MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director

ESTIMATED TIME
0.5 HOURS

DATE: January 26, 1998

SUBJECT: Research Priorities

ACTION REQUIRED

Initial review of research priorities for submission to NMFS.

BACKGROUND

During their November meetings, the Groundfish Plan Teams recommended the research priorities as listed in Item C-9(a). The 1997 list of research priorities is attached as Item C-9(b), as amended. After receiving comments from NMFS and the SSC in February, the Council will forward the priorities to NOAA for use in preparing its annual budget.

GULF OF ALASKA GROUNDFISH PLAN TEAM RESEARCH PRIORITIES

The following research projects were prioritized based on two agency needs: improving stock assessments, and improving ecosystem management. The feasibility of each project is ranked as: easy, moderately difficult, or difficult. These should be added to the current research list (Item C-4(b)).

All Species Studies of the response of fish to survey bottom trawling (catchability/selectivity). (Moderately difficult to difficult)

Pollock The top two research projects that would improve the Gulf of Alaska pollock assessment were:

1. Feasibility study to evaluate the possibility of conducting a Gulfwide hydroacoustic survey in conjunction with the triennial bottom trawl survey. (Moderately difficult)

2. Examination of the response of pollock to survey vessel noise and survey trawling. (Moderately difficult)

The top three research projects that would address ecosystem concerns related to harvesting Gulf of Alaska pollock are:

1. Predator response to varying prey concentrations and seasonal food supply. (Difficult)

2. Collections of food habits, daily ration on seasonal basis. (Easy to moderately difficult)

3. Response of fish to commercial trawling (part of a marine mammal fishery interaction study). (Moderately difficult to difficult)

Demersal Shelf Rockfish. Habitat mapping of the continental shelf and slope is needed to adequately assess species such as DSR, Atka Mackerel and Shortraker/Rougheye that are habitat-specific in there distribution.

Atka Mackerel. Conduct a pilot survey utilizing commercial fishing techniques to explore Atka mackerel school dynamics and behavior and links to prey, tides, and habitat.

Bering Sea/Aleutian Islands Groundfish Plan Team Research Priorities

The Bering Sea plan team concurs with the research priorities identified last year by the Scientific and Statistical Committee (Item C-4(b)). However, there are several research needs that the team would like to see addressed in the short term.

1. Collect and analyze flatfish maturity data, particularly for flathead sole. The intent is to provide other information to estimate natural mortality, to calculate B40% (spawning biomass), and to improve synthesis modeling. Arrowtooth flounder and flathead sole are pointed out as species where information should be relatively easy to collect since they spawn during the winter when the fishery occurs. Alaska plaice are summer spawners and information could be collected during a summer survey.

2. Determine if there is differential growth and natural mortality for male and female Atka mackerel.

3. Otoliths of Greenland turbot have been collected but not analyzed. Aging these samples would improve the stock assessment.

4. Analyze the distribution of POP in the Bering Sea. In previous years, the fishery has occurred west of the Pribilofs, yet survey data from this area are limited. This may be a separate stock unit.

North Pacific Fishery Management Council
Research Priorities (Excerpted from February 1997 SSC Minutes)
*Amended to include additional Plan Team recommendations for rockfish (additions in italics)

Research Priorities

The SSC reviewed Plan Team recommendations for additional research and updated the January 1996 SSC research recommendations. The SSC emphasizes that this list is not inclusive of all needed research nor is it prioritized; rather it represents a compilation of research ideas recognized by the SSC as deserving attention by NMFS, ADF&G, IPHC, other agencies, and institutions of higher learning. The SSC chair will provide the executive director with a list of appropriate institutions. We request that this portion of the minutes be distributed appropriately. Finally, it would also be helpful if the Council solicited from these institutions a list of ongoing research activities which may be related to groundfish and crab management. In this way, these institutions and the Council can become aware of ongoing research as well as mutual interests and needs.

Given the potential expansion of state-water fisheries, the need for understanding the relationships between groundfish in state and federal managed waters, and limited programmatic resources, the SSC encourages close coordination of resource assessment and research efforts.

A. Critical Assessment Problems

1. Rockfish: There is a general need for better assessment data, particularly investigation of stock structure and biological variables.

   (a) Supplement triennial trawl survey biomass estimates with estimates of biomass or indices of biomass obtained from alternative survey designs.

   (b) Obtain age and length samples from the commercial fishery, especially for Pacific ocean perch, northern rockfish, and dusky rockfish.

   (c) Increase capacity for production ageing of rockfish age structures so that age information from surveys and the fishery can be included in stock assessments in a timely manner.

2. Walleye pollock: There is a continuing need for research on stock structure as it relates to assessment. There is a critical need for a tagging study to focus on stock interactions. We continue to emphasize the need for age-structured assessments of recognized stock units. As the Bering Sea pollock population has declined, the forecasts of future pollock recruitment have undergone greater scrutiny. Research on alternative forecasting methodologies is needed

   The SSC believes that research should be undertaken to determine the magnitude of the catch, size and age structure of the EBS stock harvested in the Russian zone in the vicinity of the transboundary area. It may be necessary to consider fishing removals from the Russian zone and their impact on EBS pollock mortality in the estimates of ABC and TAC.

   Assessment of the status of the Gulf of Alaska resource is critically dependent upon results of resource surveys. Currently, these surveys are conducted every three years. Various ways of supplementing the triennial survey data should be evaluated. The relationship between fish in Prince William Sound to those in the Gulf of Alaska needs to be elucidated.

3. Crab research: Research should be expanded on handling mortality, stock structure and life history parameters.

4. Age- and length-structured assessments: These assessments integrate several data sources using some weighting scheme. Little research has gone into evaluation of different weighting schemes, although the weight can have a large effect on the assessment results. Research is needed on which weighting schemes are robust to uncertainties among the different data sources. Age structured assessments are incumbent upon age determination techniques, and ongoing age validation is needed. The Lowell-Wakefield Symposium in October 1997 will address the implementation and improvement of age-structured models.

   Correct model specification is critical to stock assessment. Further research is needed on model performance in terms of bias and variability. In particular, computer simulations, sensitivity studies, and retrospective analyses are needed. As models become more complex in terms of parameters, error structure, and data sources, there is a greater need to understand how well they perform.

5. There is incomplete life history information, e.g., growth and maturity data, for a number of stocks. This information is essential for determination of ABC, OFL and preferred fishing mortality rates. Maturity data are lacking on the following: Pacific cod, Dover sole, other flatfish, sablefish, and many species of rockfish. Life history and distributional patterns of Greenland turbot are lacking and require additional research. To better understand sablefish recruitment variability, additional information on the geographical distributional and movement of juvenile sablefish is needed.

6. Identification of the origin of chum and chinook salmon stocks captured incidentally in the groundfish fisheries is needed. The chum salmon stocks in particular are recognized as a mixture of Asian and North American origin. Resolution of stock origin is important in the consideration of bycatch management.

7. There is need for information about stock structure and movement of walleye pollock, Atka mackerel, Pacific cod, POP, and other rockfish. With such information, a combined BSAI/GOA assessment might provide better information, especially for Atka mackerel and Pacific cod.

8. Further research is needed about management strategies which provide for conservation of aquatic resources. Some topics which need attention include: which measure of biomass should be used in biomass-based adjustment of ABC and OFL; what measure of average recruitment to use in $B_{40\%}$; the effect of seasonality in spawning, recruitment, and harvest on optimal harvest rate; adaptive management schemes which are designed to provide understanding of multispecies interactions and spatial population dynamics.

9. Presentation of uncertainty in stock assessments is often lacking or incomplete. Further research is needed into which methods are most appropriate for capturing uncertainty in the status of populations.

10. Management measures such as time-area closures and other restrictions are frequently imposed, but rarely rescinded. Studies are needed to evaluate the effectiveness of management measures on conserving populations, achieving management goals and assessing other ecosystem effects.

B. Stock survey concerns

1. Conservation of aquatic resources in the North Pacific is critically dependent on a consistent time series of trawl, hydroacoustic, and longline surveys. The continuity of this series must remain one of the highest priorities of NMFS and the Council.

2. Explore ways for inaugurating or improving surveys to assess rockfish (including nearshore pelagics), pollock, squid and Atka mackerel.

3. Expand bottom trawl surveys in the Gulf of Alaska and Bering Sea to include slope areas that encompass the population range of Greenland turbot, rockfish, thornyheads, and sablefish.

4. Conduct surveys of the Aleutian Islands management area to assist in the assessment of groundfish stocks found in this region.

5. Improve surveys for Bering Sea crab complementary to the existing Bering Sea crab/groundfish survey (e.g. Norton Sound, Pribilof Islands, St. Matthew Island, and Bristol Bay).

6. Direct observation (e.g. submersible and dive surveys) offers unique opportunities to directly examine gear performance, fish behavior in the proximity of gear, gear related habitat impacts, and differences of fish density between trawlable and nontrawlable habitat.

7. There is a continuing need to perform gear calibration and fish observation studies to validate indices of abundance (e.g. fishing longline and trawl gear side-by-side, and fishing different baits on longline gear over the same stations).

8. Within the EEZ are seamounts which are unsampled for groundfish, halibut, and crab abundance. Surveys which sample these seamounts may improve estimates of total abundance in the EEZ, particularly for sablefish and rockfish stocks.

9. Data from annual ADF&G crab surveys should be examined and their usefulness for assessing groundfish abundance in near-shore areas should be evaluated. Dialogue between ADF&G and NMFS assessment scientists regarding ways of gaining more useful groundfish data from this survey should be encouraged.

C. Expanded Ecosystem Studies

1. Because of the importance of marine mammal and seabird considerations in fisheries management, further studies are needed on interactions among fisheries, marine mammals, and seabird populations. In particular relationships among oceanographic conditions, conditions and animal condition and health should be explored. Research should be done on sources of age-specific fish mortality.

2. Effort is needed on status of stocks and distribution of forage fishes, such as capelin, eulachon, and sand lance. Forage fish are an important part of the ecosystem , yet little is known about these stocks. The Lowell-Wakefield Symposium (October 1996) presented current research on forage fishes.

3. Studies of the effects of harvesting and processing activities on the ecosystem and habitat should be instituted. For example, studies contrasting species diversity and abundance in the red king crab savings area with that in adjacent regions.

4. Trophic dynamics research should be undertaken on the relationships among critical species, e.g., Pacific cod and its prey (including shrimp and crabs). The feasibility of constructing multispecies models using ongoing collection of gut contents data should be investigated.

5. Groups of species in the rockfish and flatfish families are now managed as "species complexes." Research should be expanded on the question of biological linkages among the components of "species complexes" that justify this management approach. Further, are there other, unidentified groups of species that are ecologically related and could be managed as a unit?

6. Studies are needed to identify essential habitat for groundfish and forage fish species in the Gulf of Alaska and Bering Sea. This identification is required by the MSFCMA and would benefit from field studies conducted across a matrix of spatial temporal, and life history stages.

7. Expand studies of distribution, abundance, and productivity of seabird populations and ensure that data are collected in ways that provide for rigorous analyses of seabird/marine mammal/oceanographic/fisheries interactions. The majority of data on seabirds in Alaska was collected during the 1970s (through OCSEAP); the quantity of data collected afterwards has been insufficient to adequately examine these interactions.

8. Multivariate statistical analysis of the time series of annual survey data may identify which species regularly occur in assemblages. Mapping these assemblages through space and time may reveal changes in the distribution and abundance of the species of the Eastern Bering Sea. These mappings and trajectories may be applicable to adaptive management approaches suggested for exploring ecosystem concerns. Although related analyses were started by NMFS in the late 1970's , they have not been conducted in recent years. Recent advances in spatial statistics may prove fruitful tools for reexaming these existing data.

D. Socioeconomic research

1. There is a critical need for the development and continued maintenance of basic economic information databases on the fisheries of GOA and BS/AI. This information is required for establishing a baseline to be used in the evaluation of the impacts of alternative management measures. At a minimum there is a need for reliable information on:

   a) the cost and revenues of fishing and processing operations,

   b) the location where goods and services are purchased,

   c) the characteristics of markets for fish products,

   d) patterns of ownership in fishing and processing operations,

   e) the relationships between harvesting and processing sectors,

   f) unemployment rates by community over time, labor wage rates in alternative occupations (to fishing) by community over time, and assessment of the opportunity costs of labor,

   g) the cumulative efficiency and equity consequences of management actions that apply time/area closures,

   h) the transfer of halibut and sablefish IQ's (transactions price, volume, changes in distribution of ownership, etc.),

   I) comprehensive method for managing catch and bycatch,

j) net economic benefits of commercial and recreational harvests, in particular, for halibut, and

k) needed to estimate regional and community impacts.

2. Research pertinent to assessment of the social impacts of actions contemplated by the Council include:

a) Social Assessments: Selected community and industry assessments should be conducted to establish baseline conditions underlying social problems identified by the Council and the Advisory Panel. As appropriate, these projects can be extended to generate time series information.

b) Social Impacts: Social impact and policy research should be conducted regarding the identification and potential effects of alternative management actions.

c) Develop better methods for determining the social costs and benefits of management actions (e.g. through the use of non-market valuation techniques).

3. Analysis of anticipated impacts of proposed management changes would benefit from improved understanding of fleet behavioral response to alternative fishing opportunities and restructure the Bering Sea bycatch allocation model to provide better predictions of how fishing effort will shift in response to time/area closures,

E. Bycatch problems

1. Research on gear modification and other methods for reducing bycatch should be expanded.

2. A better quantification of discard mortality rates is needed, especially for halibut and crab.

4. Data on size/age and sex of crabs taken as bycatch are needed to assess impacts.

5. Develop methods for performing comprehensive evaluations of single and multiple time/area closures and other bycatch management measures.

6. Develop better methods for assessing the social costs of bycatch.

7. Identify sources of variability in actual and estimated bycatch rates.

F. Alaska Fishery Monitoring

1. An analysis of the utility of fishery logbook information should be conducted. In particular, determine if it is possible to gain insight into fleet performance from such information. Examine feasibility for developing a representative CPUE index and determine if it is proportional to stock size

2. Evaluate sampling procedures used by observers and various catch estimation procedures.

3. Development of catch and bycatch sampling procedures for individual vessel accountability programs.

Mail for Clarence Pautzke

Date: 12/8/97
Sender: mail@kamniro.kamchatka.su
To: Clarence Pautzke
Priority: Normal
Subject: from Zolotov

To: Clarence.Pautzke@noaa.gov.
For: Dr. Clarence G. Pautzke, Executive Director,
North Pacific Fishery Management Council
From: Dr. Yuri P. Diyakov, KamchatNIRO, Kamchatka, Russia
e-mail: mail@kamniro.kamchatka.su

Dear Dr. Pautzke,

In accordance with your conversation with Dr. Oleg G. Zolotov in Seattle in November, I am submitting the following proposal to the North Pacific Fisheries Management Council. I hope your organization, or some other group you might pass it on to might be of assistance to us in improving our abilities to assess the Bering Sea pollock resource. I think it is very important
that we combine our scientific efforts to improve our understanding of Bering Sea pollock under the present conditions of the fishery.

Sincerely your,

Yuri Diyakov, Director of Kamchatka Fisheries & Oceanography Research Institute.

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Proposal to the North Pacific Fisheries Management Council
for Funding of:

U.S.-Russia Cooperative Studies of the Age, Growth, and Related Biological Statistics of Bering Sea Pollock

The development of common methods of assessment and data collection is a very important topic for Russian and American researchers. There is a need to consider aspects of data collection and analysis, such as age and growth analysis, sample size and collection procedures for the collection of biological statistics.

Aging by scales still remains the main method of walleye pollock age determination in Russian research works. That makes impossible an incorporation of Russian statistics from Bering Sea into the age-structured models for pollock stock assessment for whole the area.

The Alaska Fisheries Science Center (AFSC) and KamchatNIRO in Petropavlovsk, Kamchatka have conducted exchanges of pollock otoliths , and age readers from KamchatNIRO have been trained at the AFSC. These previous exchanges have shown good results and agreement between age readers at the two institutes. We propose that these exchanges be maintained, and that additional readers from KamchatNIRO be trained at the AFSC.
The otolith readers from KamchatNIRO trained at the AFSC would provide a pool of specialists that could train readers at other Russian fishery institutes.

The establishment of a U.S.-Russian cooperative pollock otolith program will

AGENDA C-9
FEBRUARY 1998
Supplemental

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Alaska Fisheries Science Center
BIN C15700; Building 4
7600 Sand Point Way NE
Seattle, WA 98115

JAN 30 1998

Dr. Clarence G. Pautzke
Executive Director
North Pacific Fishery
Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Dear Clarence,

Recently, you requested that information be provided describing actions that are being taken by the Center to address research issues identified by the Council's SSC and Groundfish Plan Teams. Since the SSC's 1996 list has not been updated, attention was restricted to items identified by the Teams and provided to the Council during its December 1997 meeting.

All species

1. Studies of the response of fish to survey bottom trawling (catchability/selectivity)

Experiments to estimate the efficiency of the survey trawls used by the AFSC have been conducted each year since 1994. The first attempt used a depletion experiment to estimate the efficiency of the 83-112 trawl (the trawl used in the EBS survey) for snow crab. Subsequent experiments attempted to estimate two components of the catching process: herding by the doors and bridles and escapement under the footrope. Herding studies on the 83-112 were conducted in 1994 and 1995 by varying the lengths of the bridles. Escapement studies on the 83-112 were first conducted using video cameras to count fish escaping under the footrope (1995) and later conducted using a bag under the trawl to capture fish escaping under the footrope (1997). Escapement studies on the poly nor'eastern trawl (the trawl used in the Gulf of Alaska and Aleutian Islands surveys) were conducted using the under-trawl bag in 1996 and again in 1997. Herding studies on the poly nor'eastern are planned for 1998. Upon completion of the 1998 experiment, we will be able to calculate the efficiency of both survey trawls for cod, rock sole, flathead sole, and yellowfin sole. Efficiency estimates for pollock, atka mackerel, and rockfish cannot be obtained with the methods we are currently using, either because an unknown quantity of fish pass over the headrope (pollock) or because the preferred habitat is too rough to allow the use of under-trawl bags. However, groundfish assessment and midwater assessment personnel are currently working on a hydroacoustic buoy that may allow the estimation of midwater escapement over the headrope. In addition, groundfish personnel are continuing to develop underwater video techniques that will allow the estimation of escapement on rough bottoms.

Stock assessment models, however, need estimates of catchability or efficiency multiplied by the proportion of the stock within the survey area. Although catchability can be estimated for some species that are

now adequately covered by the surveys for other species, catchability estimates are problematical because a substantial part of their population resides in areas that are either too shallow, too deep, or too rough to be covered by our current surveys. For those species (cod and the three flatfish species) where good estimates of catchability are now available, the question of how to use the estimates in the stock assessment models becomes an issue. To address this issue, Dave Somerton agreed to assume the chairmanship of an ICES study group focused on incorporating catchability estimates into the stock assessment process and is currently working with Grant Thompson on a study to examine the use of catchability estimates in a Bayesian approach to stock assessment modeling.

Gulf of Alaska

Pollock

1. Feasibility study to evaluate the possibility of conducting a Gulf-wide hydroacoustic survey in conjunction with the triennial bottom trawl survey

Gulf of Alaska pollock assessment has utilized resource survey results from the gulf-wide triennial bottom trawl survey conducted during the summer and the Shelikof acoustic survey of spawning pollock in the winter. Pollock are known to be semi-demersal in their distribution, and a summer survey effort should be accompanied by an acoustic survey to assess the midwater component of the stock. Acoustic survey methodology is most appropriate for measuring the abundance of fish populations when the fish have an off-bottom distribution and when the target species is the dominant fish species in the water column. Biases in the method are caused by contamination of the acoustic returns from other abundant species. Semi-demersal rockfishes, which are abundant in the Gulf of Alaska fishery and a dense scattering layer, may be significant contamination sources invalidating the use of acoustics in the summer. A feasibility study is necessary to evaluate the utility of applying acoustic methodology and the impact of this potential contamination before a full scale summer survey is conducted. Our first opportunity to conduct a feasibility study is 1999, the next scheduled year for the Gulf triennial survey. This window of opportunity will depend on the availability of sea days aboard the NOAA Ship MILLER FREEMAN. If the FREEMAN is available for the 1999 triennial bottom trawl survey, then we expect that there will be 1 to 2 weeks of sea time to conduct the identified feasibility study. Currently, we have inadequate resources (FREEMAN sea days and acoustic survey team) for conducting a full scale summer acoustic survey of the Gulf of Alaska.

2. Examination of the response of pollock to survey vessel noise and survey trawling

Estimates of abundance for walleye pollock could be in error if the fish exhibit a diving response to vessel and trawl noise. To examine the possibility that walleye pollock (and hake) respond to vessel and trawl noise, an acoustic-buoy was designed and built in 1997. The freely drifting buoy can be easily deployed and recovered from a vessel. It

has the capability to measure the vertical and horizontal fish movements which may occur from noise generated when a vessel or trawl passes near the buoy and over the fish. The buoy has the capability to transmit the data to a support vessel in real time and thus provide time-critical information for conducting field experiments to assess the behavioral response of the fish to vessel and trawl noise. Field trials with the buoy have been completed in Port Susan, Washington and in the Bering Sea. Work is planned during the spring 1998 acoustic-trawl survey of pollock in Shelikof Strait to determine whether spawning aggregations of pollock respond to vessel noise generated during routine survey operations.

Ecosystem concerns related to harvesting Gulf of Alaska pollock

1. Predator response to varying prey concentrations and seasonal food supply

At present, we are doing no directed research in this area for the Gulf of Alaska. What we would like to do is make simultaneous collections of groundfish stomachs and prey abundance in the same place on a seasonal basis. This will allow us to understand and model a predator's functional feeding response, which is a way of describing how predators change their consumption of prey when prey abundance and type varies. This knowledge will improve our models (single-species and multispecies) that include predation. The main impediment to performing this work is obtaining additional shiptime aboard a vessel like the MILLER FREEMAN that can accommodate bottom trawls, hydroacoustic equipment, and smaller nets for sampling prey. We would also require extra funds or personnel in order to perform the at-sea sampling, work up the stomach and plankton samples in the lab, and analyze the hydroacoustic data.

2. Collections of food habits, daily ration on seasonal basis

At present, we are collecting food habits data on a triennial basis during the summer bottom trawl survey of the Gulf of Alaska. What we would like to do is obtain groundfish stomach samples on a seasonal basis from a broad, representative area of the GOA. These samples would allow us to better quantify predator-induced mortality of key species such as pollock and to include those estimates in our models. In order to perform this work, we require additional shiptime and funds or personnel to analyze the samples in the laboratory.

3. Response of fish to commercial trawling (part of a marine mammal fishery interaction study)

A field experiment to determine the response of pollock to commercial trawling has been designed by AFSC scientists but can not be executed until results from field studies with the acoustic-buoy (see item 2) have been evaluated. The results of this work should provide information to determine whether commercial trawling activities can affect the prey distribution of marine mammals. The proposed experiment, if funds become available, would occur around Kodiak Island and would determine whether significant changes in the distribution and abundance of pollock have occurred in an area before, during, and

immediately following commercial trawling activities. High resolution acoustic-trawl surveys would be repeated within two confined areas, one where fishing occurs and another where it does not. The surveys would be conducted before, during, and after the fishing season to assess whether shifts in, for example, the pollock vertical distribution or school size resulted from fleet activity. In addition, acoustic-buoy work within the areas may help identify particular fish behavioral responses that produced the larger-scaled distributional shifts that may be detected from the survey effort.

Demersal Shelf Rockfish

1. Habitat mapping of the continental shelf and slope is needed to adequately assess species such as demersal shelf rockfish, Atka mackerel, and shortraker/rougheye that are habitat-specific in their distribution

Hydroacoustic/sonar techniques show promise as an efficient means for determining and quantifying bottom relief and substrate type for purposes of habitat identification and stratification. Research is now underway by the AFSC to evaluate the efficacy of a relatively low cost acoustic seabed classification system, the *QTC View*, from the Quester Tangent Corporation. During the summers of 1996 and 1997, extensive at sea testing of this system was conducted in waters off southeast Alaska. Preliminary results look encouraging. This system may prove to be a cost effective way of mapping slope rockfish habitats along limited areas of the continental shelf and slope. Other promising avenues for quantifying habitats on a much larger scale include side-scan and multi-beam sonar approaches. Budgetary constraints are the main obstacle preventing wide use of these technologies for large-scale habitat mapping. Side-scan and multi-beam sonar surveys can be quite expensive. Large amounts of ship time, specialized sonar, computer hardware and software, as well as specialized personnel are needed to carry out the survey and process the survey data.

Atka Mackerel

1. Conduct a pilot survey utilizing commercial fishing techniques to explore Atka mackerel school dynamics and behavior and links to prey, tides, and habitat

Atka mackerel are currently surveyed by the triennial groundfish trawl surveys. Standard trawl and acoustic survey methods are inadequate for assessing the abundance of Atka mackerel, because they exhibit extremely patchy distributions and lack a swim bladder. The distribution of Atka mackerel may be linked to prey availability and oceanographic and habitat features. As a first step towards improving survey methodology for Atka mackerel, the school dynamics must be better understood. A pilot study is proposed to determine life history and behavioral aspects of Atka mackerel that may influence relative availability to fisheries and surveys. This study would be conducted in key Atka mackerel habitat and/or fishery areas with the objectives of 1) establishing procedures for implementation of a cooperative industry survey and 2) conduct sampling in key areas to look at the temporal and spatial distribution

of Atka mackerel, and collect biological information. The main impediment to this study would be funding for support personnel to conduct the pilot study and analyze the samples in the laboratory.

Bering Sea/Aleutian Islands

1. Collect and analyze flatfish maturity, particularly for flathead sole. The intent is to provide other information to estimate natural mortality, to calculate $B_{40\%}$ (spawning biomass), and to improve synthesis modeling. Arrowtooth flounder and flathead sole are pointed out as species where information should be relatively easy to collect since they spawn during the winter when the fishery occurs. Alaska plaice are summer spawners and information could be collected during a summer survey.

The maturity schedule of Bering Sea yellowfin sole has been determined from the histological examination of ovaries collected from NMFS annual trawl surveys. Arrowtooth flounder ovary samples from the Gulf of Alaska were also examined histologically for maturity determination, which serve as a proxy for the Bering Sea stock. The maturity schedule of rock sole has been estimated from anatomical examinations of pre-spawning and spawning rock sole from observer sampling of the rock sole roe fishery. The maturation characteristics of flathead sole and Alaska plaice, however, are unknown. Determining an appropriate harvest rate for these species is critically dependent on having an accurate estimate of the maturity schedule, which describes the probability that a fish of a given size will spawn with a specified time period and also allows for the calculation of the spawning stock size. The constraints on obtaining this needed management information are the personnel to collect and analyze the ovary samples over a sufficient time period to provide an unbiased sample and the money to fund the collection and laboratory activities.

2. Determine if there is differential growth and natural mortality for male and female Atka mackerel

The current assessment assumes a single growth vector for both sexes and constant natural mortality at age. Previous work has shown that growth did not differ by sex, but an updated reanalysis of growth data by sex should be performed. Differential mortality at age should also be explored, and the impacts on appropriate fishing mortality rates discussed. These issues can be explored within the current stock assessment. The main impediment to these analyses is lack of data. The catch-at-age samples are marginal and may not be adequate once they are stratified by sex.

3. Otoliths of Greenland turbot have been collected but not analyzed. Ageing these samples would improve the stock assessment.

In the past few years, the REFM Division Age and Growth unit has developed methods for ageing Greenland Turbot using surface imaging software. The development of this method has been particularly important for aging this species, since their otoliths are very fragile and difficult to process. Analyses of existing otolith collections will

provide further evidence for the growth rate of this species and provide better estimates of the age composition than the current approach of only using size frequency data. What we would like to do is conduct a careful evaluation of ageing methods recently published from the ICES group for the Atlantic stocks, and continue to evaluate the feasibility of the image-analyses approach for production ageing. The constraints are related to priorities and current staffing levels for the Age and Growth unit.

4. Analyze the distribution of POP in the Bering Sea. In previous years, the fishery has occurred west of the Pribolofs, yet survey data from this area are limited. This may be a separate stock unit.

Estimates of current biomass, size composition, and biological data from fishery independent surveys are important ingredients for making reliable stock assessments. These types of information, however, have been lacking for Pacific Ocean perch in the eastern Bering Sea. Pacific Ocean perch are most abundant along the continental slope, yet the last trawl survey of the slope region occurred in 1991. More current survey information is sorely needed. The AFSC should attempt to conduct another trawl survey of the eastern Bering Sea slope region as soon as possible. The main hindrance to conducting such a survey in the past has been due to budgetary constraints.

Enclosed with your letter was a proposal submitted to you by Dr. Oleg G. Zolotov, KamchatNIRO. The Center is currently working on the development of cooperative programs that will facilitate joint U.S.-Russian fisheries research. Several proposals have been prepared, and efforts to obtain funding will be initiated in the near future. While meritorious, we have no intention of funding Dr. Zolotov's project during the current fiscal year.

Sincerely,

James W. Balsiger
Science and Research Director
Alaska Region