hydropower project on moose upstream from Devils Canyon are expected to result from inundation of and blockage of migrations to critical winter range. Since some moose migrate to summer range up to 60 miles from their winter range, reductions in the capacity of winter range may result in reduced densities of moose over a vast area.

The basic approach of this study is to identify the subpopulations of moose using potential impoundment areas and to quantify their dependence on those areas. For example, winter range of each subpopulation will be delineated and the proportion of available winter range that will be lost will be estimated. Factors such as browse production, quality and availability under varying environmental conditions will be considered. Since environmental conditions influencing these factors vary from year to year it will be necessary to continue these studies for several years.

Both the short term impact on the present moose population and the longer term loss of potential population size will be estimated by determining the size and trends of the existing population and assessing its status in relation to the present capacity and trends of the range.

The relationship between moose habitat and moose populations is complex. It is difficult to quantify this relationship and impractical to attempt to measure all aspects over the entire impact area. Therefore it will be necessary to conduct intensive studies in only

portions of the area to estimate the relative capacity of certain habitat types under certain environmental conditions. These estimates will then be extrapolated to the entire impact area on the basis of more extensive moose population studies and habitat maps.

Data derived directly from the moose will be collected under this subtask while data derived from the moose's habitat will be collected under other subtasks, particularly 7.12 Plant Ecology.

It is anticipated that by the end of Phase I the basic distribution and movement patterns of the major moose subpopulations will be known. The present number of moose using the study area will be estimated. A rough estimate of the percentage of winter habitat used during the winter of 1980-81 that will be lost should be possible. In other words it should be possible to estimate the overall scope and a range of magnitude of potential impacts. Studies must be continued through Phase II to determine impacts under a wider variety of environmental conditions and to test and refine the estimates made at the end of Phase I.

Procedures

1. Approximately 60 moose will be radio-collared during the first year of study. Most of these will be collared in March 1980 when moose are on winter range and most likely to be in or near proposed impoundment areas. Subsequent collaring operations will be conducted as needed to replace collars and to fill data gaps. Moose will be collared from Devils Canyon to the confluence of the Maclaren and Susitna Rivers, however it is anticipated that most will be collared in the vicinity of the proposed Watana impoundment which is expected to impact more moose than the Devils Canyon impoundment. Radio-collared moose will be relocated at least twice a month to delineate seasonal ranges. More intensive monitoring will be conducted as needed to determine migration patterns and calving areas and to delineate critical winter range. The specific location, habitat type, activity, and association with other moose will be recorded for each relocation. Habitat type will be classified according to the system that will be used in habitat mapping under subtask 7.12.
2. Periodic systematic aerial surveys will be made during winter to further delineate winter ranges and quantify the relative use of specific areas and habitat types in and out of proposed impoundment areas. To the extent possible moose will be classified by sex and age class as an aid in identifying segregation patterns and determining population trends.
3. Moose numbers will be estimated through quadrat sampling techniques during late winter.

4. The long and short term nutritional status of moose captured for collaring will be assessed through established techniques using morphometric measurements, condition classification, blood chemistry and hair mineral element levels.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Moose studies will be closely coordinated with plant ecology studies. Moose distribution data collected between January and March 1980 will be used to delineate areas for detailed habitat mapping and for selection of intensive vegetation study areas. These habitat maps will be used in the analysis of moose distribution data. It is anticipated that continual coordination between investigators of both subtasks will be maintained to ensure efficiency of study design and compatibility of data.

Snow conditions strongly influence moose movements and browse availability. Requirements for snow data will be determined on the basis of final project design and selection of detailed vegetation study areas. If possible these needs will be coordinated with those of the hydrologic field data collection program. It may be necessary to establish additional stations solely on the basis of moose study needs.

Title

Moose distribution, movements and habitat use downstream from Devils Canyon.

Objectives

To identify moose subpopulations using habitat that will be altered by changes in stream flow below Devils Canyon.

To determine the seasonal distribution, movement patterns, size and trends of those subpopulations.

To determine the timing and degree of dependency of those subpopulations on habitat to be impacted by altered flow regimes of the Susitna River.

Background

Islands and bars in the Susitna River are heavily used by moose during winter, particularly in years of deep snow. A major factor making these areas attractive to moose appears to be the maintenance of vegetation in a subclimax stage by the existing flow regime of the river. The mechanism setting back plant succession is not known. Periodic flooding may be the dominant factor but other factors such as siltation, normal channel erosion, ice scouring and soil moisture may also be important.

Alteration of the Susitna River flow regime by the Susitna Hydroelectric Project will probably result in changes in vegetation downstream. The nature and magnitude of these changes are unknown but could be significant to moose and other species of wildlife. It is possible that even minor changes in flow such as dampening of extreme flood levels by a few inches could alter many acres of critical moose winter range. Such alterations could influence moose abundance over a large area.

Because of the many unknowns, assessment of the impact of the Susitna Hydroelectric Project on moose populations in the lower Susitna River drainage will require synthesis of information from several disciplines including hydrology, geomorphology, plant ecology and wildlife ecology. Under ideal circumstances a systematic progression of studies starting with hydrology and ending with wildlife ecology should be followed. However, the scheduled time frame for developing the Susitna Hydroelectric Project is incompatible with this approach. Therefore it will be necessary to conduct a number of studies simultaneously.

The basic approach will be to identify mechanisms of impact and roughly estimate the potential magnitude of impact during Phase I. If significant impacts are identified the studies will be redesigned

to produce a more reliable estimate of impact and to provide an initial assessment of mitigation possibilities.

Studies of the effects of water conditions on moose habitat will be conducted under Subtask 7.12 Plant Ecology. It is anticipated that by the end of Phase I these studies will indicate if substantial changes will be caused by the predicted post-construction flow regime. A habitat map, which will also be prepared under Subtask 7.12 during Phase I, will provide a basis for preliminary estimates of acreages that might be altered. If significant vegetation changes are indicated by the Phase I studies these estimates will be refined during Phase II.

The dependency of moose on habitat subject to alteration will be assessed under this subtask. During Phase I moose wintering areas on and adjacent to the river will be delineated and the relative use of various habitat types, particularly those subject to periodic flooding, will be determined. This will provide the basis for a preliminary estimate of the proportion of winter range that may be altered, however, this estimate will be valid only for the environmental conditions existing during the winters of 1979-80 and 1980-81.

Characteristics of moose use of habitat subject to flooding will be determined by more intensive study of moose using one or more limited study areas. These study areas will include areas selected for intensive vegetation studies. Movements of individual moose will be monitored to determine whether habitat subject to flooding is used transiently by large numbers of moose or more regularly by smaller numbers. Moose use of specific plots being studied under Subtask 7.12 will be assessed through direct observation and pellet group counts.

Seasonal ranges of moose wintering on the intensive study area will be superficially delineated to indicate the approximate geographic scope of any impacts that are identified.

If Phase I studies indicate that the Susitna Hydroelectric Project will cause significant alteration of habitat downstream and that alteration of this habitat is likely to result in significant changes in moose distribution and numbers, Phase II studies will be designed to delineate moose subpopulations using the entire area of potential habitat alteration and to predict the impact on each subpopulation.

Procedures

The following procedures are for Phase I studies only:

1. Existing data on moose distribution and movements adjacent to the lower Susitna River will be compiled. Sources will include historic fall sex and age composition counts, records of road and railroad kills, and incompletely analyzed data on a major winter die-off that occurred along the river in 1970-71.

2. Periodic systematic aerial surveys will be made during winter to delineate winter ranges and quantify the relative use of specific areas and habitat types adjacent to the Susitna River. To the extent possible moose will be classified by sex and age class as an aid in identifying segregation patterns and determining population trends.
3. A limited number of moose (up to 20 during 1980) will be radio-collared in areas selected for intensive vegetation study (see subtask 7.12). These moose will be relocated approximately weekly while they are in the vicinity of the river to determine the pattern of use of specific habitats. They will be relocated approximately monthly at other times of year to roughly delineate other seasonal ranges and ensure continued contact with each animal.
4. Pellet group counts will be conducted within the intensive study areas to provide a quantitative comparison of moose use of specific habitats that will also be studied under subtask 7.12.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Moose studies will be closely coordinated with plant ecology studies. Moose distribution data collected between January and March 1980 will be used to delineate areas for detailed habitat mapping and for selection of intensive vegetation study areas. These habitat maps will be used in the analysis of moose distribution data. It is anticipated that continual coordination between investigators of both subtasks will be maintained to ensure efficiency of study design and compatibility of data.

Snow conditions strongly influence moose movements and browse availability. Requirements for snow data will be determined on the basis of final project design and selection of detailed vegetation study areas. If possible these needs will be coordinated with those of the hydrologic field data collection program. It may be necessary to establish additional stations solely on the basis of moose study needs.

Title

Wolf distribution, abundance, habitat use and prey selection.

Objectives

To identify wolf packs occupying areas that will be impacted by the Susitna Hydroelectric Project.

To delineate the territories of each pack and identify den sites, rendezvous sites and major feeding areas.

To determine the numbers of wolves and rates of turnover for each pack.

To determine the food habits of each pack.

Background

Recent studies indicate that the Nelchina Basin supports moderate densities of wolves. Wolves may be affected by the Susitna Hydroelectric project if critical portions of a pack's territory are inundated or if the abundance or condition of prey is altered.

Limited available data indicate that portions of the territories of several packs may be inundated. Since all parts of a pack's territory may not be equally important to the maintenance of the pack, the effect of this loss of territory may vary from pack to pack. Therefore it is necessary to delineate the territories of each pack and determine the degree and nature of use of areas within proposed impoundments.

A major factor influencing wolf numbers and distribution is prey availability. Recent studies in other parts of the Nelchina Basin indicate that large ungulates, particularly moose, are the most important prey of most packs of wolves. Since moose and caribou tend to be migratory it is possible that the Project will result in reduced prey availability in the territories of wolf packs many miles from the impoundments.

An assessment of the impact of the Project on wolves requires a knowledge of prey populations. Therefore wolf studies will be closely coordinated with studies of potential prey species.

Initially studies will be concentrated on wolf packs that are likely to be directly impacted through loss of territory. If studies of prey species indicate that prey densities are likely to be altered in other areas, the wolf study will be expanded to delineate packs in those areas.

Procedures

1. Several members of each wolf pack will be radio-collared. Each radio-collared wolf will be relocated at least twice a month. More frequent relocations will be made when necessary to provide specific information such as location of dens and rendezvous sites. Territories will be delineated by plotting relocations on maps. Numbers of wolves in each pack will be monitored continuously by direct observation of radio-collared wolves and other wolves accompanying them.
2. Habitat selection will be determined by recording the habitat type and activity of the wolves for each sighting made.
3. Standardized track count censuses will be conducted after fresh snowfalls to provide additional information on wolf distribution and numbers and identify packs not radio-collared.
4. Food habits will be determined by observation of kills located during radio-tracking flights and analysis of scats collected at dens. When possible the age, sex and condition of prey will be determined.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Data from studies of prey, particularly moose and caribou will be used in modification of design of wolf studies. Studies of both predators and prey will be closely coordinated so that interactions between species which might influence impacts of the Sustina Hydroelectric Project can be identified.

Title

Wolverine distribution, abundance, movement patterns and habitat use.

Objectives

To determine the distribution and abundance of wolverines in the vicinity of proposed impoundments.

To determine movement patterns and home range size of wolverines.

Background

Little is known about wolverine movement patterns and habitat requirements. A basic understanding of these questions is necessary before impacts of the Susitna Hydroelectric Project can be addressed. For example if wolverines have well defined home ranges and strict habitat requirements impacts might be quite different than if they have large and loosely defined home ranges and are able to exploit a wide variety of habitat types.

Observations made in the vicinity of the study area indicate that techniques that will be employed in the wolf study could be adapted to provide the necessary basic information on wolverines.

Since very little is known of wolverines at the present time it is anticipated that only rough estimates of the mechanisms and potential magnitude of impacts will be possible at the end of Phase I. At that time it may be necessary to redesign studies to provide a more reliable basis for assessment of impact.

Procedures

1. The distribution and abundance of wolverines will be assessed through track counts and direct observations made during wolf census surveys.
2. Wolverine (up to 10 in 1980) will be radio-collared and relocated approximately twice per month to determine movement patterns and home range.
3. Habitat selection will be determined by recording habitat type and activity for each sighting made.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular wolf and wolverine tagging will be coordinated with moose tagging and when feasible several species will be radio-tracked on the same flight.

Personnel from the University of Alaska are expected to have opportunities to collect additional information on wolverines in the course of studies directed at other furbearers. All aspects of both studies will be coordinated to maximize data collection with a minimum of duplication of effort.

Title

Bear distribution, movements, abundance and habitat use.

Objectives

To determine the distribution and abundance of black and brown/grizzly bears in the vicinity of proposed impoundment areas.

To determine seasonal ranges, including denning areas, and movement patterns of bears.

To determine seasonal habitat use of black and brown/grizzly bears.

Background

Much of the Nelchina Basin is known to support high densities of brown/grizzly bears. Black bears are believed to be less abundant and less widely distributed. The main mechanism of impact affecting bears is likely to be direct loss of habitat particularly seasonally important feeding areas or denning areas. Some bears may be indirectly affected through reduction in ungulate densities in areas outside of proposed impoundments as moose and perhaps caribou constitute a major portion of bears' diet during summer in adjacent areas. Shorter term impacts will result from bear-human conflicts which are likely to occur when field facilities are established for the Susitna study program and subsequent dam construction if the project is approved.

Studies in other parts of Alaska indicate that bears have specific habitat and food preferences. These preferences often vary seasonally in a manner that suggests very specific seasonal habitat requirements. While both species of bear sometimes occur in close proximity, their habitat requirements are probably different. Therefore the impact of inundation of bear habitat may not be in direct proportion to the number of acres lost and the impact on one species of bear may be quite different from that on the other.

Procedures

1. Adult bears will be radio-collared in and adjacent to the proposed impoundment areas. Approximately 35 bears will be collared the first year. Incidentally caught bears too small to be radio-collared will be marked with visual tags. Black bears and brown/grizzly bears will be marked in the approximate proportion of their occurrence in the area. At this time it is not known if significant members of black bears will be found.
2. Radio-collared bears will be relocated periodically throughout their active period to delineate seasonal ranges and determine movement patterns. The den location for each radio-collared bear will be recorded each year.

3. All observations of both marked and unmarked bears will be recorded. For each sighting the location, habitat type, activity and association with other animals will be recorded.
4. Information on seasonal food habits will be gathered through observations of bear feeding and to the extent possible through scat analysis.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. When feasible several species will be radio-tracked on the same flight.

Title

Caribou herd identity, migration patterns and habitat use.

Objectives

To delineate calving areas.

To determine the numbers and sex and age composition of caribou occupying habitats on both sides of proposed impoundments at different seasons.

To determine migration routes and the timing of major movements in the vicinity of proposed impoundments.

Background

The distribution and movement patterns of the Nelchina caribou herd were extensively studied during the 1950's and 1960's. At that time large numbers of caribou regularly crossed proposed impoundment areas during migrations between seasonal ranges, particularly on their migration from calving areas south of the Susitna River to summer range north of the river and subsequent fall migrations to the east. Early assessments of the impact of various Susitna hydroelectric proposals suggested that impoundments could block migrations and isolate caribou from portions of their traditional range.

A number of major changes have occurred during the last decade which limit the value of data collected prior to 1970. The herd suffered a major decline in the early 1970's dropping from an estimated peak of over 70,000 to less than 10,000. The herd is currently increasing and estimated to number 20,000. Current management plans call for stabilizing the herd at the present level. Movement patterns appear to have become quite variable from year to year. While movements across proposed impoundment areas still occur it is not clear whether they are as significant to the population as they were thought to be in past years.

Location of calving areas is believed to be the most consistent characteristic of caribou distribution and movement patterns. The traditional concept of a herd assumes a well defined common calving area. The Nelchina herd still uses its traditional calving area south of the Susitna River, however, in the last few years there have been indications of significant numbers of caribou north of the river during the calving period. These caribou may represent a subherd with all sex and age classes represented or they may be segments of the main herd that are not involved in calving.

If a new subherd exists the "need" to migrate across the proposed impoundment areas may be reduced. But if different sex and age classes are on opposite sides of the river at that time of year the need to migrate would be great.

It is not likely that caribou would be completely excluded from any part of their range other than those areas that are inundated. However, even a partial barrier to movements could result in reduced use of portions of the present range and increased use of other portions. If the desire to migrate along routes blocked by impoundments is strong, caribou may attempt to cross impoundments. Potential hazards such as ice shelves and mud flats could increase mortality rates among caribou attempting to cross.

Unfortunately there is no way to predict with confidence the reaction of caribou to impoundments. The caribou impact assessment will necessarily be more subjective than those for other big game species. The approach of this study is to describe the existing patterns of caribou distribution, movements and habitat use. This should provide a basis for estimating the importance of specific migration routes to the present population and for determining the availability of alternative migration routes.

Procedures

1. Aerial surveys will be made to delineate distribution of caribou on both sides of proposed impoundments and to determine if calving is occurring north of the Susitna River.
2. Post-calving concentrations on both sides of the river will be censused by commonly used photo extrapolation techniques to determine the proportion of the herd occupying habitat north of the river.
3. Sex and age composition counts will be made in spring and fall as part of the census procedure. These counts will also indicate if the sexes and ages caribou using habitat on one side of the river are different from those using habitat on the other side.
4. Caribou (up to 40 in 1980) on both sides of the river will be radio-collared. Collars will be placed on animals in different groups of caribou scattered throughout the herd. The frequency of relocation of radio-collared caribou will vary depending on the location and activity of the caribou. Relatively low levels of monitoring will be maintained when caribou are away from the impoundment areas or are sedentary to provide basic information on seasonal ranges and habitat use and to ensure continued contact with collared individuals. The frequency of monitoring will be increased when caribou are close to impoundment areas, particularly during migrations.
5. Habitat type will be recorded for all caribou sightings.

Relationship to Other Subtasks

Procedures for recording and handling data will be coordinated with those of other wildlife studies to ensure efficiency in later impact analysis.

Personnel and logistics will be coordinated among all big game studies. In particular individuals working on other species will record caribou observations and periodically scan radio frequencies in the vicinity of impoundments to assist in identifying periods when intensive caribou monitoring is needed.

Title

Distribution and abundance of Dall sheep.

Objectives

To determine the distribution and abundance of Dall sheep adjacent to proposed impoundments.

Background

Relatively isolated groups of Dall sheep inhabit mountainous areas on both sides of the proposed Watana impoundment. At the present time it is not believed that sheep regularly use habitat that will be inundated or that they regularly migrate through areas which will be inundated. It is possible that the Watana impoundment might further isolate groups north of the river from larger adjacent populations south of the river reducing possibility of repopulation should these groups decline in the future.

The main concern is the effect of disturbance during construction of hydroelectric generation and transmission facilities. It may be possible to zone construction activities in both time and space to minimize this disturbance. The purpose of this study is to provide a basis for decisions on such zoning.

Procedures

Aerial surveys will be made to delineate seasonal ranges including rutting and lambing areas.

Relationship to Other Subtasks

Since the scope of this study is limited, only minor coordination of personnel and logistics will be necessary.

BIG GAME STUDIES - BASE
(all costs in 1000 x 1980 dollars)

Administration and Support
100 Salaries and Benefits

Job Class	Rate/month *	1980		1981		1982	
		Man	Months/Cost	Man	Months/Cost	Man	Months/Cost
Game Biologist IV	4442	6	26.7	6	26.7	1	4.4
Biometrician II	3475	6	20.9	6	20.9		
Programmer III	3035	3	9.1	6	18.2		
Administrative Assistant I	2386	2	4.8	2	4.8		
Clerk Typist III	1726	9	15.5	12	20.7	1	1.7
Total:			77.0		91.3		6.1
200 Travel			4.0		4.0		
300 Contractual Services			6.0		6.0		
Total: (rounded to nearest \$1000)			87.0		101.0		6.0

Big Game Studies
100 Salaries and Benefits

Job Class	Rate/month *	1980		1981		1982	
		Man	Months/Cost	Man	Months/Cost	Man	Months/Cost
Game Biologist III	3773	40	150.9	40	150.9	4	15.1
Game Biologist I	2841	24	68.2	20	56.8		
Fish and Game Technician III	2163	16	34.6	10	21.6		
Total:			253.7		229.3		16.8

* Rates are averaged where several positions with different merit step levels or area differentials are involved.

200 Travel	21	14	
300 Contractual	254	222	
400 Commodities	62	29	
500 Equipment	14	2	
Total: (rounded to nearest \$1000)	605	496	17
Combined Administrative and Support and Big Game Studies TOTAL:	692	597	23

BUDGET SUMMARY AQUATIC AND WILDLIFE
STUDIES AND SUPPORT PHASE I
(All costs in 1980 dollars)

Study Task	Year		
	80	81	Jan. 82
I. Administration and Support Aquatic Studies	588.0	617.0	31.0
II. Anadromous Adult Fishery Studies	994.0	666.0	9.0
III. Resident and Juvenile Anadromous Fishery Studies	455.0	477.0	15.0
IV. Spatial and Seasonal Habitat Studies	410.0	358.0	23.0
V. Administration & Support Wildlife Studies	87.0	101.0	6.0
VI. Wildlife Studies	605.0	496.0	17.0
VII. Susitna Hydro Coordinator (including support)	75.0	75.0	6.0
TOTAL: Rounded to the nearest \$1,000	3,214.0	2,790.0	107.0

ADF&G Fisheries Divisions
Regional Office

ADF&G Game Division
Regional Office

ADF&G Habitat Protection Section
Regional Office

Sustna Hydropower
Fisheries and Wildlife Study Team

Aquatic Studies Coordinator
FB IV

Wildlife Studies Coordinator
GB IV

Sustna Hydro Coordinator
HB IV

Anadromous Adult
Stock Assessment
Project Leader
FB III

Resident and Juvenile
Anadromous Studies
Staff

Spatial and Seasonal
Habitat Studies
Staff

Anadromous Studies
Staff

Resident and Juvenile
Anadromous Study
Project Leader
FB III

Spatial and Seasonal Habitat
Project Leader
FB III

Habitat Protection
Support Staff

Project Leader
Upstream moose, wolf, wolverine
GB I

Upstream moose study staff

Project Leader
Downstream moose
GB III

Downstream moose study staff

Project Leader
Bear
GB III

Bear study staff

Project Leader
Caribou and sheep
GB III

Cook Inlet
File Collection
FB I

6 FT I

Scale Analysis
FB I

5 FT III

Electrophoresis
Graduate Student

6 FT II

Stock Assessment

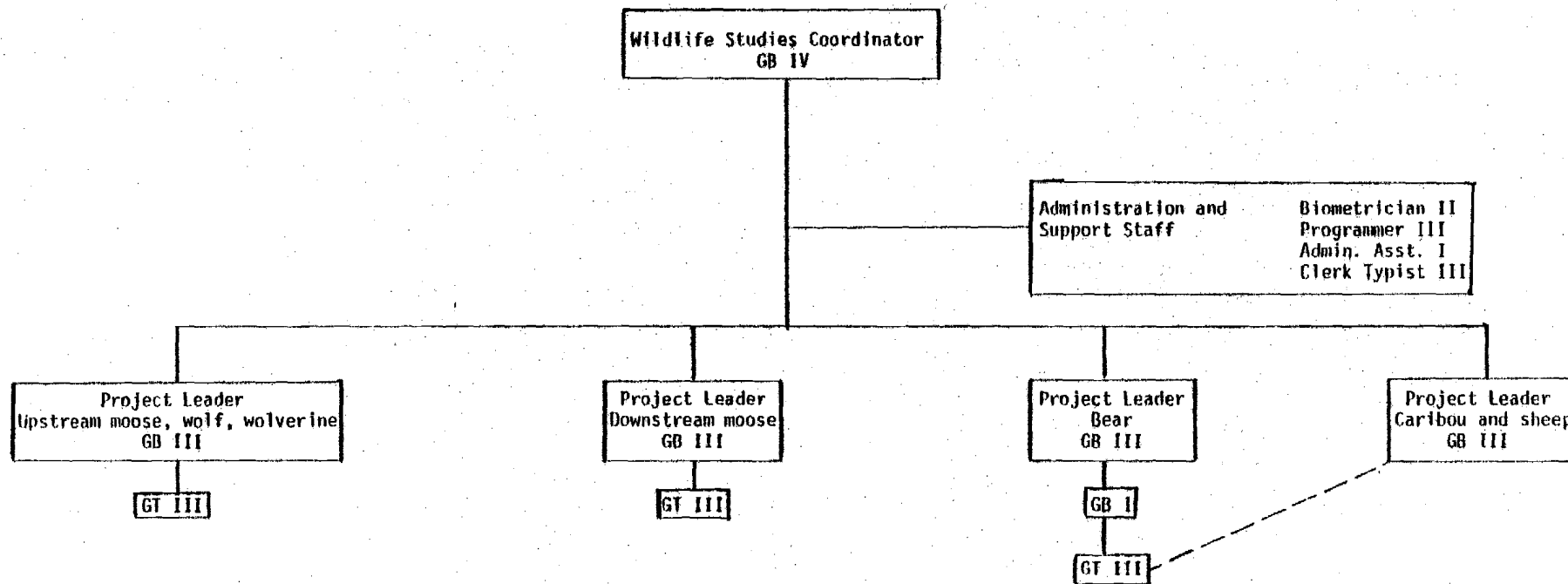
Radiotelemetry
FB II2 FB I
1 FT IISonar - Tagging
Creel Census
FB IICook Inlet to Yentna
4 FB I
2 FT IIYentna to Talkeetna
4 FB I
12 FT IIAnadromous Adult
Project Leader - FB IIICook Inlet to Talkeetna
6 FB I (1980)
7 FB I (1981)Talkeetna to Devil's Canyon
3 FB IDevil's Canyon to Tyone River
3 FB IResident and Juvenile
Anadromous Project Leader
FB III

FT III

Spatial and Seasonal
Habitat Project Leader
FB III

Hydrologist III

2 FB I/II
3 FB IClerical and
Administrative
Support1 Admin. Asst. I
1 CT III
1 Pub. Spec. II
3 CT IITechnical
Support1 Biometrician III
2 Biometrician II
1 Maintenance Mech. II
1 Cartographer IIAquatic Studies Leader
FB IV



STATE OF ALASKA

Attachment I

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

LAND AND WATER MANAGEMENT

323 E. 4TH AVENUE - ANCHORAGE 99501

October 26, 1979

Mr. Eric Yould
Executive Director
Alaska Power Authority
333 W. Fourth Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

Enclosed is a proposal for evaluation of stream flow manipulation effects downstream of the Devil's Canyon dam site as part of the Susitna Dam feasibility studies. During preparation of this proposal our staff coordinated closely with the Alaska Department of Fish and Game so that this proposal and their proposal for spatial and seasonal habitat studies would maximize joint use of field personnel, equipment, and transportation to eliminate any duplication and redundancy.

The Alaska Department of Natural Resources has major management and regulatory responsibilities under AS 46.15 (the Alaska Water Use Act) and AS 38.05 (Alaska Land Use Act). The Department will have to process applications for water rights and construction permits prior to the Federal Energy Regulatory Commission licensing process. In the process of acting upon such applications the Department is directed by AS 46.15.080, to consider the following relevant items:

1. the benefit to the applicant resulting from the proposed appropriation
 2. the effect of economic activity resulting from the proposed appropriation
 3. the effect on fish and game resources and public recreational opportunities
 4. the effect of loss of alternate uses of water that might be made within a reasonable time if not precluded or hindered by the proposed appropriation
 5. the effect upon access to navigable or public waters
- The commissioner is authorized by AS 46.15.100 to issue a permit subject to terms, conditions, restrictions or limitations necessary to protect the rights of others and the public interest.

In addition to the statutory directives listed above, my division is charged with conducting the state land disposal program. We presently have 117,399 acres of land west of the Susitna River and south of

Trapper's Creek classified for disposal. During this fiscal year alone we will be selling 31,375 net acres. With the price of gold rising, we also expect additional activity in the area, particularly in the Kahiltna drainage. The only means of access is by aircraft, snowmachine, or riverboat via the lower Susitna River with major access points from Talkeetna and from Willow via the Little Susitna River.

We understand that the preliminary plan of study submitted by Acres American suggests terminating the downstream study boundary at Talkeetna. Examination of existing hydrological records and project show that approximately 43% of the average flow in the Susitna main stem near Talkeetna will be subject to manipulation by the power project. Given this situation we can not adequately address concerns that will arise over navigation and fisheries downstream from Talkeetna to salt water without studies being conducted on this reach of the river. By including these essential issues in the scope of APA funded investigations, management agencies and the public will have the necessary information to objectively consider tradeoffs between downstream resource uses and optimum operation of the dam and reservoir for power generation.

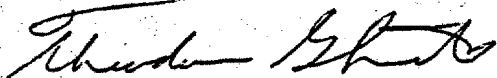
We would prefer the opportunity to review Acres revised plan of study in comparison to the Corps of Engineers year old plan of study prior to APA's final selection decision. Given the timeframe for APA's decision process it appears this will not be possible. Therefore by copy of this letter I am forwarding the attached proposal to Acres for their consideration for inclusion into their POS.

Should Acres and APA desire to use the Department of Natural Resources or Fish and Game as a subcontractor in this effort I suggest that any authorization of funds to DNR be executed by a Reimbursable Service Agreement (RSA) with payments subject to approval by Acres as the study manager. The reason for this is to avoid delays in accepting and receiving authorization to expend funds from non-state sources which requires conduct of the Revised Program (RP) process. Work under an RSA between state agencies could commence within a month whereas the RP process could take up to three months.

While we feel that state agencies could adequately conduct elements of the feasibility study in a compatible time frame for FERC licensing submission, the basic concern is that work be done which enables appropriate management agencies to execute their responsibilities in a timely manner for all concerned. Should a private subcontractor be selected for all elements of the study, I suggest that APA consider retention of certain scientific and durable equipment (flow recorders, meters, boats, etc.) that may be purchased for the project. Your agency will undoubtedly be conducting such studies across the state for a number of years, whereas outside contractors may or may not be working in the state in future years. Such an arrangement could reduce outlays for future studies by providing a pool of certain necessary equipment instate.

I hope this information is helpful. Please do not hesitate to contact me or my staff if you have any questions. We look forward to continued involvement in this project.

Sincerely,



Theodore G. Smith, Director
Division of Forest, Land and Water Management

cc: John Lawrence, Acres American
Jeff Haynes, Deputy Commissioner, DNR Tom Trent, ADF&G
Charles Behlke, Chairman, Alaska Power Authority
Brent Petrie, WMS
Bill Long, DGGS

TASK: Assessment of Instream Flow Requirements for the Susitna
(In cooperation with ADF&G Spatial and Seasonal Habitat

BACKGROUND:

Increased water demands and significant changes in flow regimes sometimes result in conflicts over water use. A major concern of many resource agencies is the conflict between out-of-stream uses of water or flow regime changes and the needs of fish and wildlife, navigation, recreation and other instream flow uses. DNR, in conjunction with ADF&G, USEWS, USGS, ADEC, ADOTPF, and the U.S. Water Resources Council, is presently pursuing an instream flow program for the State of Alaska. The program is patterned after the procedures developed by the Cooperative Instream Flow Service Group, Department of the Interior, U.S. Fish and Wildlife Service, located at Fort Collins, Colorado.

Work has initially begun during this past summer by ADF&G, DNR, and other interested agencies to obtain field data from Willow and Deception Creeks in the Susitna Basin and analysis of this data is currently underway. Additional funding for ADF&G and DNR to pursue the Willow and Deception Creeks study has recently been authorized by the U.S. Water Resources Council. Data produced as a result of this federal grant will augment the instream flow work performed as part of the Susitna Dam feasibility study.

PARTICIPATION:

This study will be performed in addition to work proposed by ADF&G, but will be done in close cooperation and coordination with that agency and other tasks performed by consultants as part of the overall Susitna Dam feasibility study. If the ADF&G instream flow study as part of their Spatial and Seasonal Habitat Studies is not funded, DNR will need to increase this budget in the amount that ADF&G was not budgeted, in order to perform the necessary work. It is anticipated that other agencies such as USEWS and USGS will participate in these instream flow studies, particularly the USEWS during data processing and analysis.

TASK OBJECTIVES:

This study will extend the field methods in use in the Willow and Deception Creek basins to serve as a tool to assess the effects of different flow regimes on aquatic and riparian habitat in the Susitna River. The study will provide data to the Alaska Power Authority (APA) on which decisions may be made regarding dam location, design, and operation through the following objectives.

- A. The study will provide data to allow the APA to make decisions regarding the magnitude and timing of flow releases from the proposed dams.
- B. The study will allow the APA to evaluate the effects of altered flow regimes on fisheries in the Susitna River along with other instream uses of the Susitna River such as boating and navigation.

- C. Data generated from this study will aid the APA in evaluating dam design and operation to optimize power production.
- D. Data generated from this study can be utilized by the APA for planning and evaluating necessary mitigation measures for downstream resources.
- E. Results of this study will provide necessary data to regulatory and management agencies, such as DNR, ADF&G, DEC, USFWS, NMFS and FERC, such that these agencies can adequately perform their permitting and management responsibilities.

LIST OF SUBTASKS:

The above stated objectives will be accomplished through the following subtasks. Cooperating agencies and/or firms are also indicated.

- A) Consultation with state and federal agencies and consulting firms to coordinate the plan of study (DNR, APA, Acres, R&M, TES, ADF&G, USGS, USFWS).
- B) Order equipment and arrange logistical support (DNR, ADF&G, USGS, CIRI/H&N).
- C) Training in field techniques and data interpretation for project personnel (DNR, ADF&G, USFWS, USGS).
- D) Conversion of software to an accessible computer and training of computer personnel (ADF&G, USFWS, ACRES, DNR).
- E) Development and refining of preliminary probability of use curves (ADF&G, DNR, USFWS, USGS).
- F) Collection of data to refine and validate probability of use curves (ADF&G, DNR, USFWS, USGS).
- G) Collection of hydrological (stream flow) data (DNR, ADF&G, USGS, USFWS).
- H) Data processing and analysis (ADF&G, USFWS, USGS, and DNR).
- I) Utilizing this data and analysis, provide information to licensing and management agencies (APA, FERC, DNR, ADF&G, DEC).

STUDY LOCATION:

Selection of study reaches in the Susitna River System will be required to provide the necessary flow information for this study. Sites will be required on the main stem of the Susitna River downstream from the proposed dam sites to salt water with additional sites located on major tributaries in the proposed study area. A wide variety of representative selections will be required to delineate the probability of use curves for the aquatic environment. Location of the transects will require close coordination with state and federal wildlife agencies,

the USGS and involved consultants to satisfy hydrologic and hydraulic considerations for determining channel morphology and aquatic habitat parameters for defining preferred habitat in these areas.

SCHEDULE:

This study will require three years of data collection and analysis as outlined below.

A. First Year:

1. Coordination of plan of study, personnel, equipment, and site selection of transects.
2. Order equipment and arrange logistical support.
3. Project staffing.
4. Conversion of software to an accessible computer in Alaska.
5. Development and refinement of preliminary probability of use curves.
6. Initial collection of stream flow data.
7. Initial data processing and analysis.

B. Second Year:

1. Continue data collection.
2. Continue data processing and analysis.
3. Refine and validate probability of use curves.

C. Third Year:

1. Complete data collection.
2. Complete data processing and analysis.
3. Complete probability of use curves.
4. Report writing and submission of data to APA for utilization in FERC licensing and permitting processes.

BUDGET:

The total budget for DNR involvement in this study will be \$407,861.00 over the three year duration of the study. This is broken out per year below, with a detailed budget for the first year attached.

A. First Year:

Personal Services	\$ 92,706.00
Travel	14,400.00
Commodities	2,100.00
Contractual	21,000.00
Equipment	57,655.00

Total First Year Budget	\$187,861.00
-------------------------	--------------

B. Second Year:

Little extra equipment will be needed. This year's budget will be comprised primarily of Personal Services, Travel and Commodities as shown above totaling approximately \$110,000.00.

C. Third Year:

This year's budget will approximate the second year, totaling \$110,000.00.

PROPOSED BUDGET SUSITNA
INSTREAM FLOW PROJECT

Personal Services

- (1) Hydrologist III 18A 12 months = 34,178.64
- (1) Ecologist I 16A 12 months = 29,750.76
- (2) Temp. Land Management Tech II 14A 6 months = 21,563.40
- Overtime for LMT II = \$7214.00

Total \$92,706.00

Travel

- 2 positions 800.00 per month x 8 months = 6,400
- 2 positions 800.00 per month x 6 months = 4,800

(Training) 2 positions (out-of-state) 800.00
each = 1,600 x 2 trips = \$3,200.00

Total \$14,400.00

Commodities

\$250/year x 2.5 positions = \$625.00
Gas, oil, motor \$1,500.00

(2 ea.) Hard hats, hip boots and chest waders = \$475.00

Total \$2,100.00

Contractual

- A. Consult instream flow group. 3 of them will fly to Alaska from Ft. Collins, Colorado and return. 1 person from Alaska to fly to Ft. Collins and return. \$3200.00.
- B. Repairs of boat, motor and other equipment \$1000.00.
- C. Phone 200.00 per month per phone x 2 x 12 mo. = \$4,800.00. This includes long distance calls.
- D. Plane charter to fly over sites \$2,000.00.
- E. Computer analysis of field data \$10,000.00.

Totals \$21,000.00

Equipment

Office equipment

- 1. 2 desks, 2 chairs, 1 bookcase, 1 file cabinet = \$1,300.00
- 2. 1 calculator 300.00
- 3. (Special) paper, rite in rain, forms, and printing = \$700.00

Field equipment

1. Level, Lietz B-2 (32x)	\$1,600.00
2. Tripod (dome)	250.00
3. Survey stakes	150.00
4. Measuring tape & holder (300 ft.)	150.00
5. 35 mm camera and lens, film and development	900.00
6. Electronic surveying equipment, angle measurements, range measurements, field computer	20,500.00
7. Current meters, pygmy and AA meter	500.00
8. Marsh-McBirny flow meter, digital readout	1,600.00
9. (2) topsetting wading rods	400.00
10. Suspended system (flow metering system)	400.00
11. Boat mounted (flow metering system)	1,600.00
12. Sonar - narrow beam	3,000.00
13. Headset and battery	50.00
14. 2 way radio, walkie talkie (2 sets)	2,000.00
15. Compass	100.00
16. (2) portable ultrasonic level and flow recorder.	6,800.00
17. (2 ea.) First Aid Kit	200.00
18. Bank anchors $\frac{1}{2}$ " x 48" rebar	20.00
19. (2) leveling rod (Philadelphia)	300.00
20. (1) Cable tagline 300+feet	150.00
21. Tools for repairs	175.00

Boat equipment

20 foot riverboat	\$4,000.00
13 foot Avon riverboat	1,800.00
85 hp (jet boat)	3,000.00
25 hp (Kicker) jet foot	1,200.00
10 hp for Avon (jet foot)	700.00
25 gallon gas tank	350.00
(2) 10 gallon gas tanks	60.00
(4) life vests	150.00
Boat trailer (service contract)	2,000.00
Oars (2 sets)	150.00
(2) Anchor, anchor rope	100.00

Camping equipment

Tents, stoves, lanterns, personal sleeping bags, cooking equipment	1,000.00
--	----------

Total all equipment:	\$ 57,655.00
Total Personal, travel, contractual, commodities:	\$130,206.00
Total budget:	\$187,861.00

Budget for additional years would be less because little extra equipment would be needed. Estimated cost for additional years \$110,000.00 per year.