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CORRECTION

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Partial Listing of Publications, Manuscripts, Reports, and Documents[1/] Related to Salmon Aquaculture Research Activities of the Auke Bay Laboratory.

-November 29, 1978-

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Wertheimer, A. C. and R. M. Martin. 1978. Successful artificial spawning of sea-run coho salmon held to maturity in a saltwater net pen. Unpubl. Manuscr., 3 p. Northwest and Alaska Fisheries Center Auke Bay Laboratory, National Marine Fisheries Service, NOAA, Auke Bay, Alaska 99821

1/ In addition to formally published literature, several kinds of unpublished manuscripts and reports are also listed. These include manuscripts at some stage of a peer review process, completed manuscripts on file in the ABL Library (MR-F series), and Processed Reports for limited distribution of preliminary data.

11/29/78 Dr. Burkett Handout

F.R.E.D. RESEARCH

Species

Chum	Sockeye
Coho	Rainbow
Pink	Sheefish
Chinook	Grayling

Chum at Beaver Falls, Snettisham, Crystal Lake, Klawock, Hidden Falls, Clear, Kotzebue, Russell Creek, Tutka, and Halibut Cove.

Coho at Starrigavan, Snettisham, Crystal Lake, Klawock, Hidden Falls, Fish Creek, Big Lake, Elmendorf, Fort Richardson, Little Port Walter, Seward Lagoon, Kachemak Bay, Halibut Cove, Fire Lake and Kasilof.

Pink at Starrigavan, Tutka, Kitoi, Halibut Cove, Auke Bay, Little Port Walter and Anan Creek.

Chinook at Deer Mountain, Beaver Falls, Starrigavan, Fish Creek, Snettisham, Crystal Lake, Kasilof, Fire Lake, Elmendorf, Fort Richardson and Clear.

Sockeye at Auke Bay, Big Lake, Kasilof, Karluk, Kitoi, Halibut Cove, Nunavaugaluk, Moose Creek and Hidden Lake.

Rainbow at Deer Mountain, Crystal Lake, Elmendorf, Fort Richardson and Fire Lake.

Sheefish at Fire Lake and Clear.

Grayling at Fire Lake and Clear.

Incubation

Types of incubators - 502
Loading Densities - Increase from 7-12 eggs per cubic inch for chum, 10-20 per cubic inch for pinks.
Substrate - Progression from none, to gravel, to Astroturf, to Intalox Saddles.
Fry transport and handling - Volitional-type incubators, fish pumps, fry separators, pen towing.
Glacial water suitability - Incubation in glacial water such as Kenai Lake.
Accelerated incubation - 0-age smolts

Rearing

Short-term fry rearing - Pinks and chums in estuarine pens and fresh water units to measure any changes in adult survival.
Accelerated coho and chinook growth - Using heated water from power plants or hatchery heaters, 0-age smolts are produced.
Normal coho and chinook growth - Using ambient temperature water, either to produce one-year old smolts because no heat is available or to compare survival of these to accelerated smolts.
Fresh and salt water rearing - To compare efficacy of the two methods.

Types of units - To compare raceways, Swedish Ponds, net pens, cones, floating raceways.
Loading densities - Maximum in tidal flow and in piped flow-through units, reaeration.
Multiple pass systems - For increasing carrying capacities.
Diet testing - Comparing AMP (Alaska Moist Pellet) to OMP, also ADP (Alaska Dry Pellet) to improve survival, reduce cost, and to develop Alaskan industry based on better-use of fish products.

Release and Stocking

Compare timing of release - To improve survival.
Size at release - To compare and improve survival.
Estuarine productivity - To determine carrying capacity of marine waters near hatcheries and to pick best time of release.
Predation effects - To maximize survival by manipulating size of fish released and timing and place. Also to measure effects of predator control. King River Chin-

Pathology

Vaccines - To combat disease such as Vibriosis.
Disease transmission - To determine mode of disease transmission so that it can be minimized.
Kidney disease prevention - Studying the effect of erythromycin on preventing kidney disease transmission.
Hatchery disinfection - Crystal Lake and Kasilof.
Controlling fungus - Comparing use of chemicals and salt water to reduce fungus.

Genetics

Selection - Rainbow brood stocks are being selected for desirable traits.
Genetic variability - Is being measured in wild and hatchery stocks to determine need for maintaining gene pools and for incorporating additional variability in stocks.
Phenotypic traits - Studying characteristics of chinook and coho stocks to determine which donors may be most useful to programs (Speel Lake coho, King Salmon River chinook).
Age at maturity - To maximize production potentials of hatcheries and to produce larger adults.
Run timing - To allow segregation of stocks in fisheries and to provide fish to sport fishermen at appropriate times.
Maintaining stock integrities - Specifying minimum numbers of adults to spawn at hatcheries and minimize transplantation of stocks.

Carrying Capacity

Lake and stream inventory - To determine production potential of lakes and streams for rehabilitation and enhancement projects.
Lake fertilization - Improvement of production potential of lakes.

Brood Stocks

Surveying potential donor stocks for rehabilitation and enhancement projects.

Enumeration

Tagging - Technology in coded wire tagging has increased (tagging 1.0g fry).
Fish counters - Studying and utilizing sonar for smolt and adult counting. A new fry counter is being tested.

Geothermal

Surveys - To determine availability of geothermal heat for accelerated salmon production.

Induced Spawning

Gonadotropins - By accelerating spawning time, coho or chinook may be smolt size the following spring or summer.

Egg Planting

Egg planting devices - Have proven to be better than traditional shovel methods -- may be used in rehabilitation or enhancement projects such as Karluk.

Homing and Imprinting

Studies to determine time necessary for imprinting transplanted stocks, degree of straying.

Migration

Our tagging studies and commercial fisheries recovery efforts are showing migratory patterns and degree of continuous harvesting of stocks over wide areas.

Fish Passes

Baseline studies to determine need for fish passes (Anan, Apollo).
Construction and evaluation of fish passes to measure efficacy (Anan, Frazer River).
Evaluation of types of fish passes.

Habitat Alteration

Studying effects of log jam and beaver dam clearance.
Channel stabilization - Effect on escapement (Ocean River-Alaska Peninsula).

11/29/78 Handout R. S. Hadley
Alaska Sea Grant
University of Alaska

A REVIEW OF AQUACULTURE RELATED PROGRAMS AT THE UNIVERSITY OF ALASKA

November 27, 1978

RESEARCH OBJECTIVE

Aquaculture research is carried out under the Renewable Marine Resources Research program of the University of Alaska Sea Grant Program. The objective of the program is:

> *To provide new information which will assist in the development of new industries, new management techniques, or new harvesting methods which will utilize and conserve the renewable marine resources of Alaskan waters.*

Specific to aquaculture, the short-term research objective is as follows:

> *To assist in the development of the non-profit salmon hatchery through research, advisory and education programs.*

RESEARCH FACILITIES

Facilities of the University of Alaska which are utilized in aquaculture research include the laboratories and marine station of the Institute of Marine Science in Fairbanks and Seward, and the Division of Fisheries in Juneau.

All three locations possess faculty, graduate students and staff with an interest in pursuing research which would be useful to the advancement of the art of aquaculture in Alaska. These interests cover the broad areas of physical, chemical and biological oceanography, and special emphasis at the Juneau campus on fishery research in the area of genetics, fish culture, fish diseases, and fish ecology.

To a greater or lesser extent, laboratories are maintained at each location which are equipped to perform research applicable to aquaculture, including flow-through, saltwater, live tank systems.

CURRENT AQUACULTURE PROGRAMS

The following are the education, extension and research aquaculture projects which are currently carried out by the University of Alaska statewide system:

EDUCATION

Course Development: Experimental Fish Culture

ADVISORY

Marine Advisory Program, Mission B - Aquaculture

RESEARCH

Carrying Capacity of Estuarine Waters

Fishfeed Development

Genetic Interaction of Auke Creek Hatchery Pink Salmon with Natural Spawning Stocks in Auke Creek

Inheritance of Egg and Fry Characteristics in Chum Salmon

Descriptions of each project are included in Appendix A.

Additional research is underway by graduate students associated with the various University programs. The following are the areas of the student research:

Dave Urquhart - U of A, Fairbanks - Feeding ecology of pink salmon in Prince William Sound.

Dave Barnard - U of A, Fairbanks - Feeding ecology of chum salmon fry in Prince William Sound.

Andrew McGregor - U of A, Juneau - Comparison of local pink salmon stocks at Auke Creek.

METHOD FOR DISSEMINATION OF RESEARCH RESULTS

Research results are published either as technical reports or as articles in scientific journals. In all cases, copies of these reports or articles are provided to an extensive, permanent mailing list. This includes the required distribution to all University and state libraries. Additionally, information on current importance on aquaculture information is provided in the "Aquaculture News Briefs" section of *Alaska Seas and Coasts*.

The Alaska Sea Grant Program, in conjunction with the Cooperative Extension Service, maintains a Marine Advisory Program. This program provides direct one-to-one dissemination of information of interest to the marine community. Curt Kerns of the MAP staff is the Aquaculture Specialist and is responsible for the communication between the University and the aquaculture "industry."

RECOMMENDATIONS FOR FUTURE RESEARCH DIRECTION AND RESPONSIBILITIES

The University of Alaska will continue to seek new knowledge and assist in the development of new industrial development in order to meet the major objectives of the program. Major areas of research for the future are:

- Continuation of an understanding of the estuarine survival of young salmon.
- Continuation of the understanding of genetic interactions and genetic tagging.

AQUACULTURE RELATED PUBLICATIONS

Alaska Statutes: Commercial Fishing Loan Act, Salmon Hatcheries, Fisheries Enhancement Loan Program, Salmon Authorities (as amended through 1977) Compiled by E. Thomas Robinson in Aquaculture Notes, AK-SG-77-6, 17 pp.

Aquaculture in Alaska: A Resource Potential
E. J. Kelley and D. W. Hood, eds. Institute of Marine Science, Public Information Bulletin 73-1, AK-SG-73-5, 20 pp.

Artificial Salmon Spawning
Curt L. Kerns and William W. Smoker, Marine Advisory Bulletin No. 6, 1977 (in press).

Artificial Upwelling in Alaska Fiord Estuaries
W. E. Shiels and D. W. Hood, in The Northern Engineer, Vol. 2, No. 4, 1970, pp. 8-12.

Accounting for Private Nonprofit Salmon Hatcheries
E. Thomas Robinson, AK-SG-77-13 (in press).

Economic Feasibility of Private Nonprofit Salmon Hatcheries
Franklin L. Orth, AK-SG-77-4, 99 pp.

Enhancement of Primary Productivity by Artificial Upwelling
R. A. Neve', R. Clasby, J. J. Goering, and D. W. Hood, in Aquaculture Notes, AK-SG-76-8, 22 pp.

History of the Marine Hatcheries of Alaska
William R. Hunt, AK-SG-76-10, 45 pp.

Japanese and Soviet Attitudes Toward Aquaculture
Tsuneo Nishiyama, in Aquaculture Notes, AK-SG-77-2, 19 pp.

Notes on Rearing Juvenile Chum Salmon, Oncorhynchus keta, in an Artificial Upwelling System
A. J. Paul, D. W. Hood, and R. A. Neve', in Aquaculture, Vol. 9, July 12, 1976, pp. 387-390

Preliminary Study on Rearing Chum Salmon, Oncorhynchus keta, in an Artificial Upwelling System
A. J. Paul, D. W. Hood and R. A. Neve', in Aquaculture Notes, AK-SG-76-11, 6 pp.

Private Nonprofit Salmon Hatcheries in Alaska
E. Thomas Robinson, in Aquaculture Notes, AK-SG-76-1, 5 pp.

Proceedings of the Conference on Salmon Aquaculture and the Alaskan Fishing Community
Donald H. Rosenberg, ed., AK-SG-76-2, 302 pp.

Proceedings of the Second Alaska Aquaculture Conference
Brenda Melteff, ed., AK-SG-77-7, 78 pp.

Some Aspects of the Carrying Capacity of Prince William Sound, Alaska, for Hatchery Released Pink and Chum Salmon Fry
R. Ted Cooney, David Urquhart, Richard Neve', John Hilsinger, Robert Clasby and David Barnard, 98 pp.

APPENDIX A

Program: EDUCATION AND TRAINING
Project: E/59-03

Title: Course Development: Experimental Fish Culture

Principal Investigator: W. W. Smoker
Unit: Division of Fisheries

Funding Information
Present level: SG: $0 UA: $0
Proposed level: SG: $10,209 UA: $ 2,493
Date Initiated: 1 Nov 1978
Est. Comp. Date: 31 Oct 1979

BACKGROUND AND NEED

In recent years Alaska has made a commitment to enhance the productivity of salmon resources by means of artificial propagation. Both state government and private organizations have begun large scale programs to build and operate hatcheries and other fish production facilities. There are a number of relationships between the development and growth of fish and aspects of their environment which must be understood if the design and operation of a facility are to be successful. Some of these relationships are, for example, the effects of water quality, incubation environments, and cultural practice on development.

Students preparing for work on this new aspect of salmon resource management need to be familiar with these relationships. As a result of this need, the Division of Fisheries at the University of Alaska, Juneau, will be offering a two-semester laboratory course during the 1978-79 school year. This course will be offered to graduate and advanced undergraduate students.

As the course is currently planned, students will perform a series of demonstration experiments using salmon embryos spawned at the beginning of the course. Such experiments might include a series of embryologic preparations, comparison of different incubation environments in their effects on development, comparison between species or populations in the course of events in development, or observations of the effects of different cultural practices on the quality of fry produced. Students will gain experience in the operation of an elementary incubation facility and will gain insight into the biology and technology of propagation of fish. Furthermore, they will learn some practical elements of experimental design and analysis.

There are no other "hands-on" courses offered in the University system in which students explore the problems of fish culture. This course will fill that need and will therefore augment and complement

the program of the University of Alaska, Juneau, Fisheries Division. The course will provide training for students beginning graduate research programs.

The equipment and experience gained during the course of this project should help provide impetus for the future development of a research program in salmon aquaculture at the University of Alaska, Juneau.

Current state funding policy does not allow for special release time for University faculty to establish this type of extensive laboratory course. Currently there are no special laboratory facilities established. Considerable effort will be necessary to establish this student laboratory including construction of egg incubation equipment and development of trial demonstration experiments. Likewise, state funding is not available for the purchase of the special laboratory teaching equipment.

ACCOMPLISHMENTS

New project.

OBJECTIVE

To develop the class material and special laboratory facilities for a two-semester laboratory course in fish culture.

APPROACH

Funding under this project will allow the Principal Investigator release time from one 3 credit course for two semesters. (Normal load is 3 credit courses per semester.) This will allow the Principal Investigator the extra time necessary during the first offering of the course to develop the special laboratory experiments and to construct the special laboratory facilities. The project will also provide some of the special laboratory equipment and the installation supplies necessary for the laboratory experiments.

INTERACTION

The project interacts with Sea Grant Education and Training Project E/59-02.

EQUIPMENT

4 Health Tecna Fish Incubation Cabinets	$2,000
4 Little Giant Recirculation Pumps	320

MISSION B

Aquaculture

BACKGROUND AND NEED

While recent runs of Pacific salmon have improved somewhat, the long range trends of this $200 million a year fishery are down. Most of the decreases in the catch of salmon have been and are occurring in Alaska. Runs in other Pacific northwest states have been stabilized by extensive federal and state salmon enhancement programs.

Alaska is rapidly implementing a very large salmon enhancement program; the plans are for $400 million to be spent on private and public production facilities over the next 20 years. The idea of private investment in participation in salmon enhancement is fundamentally different in Alaska than elsewhere. The Alaska Salmon Enhancement Program (ASEP) is of a three-pronged nature: (1) traditional public sector involvement via the Alaska Department of Fish and Game; (2) regional, private nonprofit associations comprised of user groups; and (3) non-association, private nonprofit groups.

Salmon enhancement efforts in other states are largely public and serve primarily the recreation segment of the fishery; efforts in Alaska are directed predominately toward the commercial fishery. The economics are predictably much different. Higher costs incurred due to remote siting of enhancement facilities, lower product price, and the economic constraints of the marketplace all contribute toward the necessity of rapid, rigorous evolution of the biotechnology of salmon enhancement. Excitement and potentials are high, but the problems are many.

Alaska now has four regional aquaculture associations and approximately 10 non-association corporations with permits granted or being acted upon. The first returns of salmon to private facilities occurred in the summer and fall of 1977. The Prince William Sound Regional Aquaculture Corporation (PWSAC) had a return of 55,000 fish to its Evans Island Facility; the Sheldon Jackson Aquaculture training program had a return of some 110,000 fish. Several more facilities are due to go on line this coming year.

As a result of the Alaska Sea Grant Program's involvement with the formation and development of Prince William Sound Aquaculture Corporation, six major categories of need have been identified. They are:

1. Organization, finance, and business management.

2. Biological information on spawning, incubation, egg handling, and estuarine survival.

3. Engineering design.

4. Cost/benefit information.

5. Cost efficiency in subsystem design.

6. Identification of biological constraints to increase return.

It is felt that the nonprofit, private fish hatcheries will have the very positive effect of stimulating local economy, the fishing industry, and all supporting industries. Armin Koernig, President of the Prince William Sound Aquaculture Corporation, summed up the feeling behind the private hatchery scheme when he said, "These projects involve self-help and determination in the best spirit of Alaska independence."

ACCOMPLISHMENTS

In response to requests for assistance, a talent bank was established two years ago to assist the Aquaculture Agent in getting information to developing hatchery firms. To date, the following assistance has been provided:

1. Development of a Chart of Accounts for regional aquaculture associations by Mr. E. Thomas Robinson, adopted in whole or in part by all four regional associations.

2. An economic assessment of the PWSAC hatchery by Dr. F. L. Orth that has resulted in changes that have improved the economic picture for the facility.

3. Via talent bank, personnel assisted the Board of Directors of PWSAC in becoming a more effective corporation.

4. Stimulated Cook Inlet Aquaculture Association into planning several lake fertilization projects for 1979.

5. Precipitated Kodiak-area Native corporations' awareness of aquaculture; a staff person has been hired, several projects are planned by village corporations.

6. In conjunction with user groups, started the process of developing a practical diet for pink and chum salmon fry held in saltwater.

7. Working with the seafood specialist and a fish meal producer, ran a series of experiments that point the way toward the economical use of the vast quantities of fish waste produced in Alaska.

8. A major focus was the development of a Uniform Reporting Procedure for all ASEP efforts, public and private, which will provide accurate industry statistics to economists, planners, the Alaska State Legislature and other user groups.

ACTIVITIES

Aquaculture Class

Thirty-five persons were trained in basic aquaculture, salmon biology, and enhancement techniques via a course, Fisheries 393, taught in Petersburg and Kodiak. The class will also be offered in the Kenai area later this year. Many of these students were would-be or actual hatchery permit holders or corporation board members.

Aquaculture Notes

Several publications have been distributed:

- "History of Marine Hatcheries of Alaska"
- "Alaska Statutes--Commercial Fishing Loan Act, Salmon Hatcheries, Fisheries Enhancement Loan Program, Salmon Authorities"
- "Economic Feasibility of Private Nonprofit Ocean Ranching Ventures"
- "Artificial Salmon Spawning, a Manual"
- "Japanese and Soviet Attitudes Toward Aquaculture"
- "The Alaska Salmon Enhancement Program: Imperatives for Economic Success"

Additionally, the following publications are currently being readied for publication:

- "Engineering for Aquaculturists"
- "Life Cycle Costing: a Tool for Decision Making"
- "Accounting for Private Nonprofit Salmon Hatcheries"

Other Publications

A major article on the ASEP appeared in the widely distributed periodical Alaska Seas and Coasts, as does a column "Aquaculture News Briefs."

Aquaculture Distribution List

A mailing list of some 30 aquaculturists is maintained. Information of importance to Alaskan salmon culturists is rapidly disseminated. Some 40 items such as evaluations of new laws, a paper on corporate insurance, news of Canadian enhancement techniques, use of a Secci disk, sources of information, reprints of scientific articles of especially high interest, etc., were sent out. A five-page questionnaire was mailed out inquiring as to specific needs and ways to improve the distribution list service.

A Fisheries Institute was held in Petersburg that brought together the state's aquaculturists and commercial fishermen to exchange views and address issues of common interest.

OBJECTIVES

To assist in the development of the state's aquaculture potential by offering technical information to interested corporations, individuals, schools, and other government entities. During the next year, the following specific objectives will be addressed:

- To respond to requests for assistance by aquaculture groups in the areas of business management, economics, salmon hatchery techniques, chemistry, and biological engineering.
- To train individuals in hatchery techniques through the use of University of Alaska credit and non-credit courses in conjunction with other experienced state and local personnel. Coordinate training of hatchery personnel of the regional corporations working in cooperation with other federal agencies such as CETA.
- To train management officers and board members of new aquaculture corporations in principles of business management, cost accounting, and decision making vis-a-vis aquaculture.
- To disseminate results of research projects to specific user groups in a timely manner. Disseminate information on relevant state and federal legislation to user groups.

APPROACH

Talent Bank

Our best response for help can be made by utilizing a team of specialists and drawing upon the appropriate specialist or specialists for assistance to any group at any time. This "talent bank" will consist of fishery and hatchery biologists, hydraulic engineers and designers, business management specialists, chemists, and economists.

Of immediate concern is the continued need for the economist or business management specialist. Assistance in this area of need is not readily available to corporations and is too often not considered a high priority. However, failure to attend to the details of organizational management, business management, and the economics of the entire operation, will absolutely lead to failure. Therefore, based on past performances, we are expecting, that the demand for an economist and business management help will be of continued high priority.

Requests for assistance from newly developing corporations or from existing corporations will be directed through the Marine Advisory Aquaculture Specialist. He will arrange for meetings or workshops between the University personnel and the corporation. Individuals from the University will advise the corporation in their areas of expertise. There are currently 10 people who can respond to requests for assistance:

W. Phillips	Corporation management
T. Robinson	Nonprofit corporate accounting
G. Gleason	Marketing
H. Zach	Computers
R. Solie	Public sector labor relations
J. Colonell	Engineering
R. Carlson	Water management
T. Cooney	Oceanography/carrying capacity of estuaries
D. Hoffman	Business management
C. Kerns	Aquaculture techniques/facility design/ feasibility.

Others are expected to become available as the need arises.

Aquaculture Class

User group response has resulted in the creation of an Introduction to Aquaculture class which has been taught and will continue to be taught through the Division of Fisheries, University of Alaska,

Juneau, by the Aquaculture Specialist. Major approach philosophy has been to introduce students to the basics in salmon biology, hatchery technology, genetics, and management implications. Each class requires 15 lecture hours. Classes have been taught in Petersburg and Kodiak and will be taught on the Kenai Peninsula.

Aquaculture Workshops

Besides offering specific advice to aquaculture corporations, much could be gained by offering a technical business management seminar to officers and managers of all aquaculture corporations. Several such seminars are to be given for the funding year and will be planned by the School of Management and the Aquaculture Specialists.

The Aquaculture Specialist will serve as the educational coordinator between the talent bank specialist and the officers and management of the aquaculture corporation. He and the local advisory agents will assist the aquaculture corporations on a local level in implementing the finance and business management plans set forth by the talent bank. This will provide the continuity and rapid problem solving capability that an effective training program requires.

A workshop on sharing risk is planned for the upcoming year. While aquaculturists are the prime audience, a wide range of marine resource users could benefit from a better understanding of risk taking and sharing.

Aquaculture Notes

Results of University research in the field of aquaculture will continue to be disseminated through the publication of Aquaculture Notes.

INTERACTION

This project interacts with Sea Grant Renewable Marine Resource projects on Ocean Ranching.

EQUIPMENT REQUESTED

None.

Program: RENEWABLE MARINE RESOURCE
Project: R/02-01

Title: Carrying Capacity of Estuarine Waters

Principal Investigator: R. T. Cooney
Unit: Institute of Marine Science

Associate Investigator: W. S. Reeburg
Unit: Institute of Marine Science

Associate Investigator: R. A. Nevé
Unit: Institute of Marine Science

Funding Information:

Present level:	SG: $53,300	Proposed level:	SG: $74,300
	UA: $26,500		UA: $33,600
Date Initiated:	1 Nov 75	Est. Comp. Date:	31 Oct 78

BACKGROUND AND NEED

The development of private nonprofit salmon hatcheries is a reality in Alaska. This research project was initiated on request of the Prince William Sound Aquaculture Corporation (PWSAC) to examine the ability of the estuary adjacent to the Port San Juan hatchery to support the large numbers of fry pink salmon released each spring from the facility. Port San Juan is located on Evans Island in southwest Prince William Sound.

Bailey, et al., (1975) looked at the carrying capacity of a cove in southeastern Alaska with regard to its ability to support natural runs of pink and chum salmon. The results were speculative due to insufficient data, but they did point out the importance of consideration of carrying capacity when operating a hatchery or choosing new hatchery sites. It is difficult to know which factors are significant in terms of the capacity of an estuary to accommoddate high levels of fry survival; but certainly food availability, predation, competition, and variations in temperature which may affect growth rates and timing of emergence, are among the important factors.

As was detailed in a previous proposal, the literature describing the feeding dependencies of juvenile pink salmon suggests the young fishes may first exploit epibenthic and meiobenthic food sources close to home streams before assuming a more pelagic feeding role as they move out of the estuaries into the open shelf and ocean environments (Gerke and Kaczynski, 1972; Manzer, 1969; Robinson, et al., 1968). If this notion concerning an initial dependency on shallow water meiobenthic communities is correct,

the carrying capacity of a region would be more closely related to the nearshore area exhibiting appropriate "nursery" characteristics than to the productivity of the overlying waters. Nothing is known about the vulnerability of first feeding fry in the nearshore areas except that Dolly Varden trout and some other sea fishes commonly congregate around stream mouths feeding on fry as they emerge.

Our present research is designed to evaluate the extent to which the nearshore benthic community is utilized. If this habitat proves to be "critical" and limiting in the extent to which it can support large introduced fry populations, something significant will have been learned since the meiofaunal community is generally considered to be at the top of a food chain with only the larger epibenthic harpacticoid copepods occasionally being used as a food source (McIntyre and Murison, 1973). The information would be invaluable to PWSAC as an aid in selection of additional hatchery sites as well as in the advisability of holding and feeding the young fishes in the hatchery prior to release in the pelagic zone of the estuary.

ACCOMPLISHMENTS

A preliminary investigation of the salmon fry carrying capacity of the estuarine waters adjacent to the Prince William Sound Aquaculture Corporation's Port San Juan salmon hatchery was carried out during the period 4 April through 8 June 1976. The field party consisted of a Biological Oceanographer, Mr. Bob Clasby, and two graduate students. Selected stations were sampled in the bay and adjacent waters for temperature, salinity, nutrients, chloropyll *a*, and phytoplankton and zooplankton standing stocks. Potential salmon fry food items were collected using fine-mesh (216μ Nitex) plankton nets towed vertically or horizontally. Salmon fry were sampled with handheld dip nets.

A first order analysis of our observations indicates that the chemical and physical characteristics of the bay are governed by tidal currents moving in and out through the entrances to the north and east of Bettles Island. The predominant northeast to east winds of the area cause some wind mixing to occur within the bay. The production of organic matter and its transfer up the food chain preceded the out-migration of salmon fry by approximately one month. Phytoplankton standing stock (measured as chlorophyll *a*) exhibited a gradual increase starting in early April, peaking in late May, then declining with a slight increase again in early June. The zooplankton in the upper 20 m of the water column were most abundant between 15 to 30 April. Salmon fry emergence became significant at about this time and continued into mid June. These observations suggest that maximum zooplankton densities in the surface waters of the bay fell

below 500/m^3 prior to significant fry out-migration, although the concentration did start to increase again in late May. At this time there is no way of knowing if the low concentration of zooplankton had any effect on the feeding of the salmon fry.

Concentrations of salmon fry were observed in the nearshore areas of the bay, while none were observed in the pelagic areas. Stomach content analyses conducted on a small number of these fry indicated that they were feeding on the dominant zooplankton of the nearshore area (copepod genus *Oncaea*) which differed from that found in the pelagic areas of the bay. It appears that the nearshore habitat is unique and deserves a more concentrated research effort than was expended on this area in 1976.

The first year's effort demonstrated the feasability of collecting, processing and evaluating data in the field, and showed where to concentrate major research during the 1977 field season.

This season, April-June 1977, we expect to address two major questions: (1) What are the food dependencies of first feeding fry in the area adjacent to the hatchery and are these dependencies benthic or pelagic? and (2) What features characterize "critical habitat" for first feeding fry if the meiobenthos proves to be important, and can "habitat" be ascribed to a planktophagous feeding regime if pelagic organisms prove to be the food source?

Of secondary importance will be our efforts to gain more information about the kind of predation to which the salmon fry are susceptible and the frequencies with which it occurs. We will also take every opportunity to follow the salmon fry past their "critical" first feeding and learn what we can about feeding dependencies as the fry mature, increasing in size and swimming capability.

OBJECTIVES

To identify those parameters which, when monitored seasonally, will provide the basis for deciding on optimal release times for hatchery-raised fry. During the third year, the following specific objectives will be addressed:

- Complete studies of the nursery habitats in the estuary adjacent to the Port San Juan hatchery.
- Examine habitat and fry feeding habits off several naturally producing pink salmon streams for comparison with the Port San Juan model.

APPROACH

We plan to put a field party in the area in mid-April or at the time when fry are beginning to migrate from the hatchery

into the estuary. Personnel will complete specific studies of nursery habitats adjacent to the Port San Juan hatchery and then will conduct assessments of several other areas in Prince William Sound from a charter fishing vessel. The selection of streams or sites will be accomplished through interaction with PWSAC biologists and by consulting the historical records published by Alaska Department of Fish and Game.

This approach will characterize the final step in the sequencing of the overall project as envisioned at this point in time (March 1977). It is possible that developments emerging from efforts planned this summer will cause a revision in plans for the 1977-7 funding period.

The development and finalization of a quantitative description of "carrying capacity" will be attempted using the results of the studies examining feeding dependencies, nearshore nursery areas, food abundance both benthic and pelagic, predator-prey relationships, competitors, and temperature or other environmental factor At the least we expect to be able to rank the most obvious variables in order of importance, and to suggest some strategies for optimizing fry survival.

INTERACTION

This project interacts with Sea Grant Information and Advisory Pr A/71-05; Renewable Marine Resource Research Project R/02-05; and Program of the Alaska Department of Fish and Game.

EQUIPMENT REQUESTED

None.

REFERENCES

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Gerke, R. J. and V. W. Kaczynski. 1972. Food of Juvenile Pink and Chum Salmon in Puget Sound Washington. Wash. Dept. Fish; Tech. Rep. 10, 27 p.

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McIntyre, A. D., Murison, D. J. 1973. The Meiofauna of a Flatfish Nursery Ground. J. mar. biol. Ass. U.K. 53: 93-118.

Robinson, D. G., W. E. Barraclough, and J. D. Fulton. 1969. Number, Size, Composition, Weight and Food of Larval and Juvenile Fish Caught with a Two-boat Surface Trawl in the Straits of Georgia May 1-4, 1967. Fish. Res. Board Can., Pac. Oceanogr. Group, Nanaim, B.C., Manuscr. Rept. Ser. 964, 105 p.

Program: RENEWABLE MARINE RESOURCES
Project: R/02-06

Title: Fishfeed Development

Principal Investigator: C. L. Kerns
Unit: Marine Advisory Program

Funding Information

Present level:	SG: $0	Proposed level:	SG: $10,104
	UA: $0		UA: $ 5,900
Date Initiated:	1 Nov 78	Est. Comp. Date:	31 Oct 81

BACKGROUND AND NEED

An efficacious regimen for pink (*Oncorhynchus gorbuscha*) and chum salmon (*O. keta*) has yet to be developed. While salmon ranching is burgeoning in Alaska (and elsewhere), the biological realities are that unfed salmon fry face very severe environs upon release. Short term rearing has been demonstrated to markedly increase survival, fry to adult. With the added expenses that Alaskan aquaculturists face due to the high cost of goods and services, every economic advantage must be sought. The development of a practical ration for pink and chum salmon will be of inestimable value to Alaskan salmon ranchers.

Researchers at the Pacific Biological Station in British Columbia have found that pink and chum salmon have different nutritional requirements than do king (*O. tschawytscha*) and coho salmon (*O. kisutch*). In a series of experiments on saltwater net pen rearing of the various Pacific salmon, it was noted that year after year king and coho salmon grew satisfactorily but pink and chum salmon did not. Diet has been determined to be the central problem. (The commonly used rations, Oregon Moist Pellet (OMP) and the dry ration, Abernathy, were developed specifically for king and coho.)

In the Japanese experience short term rearing, i. e., holding salmon fry until estuary conditions are optimal before release, increases the survival, fry to adult, by approximately two-fold. The increases in survival are thought to be related to the timing of the spring plankton blooms. If fry migrate before the bloom they suffer two manifestations of essentially one problem: (1) limited food supply for themselves; and (2) increased susceptibility to predation. Researchers at the National Marine Fisheries Service's Auke Bay Laboratory found that with one lot of pink salmon fry that migrated two weeks earlier than another, the survival of the later migrating fry was increased 1.7-fold over that of the earlier departing lot.

The present locally produced supply and the prognosis for the future supply of fish meals, the major component of artificial fish diets, is excellent. Alaska currently has three fish meal plants in operation; bottomfish and increased shore-based processing should increase the meal supply sharply. Crab, herring and salmon meal are currently shipped to feed mills in Oregon and Washington where with the addition of scrap fish and cereal meals they are made into salmon rations that are returned to Alaska. This obvious energy-inefficient practice started before local demand for salmon rations warranted local production. With the state's $500 million public and private salmon enhancement program just beginning, the local need for economical fish rations is sure to grow.

OBJECTIVE

To develop and test an economical dry salmon ration composed of readily available locally produced dry ingredients and a species of abundant underutilized fresh fish.

Specific objectives for this project during year one will be to test varying rations of calories to protein (c/p) (see Table I, Diet Formulations) in order to find the optimal regimen that pink salmon fry require under the local conditions of Prince William Sound. A comparison with the commercially available moist and dry ration will be made as controls (see Table II for contents of test diets).

Year two will be spent determining optimum dietary protein levels. In year three alternate waste or by-product ingredients will be explored; in addition, a statistical evaluation of the returning adult pink salmon from year one will be run.

APPROACH

Three or four test rations with varying levels of energy and protein, consequently varying ratios of c/p, will be manufactured and tested on a pilot scale level. The rations contain the same proportions of herring, salmon and crab meals, whey and vitamins. The amount of fresh fish and lipids will be varied inversely to produce the different c/p ratios. The test rations will be made by using extrusion-heat drying-cracking-screening.

Of the three levels of testing available--laboratory, pilot, and production--pilot scale was thought to provide the best mix of speed and practical significance.

Efforts to develop the ration will be shared by three groups: Seward Fisheries (SF), Prince William Sound Regional Aquaculture

Association (PWSAC), and the University of Alaska Sea Grant Program. Seward Fisheries are to supply most of the feed ingredients, some chemical analyses, and selected equipment. PWSAC will supply its facilities at Port San Juan, the manpower to feed the fish, the fish, and other assistance. It is planned that the Principal Investigator will manufacture the ration, assist with experimental design and statistical analyses, and write up the results.

INTERACTION

This project interacts with Sea Grant Information and Advisory project A/71-01 Mission B and with Renewable Marine Resource Research project on salmon ranching.

EQUIPMENT REQUESTED

5 hp meat grinder	$1,200
dryer	600
grist mill	100
dry mill	800
screens	200
nets	3,000

TABLE I

YEAR 01 DIET FORMULATION

INGREDIENTS

DIET #	DRY									WET		
	Halibut Meal	Salmon Meal	Crab Meal	Herring Meal	Whey	Wheat Germ	Yeast	Vit.	Kelp	Fresh Fish	Marine Oil	Soy Oil
1	5	15	10	5	10	5	5	2	5	31	7	--
2	5	15	10	5	10	5	5	2	5	26	7	5
3	5	15	10	5	10	5	5	2	5	21	7	10
4	5	15	10	5	10	5	5	2	5	16	7	15

Purpose: To establish optimal calorie-to-protein (c/p) ratio for pink and chum salmon fry.

TABLE II

TOTAL DIET FORMULATED PROXIMATE CONTENTS (EXPRESSED AS % DRY WEIGHT)

DIET #	COMPUTATIONS			
	CP	LIPID	ME	C/P
1	57.1	11.86	3446.4	60.4
2	52.655	16.805	3686.4	70.0
3	48.255	21.755	3926.	81.4
4	43.855	26.705	4166.4	95.

WET FRACTION DIET FORMULATED PROXIMATE CONTENTS (EXPRESSED AS % DRY WEIGHT)

DIET #	COMPUTATIONS			
	CP	LIPID	ME	C/P
DRY FRACTION 1-4				
Expressed as 57%	29.23	4.495	1837.35	62.96
(Expressed as 100%)	(51.2)	(7.89)	(3223.42)	
WET FRACTION (Expressed as 43%)				
1	27.825	7.36	1609.	57.8
2	23.425	12.31	1849.	78.93
3	19.025	17.26	2089.	109.8
4	14.625	22.21	2329.	159.24

Program: RENEWABLE MARINE RESOURCES
Project: R/02-05

Title: Genetic Interaction of Auke Creek Hatchery Pink Salmon with Natural Spawning Stocks in Auke Creek

Principal Investigator: A. J. Gharrett
Unit: Division of Fisheries

Funding Information:

Present level:	SG: $23,700 UA: $22,600	Proposed level:	SG: $14,571 UA: $12,037
Date Initiated	1 Nov 77	Est Comp. Date:	31 Oct 82

Director's Note:

This project was scheduled to start on November 1, 1977. Due to financial problems within the University, the start of this project has been delayed until July 1, 1978. Even with this delay, samples and some equipment and chemicals have been obtained.

BACKGROUND AND NEED

The study of the genetics of salmon possesses some important implications for both fishery and hatchery management. It is not only possible to use genetic differences between populations as a basis for stock identification, but it is also important to employ genetic considerations initially in locating a hatchery and subsequently in operating it. Unfortunately, there is little information currently available regarding the genetics of Alaskan stocks and little work is being done to accumulate such information. Since extensive construction of hatcheries is being planned throughout the state as a result of private-nonprofit hatchery legislation and of public bonds for the Alaska Department of Fish and Game, it is especially important at this time to thoroughly examine the genetics of Alaska's salmon. The implementation of these hatchery programs make it important to obtain information that may help answer such questions as: How can genetics be used to improve hatchery practice? Can "genetic tagging" be practically employed to mark different hatchery stocks? What impact do hatchery fish have on natural stocks? While it is premature to expect genetics to exert an influence in aquaculture comparable to that realized in agriculture, the potential for such significant contributions exists, and answers to the questions posed above should receive serious consideration in the development of Alaska's aquaculture programs.

The crux of most genetic considerations at the populations level is genetic variation. The genetic composition of each population

of fish displays some degree of variation and has evolved from a combination of influences such as population size, selective pressures, and immigration from other populations. Because it serves as a buffer for environmental fluctuations, genetic variation is essential for the long term survival of a population; hence, the maintenance of variation in the genetic composition of their hatchery stocks should be of major concern to fish culturists.

Variation is manifested by population differences in allelic frequencies which are determined by individual differences in allelic composition at a particular locus. Allelic differences are expressed by small structural variations in the polypeptide specified by a locus. Frequently these differences can be resolved by starch gel electrophoresis, a technique by which dif ferently charged particles (e.g., proteins) are separated in an electric field (see e.g., Gordon, 1975). Following the electrophoresis of samples, histochemical stains are utilized to identify specific enzyme activities (Hunter and Markert, 1957; Shaw and Prasad, 1970). In this way, the genetic variability present at a number of different genetic loci may be assessed. The five Alaskan species of *Oncorhynchus* have all demonstrated variability at a minimum of ten electrophoretically detectable loci and only the coho has fewer than six loci that are commonly polymorphic (Utter, personal communication).

As mentioned previously, good hatchery procedures require that genetic variation be maintained in the cultured stock. This can be done utilizing a large number of breeders taken at random from the returning adults, thereby minimizing variability losses as a result of inbreeding and inadvertant selection. Changes in variability of a stock from year to year can be monitored electrophoretically.

Genetic variability has been used extensively to identify and compare discrete populations of fishes, especially salmonids (Allendorf, 1975); and some studies have been made of Alaskan stocks (e.g., Aspinwall, 1974; Grant, 1977; Donnelly, et al., 1977). The applications of electrophoretic techniques can be further extended in a hatchery situation where it is possible to alter allelic frequencies by appropriate breeding schemes, thereby producing a stock of fish which is uniquely identifiable. Usually the enhancement of relatively rare alleles is involved in this process. Such genetic "tags" could be enormously important to fishery management because they are readily detected and relatively inexpensive to implement and recover. Because these tags are heritable, once a stock is tagged, all the descendants of that stock are also tagged.

There are two potential problems with genetic tagging; the first concerns the means of implementation and the second concerns the results. When a rare allele is enhanced in a stock, one must choose parents from the relatively small number of individuals possessing that allele. Because decreases in variability may

result if an insufficient number of breeders are used, it is important that breeding schemes employed minimize inbreeding. The second potential problem in genetic tagging results from the fact that the genetic composition of the population is altered by the process. Presumably the process acts randomly on all loci except the one involved in the tag and possibly a few loci closely linked to it; nevertheless, a rearrangement is being made which could affect the fitness of the stock. Although the possibility is small that a selective disadvantage may be conveyed to inheritors of such a tag, it is necessary that genetic tagging be critically examined under a variety of circumstances (location, species, and genetic locus) before such tagging is applied extensively.

While starch gel electrophoresis provides a powerful tool for the study of the genetics of fishes, it is limited because only a small portion of the loci present in an organism can be characterized electrophoretically. In addition, many questions remain unanswered because of their complexity. Notable are questions concerning interactions between genes and between genes and the environment; such relationships can only be generally described. Within a population, particular combinations of genetic information develop that provide a genetic strategy which allows a population to interact successfully with its environment(s). A successful strategy is not necessarily unique but it is complex and may be disrupted by the introduction of genetic information from a population that has developed a different strategy. Such a disruption may result from genetic interaction of hatchery fish (particularly those descended from transplants) with nearby natural stocks. The possibility of a loss of fitness in local natural stocks resulting from such interactions make it necessary to determine the extent to which hatchery fish interbreed with local, naturally spawning stocks. Natural stocks serve as a "reserve" to genetic variability. Thus, it is essential to the sound management of salmon fisheries that the implications of these interactions be examined. While it is not possible to assess the impact of genetic interactions of hatchery fish or native stocks, it is possible to estimate the extent of interactions. This can be done by observing the rate at which an allele enhanced in the hatchery stock increases in naturally spawning stocks with which they interbreed.

In this proposal the Auke Lake system will be used as a model system to examine the interaction of hatchery pink salmon with the naturally spawning fish in this system. To accomplish this, a relatively rare allele will be enhanced in the hatchery fish and the subsequent increase of this allele in the other portions of this system will be monitored. At the same time, the relative survival of "tagged" and "untagged" hatchery fish will be examined. Finally, the genetic compositions of all the breeding groups in this system will be determined and compared.

ACCOMPLISHMENTS

Because it is the middle of the first year of funding for this project, all the milestones listed for this year have not been achieved. Significant progress has been made, however: samples have been obtained from all breeding groups for the 1977 brood year and from the hatchery stock; equipment and chemicals necessary to initiate electrophoretic screening have been procured; and a preliminary examination of a number of enzyme systems have been done on the hatchery samples. As a result of these preliminary studies, it is apparent that the activities of some enzymes deteriorate with prolonged storage. This loss in activity indicates that in order to obtain the maximum information from a particular sample, it must be processed as soon as possible after it has been taken. An encouraging note is that laboratory facilities dedicated to research will be available by mid-summer. Presently, research must be planned around heavy class use of the only laboratory facility.

OBJECTIVE

A number of genetic problems which are important to the effective management of both Alaska's salmon fisheries and its hatcheries may be addressed by employing electrophoretic techniques. Specifically, in this project these techniques will be used to examine the genetic variability and changes in variability that occur in discrete breeding groups of pink salmon to provide some insight into the following questions:

(1) To what extent do hatchery fish interbreed with naturally spawning stocks?

(2) Do genetic tags significantly reduce the fitness of the populations into which they are introduced?

(3) Do substantial differences between distinct breeding groups exist within a stream system; and if they exist, do these differences reflect a loss in variability of the hatchery stock?

APPROACH

Use of stocks from the Auke Lake System is advantageous for several reasons:

(1) There is an operational hatchery in the system, which has been stocked from native fish.

(2) The hatchery is oriented toward research.

(3) The local stocks have been identified and the drainage system well characterized.

(4) Some assistance from NMFS Auke Bay Laboratory personnel is available for obtaining samples and identifying particular stocks. This work is obtained on a reciprocation basis.

(5) The location of the Auke Bay system is adjacent to the University, thus minimizing transportation and field costs.

In the Auke Lake system both the odd and even year cycles of pink salmon are comprised of distinct breeding groups as determined by the location and the timing of spawning. Using the 20 or more distinct loci in *Oncorhynchus* that may be examined electrophoretically (Utter, personal communication; May, 1975), we will characterize the compositions of the nine different stocks of pink salmon that have been observed in the Auke Lake system as well as the pink salmon used as hatchery stock. Information obtained from these characteristics will be used to determine the following:

(1) The extent to which variation exists within each stock.

(2) The extent of similarity between stocks.

(3) The extent of divergence between even and odd year cycles.

From these results and in cooperation with the NMFS Auke Bay Laboratory, it will be possible to choose a relatively rare allele ($0.05 < p < 0.10$) which will be enhanced in the hatchery stock for use as a "genetic tag." Such tags will be used in the brood years of 1979 and 1980. Males homozygous or heterozygous for this allele will be mated with females randomly selected from the population. As a result the frequency of this allele in the hatchery population will be increased. In 1981 and 1982, the incidence of these "tags" among fish taken from the spawning grounds will be ascertained. These "tags" provide a preliminary estimate of the degree to which salmon from the hatchery interbreed with each distinct breeding group. Increased incidence of the tag in the run as a whole in subsequent generations will provide additional information.

Additionally, since a random sample of the released juveniles is routinely fin clipped, it will be possible to examine the fitness of the genetically "tagged" fish relative to the "untagged" hatchery fish. To do this the genotypic frequencies of the returning fin clipped fish (only hatchery fish) will be compared to their frequencies at release.

INTERACTION

The project interacts with Sea Grant's Renewable Marine Resource Research projects on salmon ranching and genetic research on salmon being carried out by the Alaska Department of Fish and Game and the Auke Bay Laboratory of the National Marine Fisheries Service.

EQUIPMENT

None requested.

REFERENCES

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Grant, S. 1977. Biochemical genetic variation in sockeye salmon: the use of biochemical markers for stock identification in Bristol Bay and Cook Inlet, Alaska. Final Report, Contract No. 3131, Alaska Department of Fish and Game, Division of Commercial Fisheries.

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Shaw, C. R., and R. Prasad. 1970. Starch gel electrophoresis of enzymes: a compilation of recipes. Biochem. Genet. 4:297-320.

Taylor, S. USNMFS Auke Bay Laboratory, Auke Bay, Alaska 99821.

Utter, F. M. USNMFS Montlake Laboratory, Seattle Washington 98111.

MILESTONES

Project R/02-05

Current Year

(1) Equip laboratory
(2) Develop laboratory and staining techniques
(3) Assay and compare 1977 and 1978 pink salmon runs
(4) Choose allele to be enhanced in 1979
(5) Assay other local pink salmon stocks and compare with Auke Creek fish.

1978-1979

(1) Assay 1979 pink salmon run
(2) Genetically tag hatchery fish
(3) Compare with 1977 and 1978 runs
(4) Assay and compare other local pink salmon stocks.

1979-1980

(1) Assay 1980 pink salmon run
(2) Genetically tag hatchery fish (different allele from 1979)
(3) Compare with runs of other local stocks and previous years.

1980-1981

(1) Assess interaction of hatchery fish with naturally spawning fish
(2) Assess relative survival of tagged fish
(3) Assess tagging efficiency.

1981-1982

See previous year.

APPENDIX

Procedures to be Used in Genetic Study

Sampling

Spent adult pink salmon will be obtained from each spawning site. Liver, heart, eyes, and white muscle samples will be excised from each individual. Where possible, fresh samples will be used for electrophoresis, otherwise they will be kept on ice until they can be frozen.

Downstream migrants will be sampled with small fyke nets throughout their migration period. The samples will again be used fresh when possible and frozen otherwise. The eye portion of the head will be excised for use as well as the fleshy portion of their tails.

Electrophoresis

Small tissue samples are mascerated in an equal volume of distilled water. A small rectangular piece of filter paper is dipped into the extract and inserted into a slab of gel made from hydrolyzed potato starch. Such a gel can accommodate 40 to 50 such wicks in a row. Direct current is applied to the slab so that the current flow is perpendicular to the row of wicks. After the gels have been run they may be sliced horizontally (much like peeling pages off a tablet) so that several different stains may be made for each gel. Histochemical stains specific for particular enzymes or general protein stains are used to stain these slices. Stains for more than 20 specific enzymes are available.

Sample size for comparison of groups

Sample sizes will be from 100 to 200 fish of each group being compared. This is a realistic sample size to run electrophoretically and will produce a 95 percent confidence interval of $\pm$ .03 to .04 for an allele whose frequency is .10.

Method used for genetic tagging (see Figure 1)

A relatively rare allele will be enhanced in the hatchery population by mating randomly chosen females with males heterozyous or homozygous for the rare allele. A small (approximately 1 g) muscle sample will be taken from live males which will be subsequently tagged with a numbered tag and held until it has been determined whether or not they are suitable for the experiment. At least one-half of the progeny will carry that allele (the tag). The relative frequency of the allele used should be present at .05 to .10 in the parental population. As a result of this enhancement the number of tagged individuals will increase from 2.5 to 5 fold in the offspring.

Introgression of genes from hatchery fish into naturally spawning groups

One can detect in samples of naturally spawning fish (100 to 200 fish) a contribution of 10 percent to 20 percent from the hatchery stock tagged as described above. These samples are obtained from spawnouts on the spawning grounds.

Selective disadvantage of a tag

It is necessary to determine that a particular genetic "tag" does not convey a selective disadvantage to its carrier. Approximately 10 percent of the fish released from the Auke Creek hatchery are fin clipped so they may be distinguished from naturally spawned fish when they return. By comparing the genetic compositions of returning fin clipped fish to the compositions of the released stock it will be possible to measure fitness losses greater than 20 percent to 30 percent. While this seems to be a substantial loss, there is no way to practically measure any smaller losses and even this degree of loss will require samples of 200 to 400 fish.

BASIC ENZYME PATTERNS

common homozygote AA	heterozygote AB	rare homozygote BB

INITIAL POPULATION (95% A, 5%, B)

10%	90%	10% of fish tagged

STEP 1

Screen for males heterozygous or homozygous for rare allele (about 150 will occur in 1500 returns).

Cross these males with females chosen at random:

	X	=	and ;	
males (mostly)	females (mostly)			
PARENTS		PROGENY		
		54%	46%	

This population will stablize in one more generation if no followup selection is done:

8%	40%	52%	50% of fish tagged

STEP 2

A single followup in which both males and females are screened will produce an equilibrium population:

28%	50%	22%	80% of fish tagged

Figure 1. Methods used for genetic tagging.

Program: RENEWABLE MARINE RESOURCES
Project: R/02-08

Title: Inheritance of Egg and Fry Characteristics in Chum Salmon

Principal Investigator: W. W. Smoker
Unit: Division of Fisheries

Funding Information

Present level:	SG: $0 UA: $0	Proposed level:	SG: $4,645 UA: $0
Date Initiated:	1 Nov 78	Est. Comp. Date:	31 Oct 79

BACKGROUND AND NEED

In recent years, Alaska has made a commitment to enhance the productivity of salmon resources by means of artificial propagation. Both state government and private organizations have begun large scale programs to build and operate hatcheries and other fish production facilities.

One major source of biological concern is the effects of transplanting stocks of salmon from place to place. (This is a feature of many potential facilities.) Will the artificial maintenance of large numbers of salmon which are naturally adapted to an exotic environment reduce the fitness of neighboring wild populations by the introgression of "hatchery strays"?

The answer to this question requires a precise study of how transplanted fish home to their new natal place, i.e., the extent of straying from a transplanted stock and an answer to the question of the extent of genetic control over characteristics of the fish which are strongly related to fitness (survival and reproduction). It is the latter which is addressed here.

Breeding experiments are a means of investigation of the extent and manner of genetic control over characteristics of salmon. Brannon (1972) observed rheotaxis in artificially incubated sockeye salmon fry born of parents collected in the outlet stream or inlet stream of a lake. Fry whose parents both were from the outlet exhibited a positive rheotaxis. This would have been required of natural offspring of such parents in order for them to migrate from the spawning beds to nursery grounds in the lake. Similarly fry whose parents both were from an inlet stream exhibited negative rheotaxis. Rheotaxis of hybrid fry was indeterminate. This, then, is good evidence of genetic control over characteristics important to fitness.

Bams (1976) observed the homing behavior of two groups of pink salmon. In one, male parents had been chosen from the population

occurring naturally at a hatchery site; female parents were chosen from an exotic, distant, population. In the other group, both parents were from the exotic population. Both groups were incubated, marked, and released at the hatchery site. Homing of the hybrid group, whose fathers occurred naturally at the hatchery, was much more precise in fresh water than was homing of the group in which both parents had been transplanted. Recovery rates for the two groups in the estuarine fishery were similar.

These experiments indicate the power of breeding experiments to at least qualitatively describe the genetic basis of important characteristics of salmon. While a Ph.D. student (and Sea Grant supported research assistant) in Fisheries at Oregon State University, the Principal Investigator performed two breeding experiments with chum salmon at the Netarts Bay field station. In the fall of 1975, eggs from four female Netarts chum salmon were separated into 80 lots and fertilized by five male chum salmon from each of the following populations: Hoodsport Washington (Puget Sound), the Nemah River (Willipa Bay on the Washington Coast), and local Netarts Bay. Observations were recorded of development rate (time of hatching and swimup) for each lot or sibling group. After marking by freeze branding or fin clipping, the short-term growth rates of fry in these 80 lots were observed in a common rearing environment. Their comparative susceptibilities to a bacterial disease (Vibriosis) were observed after a controlled exposure to the pathogen in the Oregon State University fish disease laboratory.

In fall, 1976, gametes from three males and three females were collected from the Netarts Bay population; a similar collection was made from the Kilchis River population about 50 miles distant. These gametes were combined in every possible combination and incubated in replicate lots in incubators designed particularly to allow precise observation of fry emergence from a gravel substrate. In two experiments some sibling groups of these fry were exposed to natural challenges of the same bacterial disease, Vibriosis, in a sea water rearing situation.

Most of this body of data remains unanalyzed. When it is analysed it will provide insight into the suitability of breeding experiments for estimating the inherent differences between stocks of salmon. It will provide experience upon which the differences between stocks of Alaska salmon can be based. When these differences are more quantitatively understood, the policies governing location of hatcheries and transplanting of stocks can be made with better reasoning.

OBJECTIVE

To determine the effects of intraspecies hydridization on hatchery swimup behavior and susceptibility to bacterial disease stress.

APPROACH

The experiments were designed so that data could be subjected to variance analysis. Programs available in the UCLA Biomedical Computer Programs library are capable of this analysis and will be used. The library is available on the University of Alaska Computer System. Data are now recorded in a format suitable for input to the machine, obtaining analysis results should be straight forward.

INTERACTION

None.

EQUIPMENT REQUESTED

None.

REFERENCES

Bams, R. A. 1976. Survival and Propensity for Homing as affect by presence or absence of locally adapted paternal genes in two transplanted populations of pink salmon (*Oncorhynchus gorbuscha*). J. Fish. Res. Board Can. 33:2716-2725.

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JANUARY 1979

STATE OF ALASKA

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF CHANGED MEETING DATE

AQUACULTURE POLICY STUDY GROUP

PLEASE DISREGARD THE NOTICE DATED 12/27/78 WHICH SCHEDULED THE AQUACULTURE POLICY STUDY GROUP MEETING ON JANUARY 5.

CHAIRMAN TERRY GARDINER HAS SET THE MEETING FOR WEDNESDAY, JANUARY 10, 1979, 9:00 A.M. in ROOM 421, STATE CAPITOL BUILDING, JUNEAU, ALASKA. AT THIS MEETING THE GROUP WILL REVIEW PROPOSALS AND SELECT A CONSULTANT FOR THE FINANCING STUDY.

* * * * * *

STATE OF ALASKA

12/28/78

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF CHANGED MEETING DATE

AQUACULTURE POLICY STUDY GROUP

PLEASE DISREGARD THE NOTICE DATED 12/27/78 WHICH SCHEDULED THE AQUACULTURE POLICY SGROUP MEETING ON JANUARY 5. CHAIRMAN TERRY GARDINER HAS SET THE MEETING FOR WEDNESDAY, JANUARY 10, 1979, 10:00 A.M. in ROOM 421, STATE CAPITOL BUILDING, JUNEAU, ALASKA. AT THIS MEETING THE COMMITTEE WILL REVIEW PROPOSALS AND SELECT A CONSULTANT FOR THE FINANCING STUDY.

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STATE OF ALASKA

12/27/78

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF MEETING

THE NEXT MEETING OF THE AQUACULTURE POLICY STUDY GROUP WILL BE HELD FRIDAY, JANUARY 5, 1978, 1:00 P.M. IN ROOM 421, STATE CAPITOL BUILDING (House Finance Committee Room), JUNEAU, ALASKA. AT THIS MEETING THE GROUP WILL REVIEW PROPOSALS FOR DEVELOPMENT OF A DETAILED WORK PLAN FOR THE AQUACULTURE POLICY STUDY GROUP WHICH HAVE PEEN SUBMITTED BY CONSULTANTS.

* * * * * *

AQUACULTURE POLICY STUDY GROUP
January 10, 1979
9:55 a.m.

CALL TO ORDER

Chairman Gardiner called the meeting to order at approximately 9:55 a.m. (attendance list appended to these minutes).

PURPOSE

He advised that the purpose of the meeting was discussion of consultant proposals submitted in response to the Group's request for development of a work plan for Aquaculture within the State.

CONSULTANT PROPOSAL REVIEW POSTPONED

Chairman Gardiner suggested that due to the absence of a number of the Group's membership, action on the pending proposals (from Earl R. Combs, Inc.; Miller & Associates, Inc.; and Barbara Sorensen) be delayed until the Group's next meeting scheduled for February 5 and 6. The Chairman advised that copies of the proposals would be mailed to absent members for review prior to the February meetings.

NEXT MEETINGS FEBRUARY 5 & 6, 1979

He further advised that the agenda for the upcoming meetings would include:

UPCOMING AGENDA

(1) Discussion of Aquaculture Study Proposals

(2) Recommendations for the Alaska Department of Fish and Game Aquaculture Policy Manual

(3) Miscellaneous proposals - information provided by John Williams.

AQUACULTURE IN HAWAII

Jack Milnes furnished the chairman copies of an outline for aquaculture development in Hawaii, asking that the outline be mailed to all members of the Group and that Mr. Grogan procure the documents set forth in outline from the State of Hawaii.

MR. TRACY RARE II LAND DECISION

Mr. Bob Tracy of the U. S. Forest Service in Juneau appeared before the Group commenting upon land status in Prince William Sound and Southeast Alaska as a result of administrative land selections under Rare II, advising that such selections may have implications for aquaculture development.

He displayed maps of the Tongass and Chugach National Forests, stating that within Wilderness classifications exceptions or exclusions would have to be made for aquaculture development.

Mr. Heimbuch asked if a Wilderness designation would be more restrictive than HR 39, and Mr. Tracy replied that he did not believe the proposed action would be more restrictive, adding that the Forest Service is in the process of developing regulations for management of the lands. WILDERNESS vs HR 39

Referring to National Monuments (Admiralty Island and Misty Fjords) Mr. Tracy advised that regulations for management are being developed and it now appears there is leeway for conducting some type of activity as long as such activity meets the requirements of the Antiquities Act. NATIONAL MONUMENTS

The Rare II decision announced by Secretary Bergland places land into three categories: RARE II DESIGNATIONS

(1) Wilderness

(2) Non-Wilderness

(3) Undecided areas requiring further planning before a designation is made.

Wilderness areas will allow no development activities pending determination by Congress as to whether or not these areas will be established Wilderness. WILDERNESS

Non-Wilderness areas permit activities to be undertaken after April 15, 1979, contingent upon approved plans. NON-WILDERNESS

Undecided areas permit no development activities until the necessary planning has been completed and the areas designated either Wilderness or Non-Wilderness. UNDECIDED

Chairman Gardiner questioned Mr. Tracy concerning exemptions included within the 1964 Wilderness Act, advising that he understood such exemptions would likewise need be included within current congressional action establishing the Wilderness. Mr. Tracy advised that the Chairman's understanding was correct.

Mr. Tracy referred to his maps of the Tongass and Chugach areas, advising that under the Rare II decision total acreage has been thus classified:

Tongass TONGASS

5.4 Million Acres - Wilderness

7.3 Million Acres - Non-Wilderness

3.5 Million Acres - Undecided

16.2 Million Acres

Chairman Gardiner stated that from the above figures it is his understanding that approximately 1/3 of the Tongass has been designated Wilderness and the remaining 2/3 is in some form of restricted status, meaning that approximately 1/2 of Southeast Alaska could end up in some form of Wilderness status. Mr. Tracy responded that the Chairman's understanding was correct.

Concerning the Chugach area, Mr. Tracy advised that CHUGACH the administration had already testified before congressional committees recommending Wilderness sites on the Kenai and Polish Fjord. He added that these areas were not included in the Forest Service inventory of land when it was compiled. Additional Wilderness areas proposed under Rare II include Afognak Island and an area on the Kenai near the Moose Range boundry. There are two areas on the Kenai included within the Non-Wilderness designation, while the rest of the acreage on the Kenai is in the undecided/planning category.

Chugach

233 Thousand Acres - Wilderness

237 Thousand Acres - Non-Wilderness

2 Million 800 Thousand Acres - Undecised

69 Thousand Acres - Previously proposed Wilderness

Referring to the above figures set forth by Mr. Tracy, Mr. Heimbuch stated it was his understanding that national legislation could alter the designations set forth under Rare II, and Chairman Gardiner advised that congressional action would supersede anything effected by the administration, but the President could also veto such congressional action. EFFECT OF CONGRESSIONAL LEGISLATION

Mr. Fisher raised a question concerning whether environmental impact statements would be necessary for hatcheries contemplated within Forest Service management plans. Mr. Tracy replied that it would depend upon the magnitude and significance of the hatchery activity. The Forest Service would prepare an environmental analysis on any project, and on the basis of that analysis would decide whether an environmental impact statement is needed. ENVIRONMENTAL IMPACT STATEMENTS

Mr. Davis raised a question concerning the Cannery Creek Project on Prince William Sound, and Mr. Tracy advised that the Secretary had excluded that area from the Rare II decision. CANNERY CREEK PROJECT

Discussion followed on difficulties encountered in mining activities (Borax--road construction) on restricted lands and the overall affect of Native Land Claim Selections.

The meeting adjourned at approximately 10:55 a.m. ADJOURNMENT

ATTENDANCE
AQUACULTURE POLICY STUDY GROUP
JANUARY 10, 1979

Bob Tracy	Forest Service	Juneau
Bill Sheridan	Forest Service	Juneau
Ivan E. Every	Cook Inlet Aquaculture	Kenai
Floyd E. Heimbuch	Cook Inlet Aquaculture	Soldotna
James E. Fisher	U.S.D.A Rep.	Anchorage
Conner Sorensen (for Barbara Sorensen)	R.R. 4, Box 4903-8	Juneau
Joe Davis	A.D.F. & G.	Juneau
Bob Burkett	A.D.F. & G. FRED Division	Juneau
Jack Milnes	SSRAA	Ketchikan
Ernie Haugen	Legislature	Juneau
Terry Gardiner	Legislature	Juneau
Armin Koernig	PWSAC	Cordova
Bob Grogan	Legislative Finance	Juneau

FEBRUARY 1979

STATE OF ALASKA

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF MEETING

AQUACULTURE POLICY STUDY GROUP

THE AQUACULTURE POLICY STUDY GROUP WILL MEET TUESDAY, FEBRUARY 13, 1979, 9:00 A.M. IN THE GOVERNOR'S CONFERENCE ROOM, 3rd FLOOR, CAPITOL BUILDING, JUNEAU, ALASKA. THE FOLLOWING ITEMS WILL BE ON THE AGENDA:

(1) Review of proposals and selection of a consultant for the Financing Study.

(2) Formulation of input for the Department of Fish & Game Aquaculture Policy Manual.

STATE OF ALASKA

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF MEETING

AQUACULTURE POLICY STUDY GROUP

THE AQUACULTURE POLICY STUDY GROUP WILL MEET ON FEBRUARY 5th AND 6th IN THE COMMISSIONER OF ADMINISTRATION'S CONFERENCE ROOM ON THE 10th FLOOR OF THE STATE OFFICE BUILDING, JUNEAU, ALASKA. THE MEETINGS WILL START AT 9:00 A.M. ON BOTH DAYS.

THE FOLLOWING ITEMS WILL BE ON THE AGENDA:

(1) Review of proposals and selection of a consultant for the Financing Study.

(2) Formulation of input for the Department of Fish & Game Aquaculture Policy Manual.

ENCLOSED FOR THE REVIEW OF THOSE WHO DID NOT ATTEND THE JANUARY 10 MEETING ARE COPIES OF PROPOSALS RECEIVED.

MINUTES
AQUACULTURE POLICY STUDY GROUP
FEBRUARY 13-14, 1979

TUESDAY - FEBRUARY 13, 1979

Call to Order

Chairman Terry Gardiner called the meeting to order at 9:15 AM in the Governor's Conference Room, Third Floor, Capitol Building.

Roll Call

See attached attendance list.

Agenda

1. Selection of consultant for salmon study.

2. Recommended changes for Department of Fish and Game Aquaculture Policy and Procedures Manual.

Salmon Fisheries Plan

Committee members discussed the various proposals that had been submitted for the salmon fisheries plan. Those included the letter proposal by Barbara Sorensen, Miller & Associates, Inc. and Earl R. Combs, Inc. Ms. Sorensen advised that her letter proposal in no way fell into the same category as the other two proposals. Her plan was more of an expanded one that could not possibly be done in the time constraints involved in this particular study.

Introduction

Jack Milnes introduced Bill Spear, Trustee, Alaska Renewable Resources Corporation. Mr. Spear outlined the purpose for which the corporation was formed and encouraged all participants to get a copy of the Act establishing the corporation which was passed in the last days of the previous legislative session. The address for the Alaska Renewable Resources Committee is P. O. Box 1647, Juneau, Alaska 99802.

Salmon Proposals Continued

Discussion ensued on the proposals of Earl R. Combs, Inc. and Miller and Associates, Inc. It was the consensus of opinion that both firms are qualified to do the study, as well as having qualified staff. However, the Miller report appeared to be more specific and was written in such a manner as to indicate a better understanding of the tasks at hand, with the exception of Task 3.

Acting Chairman

At 9:45 AM Chairman Terry Gardiner appointed Bob Burkett, ADF&G, as Acting Chairman, inasmuch as he had to participate in open session of the legislature.

Salmon Proposals Continued

It was the consensus of opinion of the group that the program needed a strong project leader for liaison between the contract consultant and the group. John Williams recommended that Bob Grogan be selected as that project leader. There was concern among the group that the results of the study must be completed before the end of this legislative session. John Williams indicated that that was not essential and that additional monies could be allocated, if necessary, for the group to get together. Acting Chairman Burkett moved to table the selection of the consultant until after Chairmam Gardiner returned. There being no objection the matter was tabled.

Redraft of Task 3

A committee of the whole went into discussion on better guidelines for the successful contractor as far as Task 3 of the study.

Break

The meeting recessed at 12 Noon, scheduled to reconvene at 1:30 PM.

Salmon Study

Upon reconvening at 1:30 PM the following was selected as the Task 3 guidelines for the Alaskan Salmon Fisheries Study:

1. To inventory both micro and macro economic evaluation systems in use in the state and elsewhere in fisheries, as well as in other resource areas.

2. To identify the economic parameters, both quantifiable and non-quantifiable, and the various methods of analyses that can be applied to these parameters.

3. To select those parameters that would be effective in making an economic evaluation appropriate to the State of Alaska.

4. In light of Tasks 1 and 2 of the request for proposals, furnish a recommendation of the most appropriate parameters and the means to analyze them.

Armin Koernig of PWSAC advised that he felt there was a need for a state coordinator between Fish and Game and Congress concerning the D-2 lands issue lobbying effort. He felt that without such a coordinator various groups might be representing conflicting stands on various issues.

Chairman Gardiner resumed the Chair at 2:15 PM.

Motion

Chairman Gardiner moved and asked for unanimous consent for the selection of Miller and Associates, Inc. to prepare the analysis of the Alaskan Salmon Fishery, Tasks 1, 2, and 4 as submitted in their January 2, 1979 response to the group request proposal and following the amended Task 3 as drafted heretofore by the study group. There being no objection, the motion carried. Chairman Gardiner agreed with the necessity for appointing a coordinator between the Legislature, the group, and the contractor. He therefore agreed to appoint one or more persons employed in the Legislative Finance Division to perform these duties. The group urged that the contract be drawn by March 1, 1979 and that they meet with the consultant at about that time.

Aquaculture Policy and Procedures Manual

Various members of the group advised that they had already submitted in writing their recommendations for changes to the Fish and Game Aquaculture Policy and Procedures Manual.

New Agenda Item

Jack Milnes recommended as an agenda item the matter of the $40,000 remaining from the original $90,000 appropriation received and whether it could be used in some positive way.

Aquaculture Policy and Procedures Manual Continued

Again Chairman Gardiner indicated his hope that the committee as a whole could come up with recommendations to the Fish and Game rather than each separate organization submitting criticism with the possibility of no positive recommendations following. The committee as a whole then commenced reviewing the Policy and Procedures Manual item by item starting with the Definitions and Terms sections.

At 3:30 PM Chairman Gardiner again excused himself turning the Chair back over to Acting Chairman Burkett.

It was suggested that a group workshop might be the more appropriate forum for recommendations to the Policy and Procedures Manual.

Break

The meeting adjourned at 4:10 PM with various members of the study group to meet in a work session immediately following.

WEDNESDAY, FEBRUARY 14, 1979

Call to Order

The meeting was called to order at 9:10 AM by Chairman Terry Gardiner, who appointed Bob Burkett as Acting Chairman, due to the fact that he has to attend legislative committee meetings.

Aquaculture Policy and Procedures Manual

Discussion again ensued on recommendations for the Policy and Procedures Manual. Various hatchery representatives indicated the problems that presently existed in the fishery including facilities with no brood stocks; the need for help managing mixed stocks; the lack of an inventory; and problems of site selection. It was the feeling of the hatchery representatives that the Department of Fish and Game should take the biggest risks. It was their opinion that that Department had the least to lose and thus should give the hatchery every benefit of the doubt.

Break

A 15 minute recess was called at 10:35 AM, reconvening at 11 AM. Ivan Every spoke to the need for corrective legislation concerning the initiative process. It was his opinion that the initiative process should only be allowed to occur once instead of looming over the industry as a constant threat.

Jack Milnes spoke concerning his position with the Renewable Resources Corporation.

Policy and Procedures Manual Continued

It was the concensus of opinion of the group that Goal Statement No. 1 was adequate and that Policy Goal Statement No. 2 should be deleted. Inasmuch as time was running short, Armin Koernig agreed to have his own secretarial staff type up the agreed upon recommended changes to the Policy and Procedures Manual and submit them to Legislative Finance, where they would then be distributed with the Minutes to the members of the Committee.

Break

The meeting adjourned at 12 Noon.

Terry Gardiner	Legislature
Curt Kerns	Sea Grant
Ivan E. Every	C.I.A.
Patrick M. Connell	Legislature
Bill Marsh	NSRAA
Bob Burkett	ADF&G, FRED Division
Sig Olson	USFS
Joe Davis	ADF&G
Margaret Branson	Legislature
Judy Jones	Reporter
Armin F. Koernig	PWSAC
John Williams	LAA
Barbara Sorensen	Revenue
J. N. Milnes	SSRAA
Wm. Spear	Alaska Renewable Resources Corp.
John Sund	Speaker of House Office
Romayne Kareen	Internal Audit
William Sheridan	Formerly USFS now ADF&G
Bob Grogan	Legislative Finance

July 1979
Meeting

MARCH 1979

STATE OF ALASKA

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

FINANCE DIVISION
POUCH WF–STATE CAPITOL
JUNEAU, ALASKA 99811
PHONE: (907) 465-3795

NOTICE OF MEETING

AQUACULTURE POLICY STUDY GROUP

THE AQUACULTURE POLICY STUDY GROUP WILL MEET ON SATURDAY, MARCH 3, 1979, 9:00 A.M. IN ROOM 423, CAPITOL BUILDING, JUNEAU, ALASKA. THE PURPOSE OF THE MEETING IS TO REVIEW A PROPOSED CONTRACT WITH MILLER ASSOCIATES.

* * * * * *

31-Q1LH

Alaska State Legislature Ph: 465-3795
3796

JUNEAU ALASKA

NOTICE OF MEETING

THE AQUACULTURE POLICY STUDY GROUP WILL MEET ON MAY 7, 1979, 9:00 A.M. IN ROOM 423 OF THE STATE CAPITOL BUILDING, JUNEAU.

THE FOLLOWING IS A PROPOSED AGENDA.

PROPOSED AGENDA

INSTITUTIONAL AND POLICY ANALYSIS: The contractors will present an investigation of policy and organizations having an effect on the salmon fishery. They will present an assessment of the areas and the extent to which identified policy and organizational problems have a detrimental effect on achieving any desired goals.

ECONOMIC EVALUATION: The contractors will present a discussion of macro and micro economic evaluation methods and perameters; particular emphasis will be placed on those parameters that have an effect in making economic evaluations of the salmon fishery.

SEARCH FOR GOALS: The contractors will present information regarding goals for fisheries, goals for the salmon industry which have been previously established, criteria for goal selection and will encourage comments from the committee regarding possible new goals.

FINANCIAL PLANNING: The contractors will discuss the existing elements of the financial system in the context of the economic analysis as well as those changes which will be necessary to achieve possible future goals.

MINUTES
AQUACULTURE POLICY STUDY GROUP
MARCH 3, 1979

SATURDAY - MARCH 3, 1979

Call to Order

Chairman Terry Gardiner called the meeting to order at 9:15 AM in Room 423 of the State Capitol Building.

Roll Call

See attached attendance list.

Agenda

Meeting with Miller and Associates, successful contractor for the salmon fisheries plan.

Introduction

Wally Miller of Miller and Associates introduced himself as well as Bill Wilkerson of Eisenhower, Carlson, et al. and Dan Malick of Leonard Lane and Associates.

Discussion on Contracts

Mr. Miller advised that his firm was open for questions and discussion on the contract. He wanted as much input from the group as possible as to how they wanted the study conducted. Bill Marsh of NSRAA suggested monthly meetings between the policy study group and the consultants or their representatives throughout the program. Mr. Wilkerson advised that although they would be willing to do so, that he didn't feel that it was absolutely necessary due to the fact that Leonard Lane and Associates had a Juneau office and would be close at hand to answer questions and to accept input. The pros and cons of soliciting federal funds for the program were discussed. The result was that funding from all areas should be looked at in order to enhance the success of the program.

Various tentative guidelines provided by the group included, among other things:

1. Maintaining the Alaska way of life on which no monetary amount can be set.

2. The State of Alaska's fiscal situation and its impact on the program.

3. The possibility of private financing taking over publicly supported projects.

4. Looking into the State's present investments to determine if this might not be a good investment under the permanent fund.

5. The fact that the Alaska Constitution as well as existing statutes would need to be reviewed in order to perform tasks 1 and 2. The questions is "is our Legislative package adequate"? Mr. Miller advised that he had already reviewed our Alaska Constitution and was struck by the strength in its language. Wherein most constitutions were vague using terms such as "may", Alaska's Constitution for the main says, "shall".

6. Miller advised that an important ingredient to the success of the program was the need for long-term financial authority as well as long-term management authority.

7. The need to minimize the competition between the fisheries, i.e. competition between salmon and bottom fish.

8. An evaluation of the permitting process.

The consultants were advised that the Fish and Game engineering staff coordinates the permitting process and can possibly be of assistance to them. Mr. Milnes advised that Jeanne Sandy had a graph on the permitting procedure and could provide them with this information.

9. The suggestion was made that the consultants secure ideas from sportsmen's associations.

Wally Miller advised that he would be obtaining a list of all members of the group as well as their telephone numbers and would be contacting them for input. He further advised that this was not merely a "paper study" and they would be talking with people from all sectors in order to get input.

Federal Fisheries Program

Mr. Wilkerson advised that it was a 99% possibility that the Forest Service would be moved to the Department of Natural Resources. Some members expressed their regret due to the excellent cooperation between the Forest Service and the State Department of Fish and Game.

Chairman Gardiner advised that he had been to Washington, D.C. and met with members of the National Resources Committee to discuss the D-2 issue. He advised he learned that there would definitely be federal oversight due to subsistence. He was surprised to learn that Alaska's Congressional delegation had already conceded this.

It was suggested that the consultants call upon Bob Grogan frequently inasmuch as he would be able to provide them with lots of information as well as the location thereof.

Mr. Miller advised that he would be needing a copy of the Little Study on "bottom fish".

Break

The meeting adjourned at 12 Noon.

AQUACULTURE POLICY STUDY GROUP

Bob Burkett	ADF&G, F.R.E.D.
Terry Gardiner	Alaska Legislature
Bob Grogan	Legislative Finance Division
Floyd E. Heimbuch	Cook Inlet A.A.
Joe Davis	ADF&G, F.R.E.D.
Curt Kerns	Sea Grant
Armin E. Koernig	PWSAC
J. N. Milnes	SSRAA
Bill Marsh	NSRAA
Bill Sheridan	Formerly USFS now ADF&G
Barbara Sorensen	Department of Revenue

GUESTS IN ATTENDANCE

Margaret Branson	Legislature
Wally Miller	Miller & Associates
Bill Wilkerson	Eisenhower, Carlson, et al
Dan Malick	Leonard Lane & Associates
Ron Wenty	

MAY 1979

MINUTES
AQUACULTURE POLICY STUDY GROUP
MAY 7, 1979

MONDAY - MAY 7, 1979

Call to Order

Chairman Terry Gardiner called the meeting to order at 9:25 a.m. in Room 423 of the State Capitol Building.

Roll Call

See attached attendance list.

Agenda

A combined presentation by Wally Miller of Miller and Associates, Inc., Bill Wilkerson of Miller and Associates, Inc. and Dan Malick of Leonard Lane and Associates of the beginning investigative work done by the contractors for the salmon fisheries plan.

Presentation of Study

Mr. Malick made the first presentation on Institutional & Policy Analysis. He referred to a chart which was an analysis of federal, state and local governments and other entities having an effect on the fisheries. He wanted comments from the group on observations they might make about the organizational complexities of trying to get a fisheries program in operation.

Mr. Wilkerson followed up with a presentation of his investigation of key federal institutions involved in the concept of salmon resource development in regards to funding and regulatory activities. He discussed the relationship between established federal fisheries programs and the State of Alaska as to the problems already faced by the state in regards to federal control and jurisdiction of Alaska land and waters. He advised, in conclusion, that at this time, as far as the federally-funded EDA is concerned, there has been no real contribution at the federal level in terms of constructing hatcheries or development of the salmon resource.

Summary

Mr. Miller commented, in summary, that Alaska has a choice of simply reacting to what the federal government does or to decide on a program and pursue that and believes that their presentation has suggested the latter as a means of accomplishing the goal of a salmon resource development program.

Mr. Malick then summarized his presentation on the Alaska Salmon Resource Development Program. Referring to the chart, he advised

that looking at each of the individual institutions a lot of variations between the specificity and clarity of their programs and goals can be seen, and a clear picture cannot be gotten of what the Alaska Salmon Resource Development Program is doing as a single entity. He concluded that maybe one of the things that will come out of here is the group can see that program as a single entity directed towards a goal and then having the institutions themselves direct the way in which the program can achieve its goal. The question is the direction the group can head towards.

Break

Meeting recessed at 11:45 a.m., scheduled to reconvene at 1:15 p.m.

Economic Evaluation

Upon reconvening at 1:30 p.m., Mr. Miller made his presentation on economic evaluations of salmon enhancement projects which encompassed the macro and micro economic evaluation techniques as applied to salmon fishing. In conjunction with this study, he presented an analysis of survival rates by species (Pink, Sockeye, Chum, Coho and Chinook) for artificial and natural salmon propagation methods. He advised that the data used are not reflective of Alaska returns, because there is a critical lack of information on expected returns in Alaska. However, he advised that the two prepared analyses can be used as models for comparing and computing survival rates for analyzing alternative propagation methods for the Alaska Salmon Resource Development Program.

Barbara Sorensen, of the Department of Revenue, advised that data is available but not readily available. Before compilation of all the pertinent data can be accomplished, a budget appropriation must be made for a data system. She further advised that the new commissioner has been made aware of the problem, but no decisions have been made regarding an appropriation.

Discussion

Members of the group discussed the first two presentations. Their input included:

1. The various economic benefits of the development of the salmon resource to the state.

2. The benefit in regard to each area's particular needs.

3. The cost benefit to fishermen.

4. A major factor: will the price of salmon continue to increase?

5. The value of presenting the project as one economic package - not just as a benefit to fishermen or the state.

6. Financial responsibility: who pays?

Financing and Search for Goals

Mr. Miller resumed the presentation with a discussion of the basic problems related to financing and information regarding goals for fisheries, goals previously established for the salmon industry and the establishment of criteria for selecting goals for this particular project.

Other Matters

Ron Wendte advised the group that he had just been made aware of a meeting scheduled this week by Pete Jeans to push a high-level discussion in the administration to end the private aquaculture program. The meeting will be attended by Specking and representatives from Fish & Game and Commerce to decide whether the program should continue to exist.

There ensued discussion among the members of the group and Mr. Miller regarding the ramifications of the possibility of the ending of the program.

Close of Presentation

Mr. Miller advised that he will contact individual members for information before continuing compilation of data for the study.

Final Discussion

Last-minute suggestions were offered by Terry Gardiner and Derek Poon for the group to consider.

Terry Gardiner suggested using the George Inlet facility and the Klawock facility for some experimental input of data to use with the suggested models of salmon propagation methods and survival rates just to get an idea of how these models would work for the Alaska data.

Derek Poon suggested, due to rising costs, investigating the possibility of investing in a faciliity and waiting to supply it with brood stock.

Break

The meeting adjourned at 5:10 p.m.

AQUACULTURE POLICY STUDY GROUP

Bob Burkett	ADF&G, F.R.E.D.
Joe Davis	ADF&G, F.R.E.D.
Terry Gardiner	Legislature
Floyd Heimbuch	Cook Inlet A.A.
Armin Koernig	PWSAC
Bill Marsh	NSRAA
Tom Meyer	NSRAA
Paul McCollum	A.V.C.P. - Fisheries Develop. Corp.
Pat Petuchov	NSRAA
Derek Poon	NSRAA
Bill Sheridan	Forest Service
Barbara Sorensen	Department of Revenue
Don Walker	NSRAA
Ron Wendte	SSRAA

GUESTS IN ATTENDANCE

Margaret Branson	Legislature
Carl Gonder	Leonard Lane & Associates
Dan Malick	Leonard Lane & Associates
Wally Miller	Miller & Associates, Inc.
Bill Wilkerson	Miller & Associates, Inc.

Alaska State Legislature Ph: 465-3795
3796

JUNEAU ALASKA

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5

ACQUACULTURE POLICY

STUDY GROUP

MEETING

MAY 7, 1979

ommercial Fisheries Program:

- Established by AS 16.05.090 but powers and duties not statutorily specified

TYPE:

- Division within the State Department of Fish & Game

SIZE:

- 160 PFT requested for FY 80
- 3 PPT requested for FY 80
- 140 Temp requested for FY 80

STRUCTURE:

- Division organized into five components
- 25% of resources in research component
- 45% of resources in management component
- 10% of resources in administration component
- 14% of resources in federal aid programs component
- 7% of resources in special projects (primarily federal aid)

GEOGRAPHICAL LOCATION:

- Statewide responsibilities
- Staff located statewide

FUNDS:

- $1,374,000 federal receipts requested for FY 80
- $443,000 General Fund requested for FY 80 (exclusively matching funds)
- $9,137,000 General Fund requested for FY 80
- $25,000 program receipts requested for FY 80

PRIMARY CONSTITUENTS:

- Commercial fishermen and seafood processors
- General public as consumers of commercial salmon products
- General public as sport users of adequately protected and maintained natural resource
- Subsistence fishermen as users of adequately protected and maintained natural resource

GOALS:

- o Protection of fisheries resources through prevention of loss due to inappropriate harvest methods and regulation of other fisheries to prevent unacceptable incidental harvests
- o Maintenance of fisheries resources through maintenance of brood stock levels of resources currently capable of producing optimum yield
- o Rehabilitation of fisheries resources by selectively protecting depressed stocks from harvest to increase the level of brood stock availability to levels capable of producing optimum yield
- o Development of new fisheries through research and regulation efforts

OBJECTIVES:

- o Maintain statewide commercial natural stock salom harvests at an average annual level equal to or above 49 million
- o Rehabilitate depressed stocks to increase average annual commercial harvest to 69 million of natural stock by 1990
- o Maintain statewide subsistence harvest of 600,000 to 1,000,000 salmon annually
- o Maintain Cook Inlet commercial harvest of salmon at 4 million annually and rehabilitate fishery gradually to 4.7 million annual natural stock harvest
- o Maintain Southeast commercial harvest of salmon at 15 million annually and rehabilitate fishery gradually to 25 million annual harvest
- o Maintain Arctic-Yukon-Kuskokwim harvest of salmon at 2 million annually and rehabilitate fishery gradually to 4 million annual harvest
- o Maintain Bristol Bay harvest of salmon at 9.8 million annually and rehabilitate fishery gradually to 14 million

PROGRAMS:

- o Primary strategy, in concert with the Board of Fisheries, is stock regulation by allocation of resources to users(total allocation is surplus beyond brood stock needed to maintain optimum resource yield)
- o Stock regulation accomplished through regulation of season openings and closures, harvest methods, and types and amount of fishing gear
- o Research and federal aid programs generate new knowledge on various aspects of fish species life history and provide the necessary knowledge and methodology for scientific management of fish resources
- o Assess total population abundance, distribution, migration routes, and timing of major salmon stocks
- o Apply biometrics and computer technology to data analysis to improve effectiveness of management and research programs

PROBLEMS:

- o Not enough funds for adequate research on life cycle of species and habitat
- o Not a lead agency---reactive once problems develop

M E M O R A N D U M

TO: WALLY MILLER

FROM: WILLIAM R. WILKERSON

DATE: May 2, 1979

RE: OUTLINE OF PRESENTATION ON FEDERAL INSTITUTIONS

I. INTRODUCTORY REMARKS

A. Summary of findings.

B. Summary of conclusions.

II. DIRECT FISHERIES PROGRAMS

A. General authority.

1. U.S. Department of Commerce Organic Act.
2. Fish and Wildlife Act of 1956 (reorganization plan No. 4, 84 Stat. 2090, October 3, 1970).
3. Agricultural Marketing Act of 1946.
4. Saltonstall-Kennedy Act of 1954.

B. Fisheries management and enforcement.

1. Fish and Wildlife Act of 1956.
2. General authority of National Oceanographic and Atmospheric Administration (NOAA).
3. Fishery Conservation and Management Act of 1976 (FCMA).
4. Black Bass Act.

C. Fish production.

1. Fishery research and experimentation program.
2. Food and Agriculture Act of 1977.
3. Loans for production of fish (Consolidated Farm and Rural Development Act).

D. Research and cooperation in resource development.

1. Cooperative agreements with nonprofit organizations, etc. (15 U.S.C. §1525).
2. Harvest Development Research (16 U.S.C. §§744 & 745).
3. Sea Grant Programs (33 U.S.C. §§1121 et seq.).
4. Commercial Fisheries Research and Development Act of 1964 (16 U.S.C §779).
5. The Food and Agriculture Act of 1977 (7 U.S.C. §3171).
6. The Defense Production Act of 1950.
7. The Anadromous Fish Conservation Act (16 U.S.C. §757).

E. Financial and technical assistance.

1. Section 607 of the Merchant Marine Act of 1936, as amended (46 U.S.C. §1177).
2. Title XI of the Merchant Marine Act of 1936, as amended (46 U.S.C. §§1271-80).
3. Fish and Wildlife Act of 1956 (16 U.S.C. §742c).