NOAA Coastal Ocean Program

FISCAL YEAR 1996 IMPLEMENTATION PLAN

SOUTHEAST BERING SEA CARRYING CAPACITY

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November 30, 1995

Table of contents

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I. Introduction

A. Background

The Bering Sea ecosystem is among the most productive of high-latitude seas, and as such produces large biomasses of fishes, birds and mammals. This productivity is important to the U.S. economy. Fish and shellfish constitute almost 10% of the world and 40% of the U.S. fisheries harvest. Pollock, salmon, halibut, and crab generate over 2 billion dollars each year in fisheries revenue and provide a major source of protein. At present, some Bering Sea fisheries, such as pollock, appear not to be overexploited, although there have been major changes in abundance over the last thirty years. Populations of several species, such as king crab and Greenland turbot, however, are at near historical lows. We do not understand the fragility of the present state of the ecosystem. Pollock, however, plays a singularly important role, and its population historically has varied over a wide range.

The relative importance of natural cycles and exploitation in explaining variability in abundance is a key management issue for the Bering Sea. In addition to perturbations created by human activities, environmental factors are seldom stable and are subject to large scale fluctuations, at times of a regular nature. It is clear that the production of new organic matter, which provides the basis for exploitable fish populations and all other higher trophic level animals, is greatly affected by environmental factors. Questions remain, however, concerning the ecosystem dynamics of the vast Bering Sea shelf that supports this high productivity.

Our conceptual model proposes that juvenile pollock are a nodal species in the ecosystem in utilizing the high primary and secondary productivity and providing food for the pelagic upper trophic level species, including adult pollock. By nodal, we imply that a large fraction of the system energy flow passes through this species population. We plan to focus on pollock in terms of their linkages to other species: to understand interspecific overlaps in feeding habits through various stages of life history, including energy flow into the pollock population and outward flow via predation by other species; to understand synchronized increases or decreases in biomass at different trophic levels that may indicate the co-influence of factors; to study changes in distribution and intensity of secondary productivity as one of the bases for change in year-class strength; and to examine pollock as a key to the large scale changes in productivity of the Bering Sea over the last three decades. As an abundant resource, pollock provides an important measure of the health of the ecosystem.

B. Goal

The goal of SE Bering Sea Carrying Capacity (SEBSCC) is to study the southeastern Bering Sea ecosystem and the role of juvenile pollock in it, including the factors that affect their survival. From this study the project will develop and test annual indices of pre-recruit (age-1) abundance.

C. Objectives

We plan an inclusive approach to implement SEBSCC that engages agencies, groups, and investigators with broad ecological interest in the southeast Bering Sea. The World Wide Web will facilitate exchange of project information, preliminary results and data. With the advice and experience of the Technical Advisory Committee, the Project Management Team will assemble a core research team from proposals solicited from the University of Alaska, other universities and agencies, the Alaska Fisheries Science Center, and the Pacific Marine Environmental Laboratory.

1) Conduct a first-quality scientific program that supports a specific goal to provide critical knowledge needed for formulating policy and management of resources of the southeast Bering Sea ecosystem.

2) Build partnerships and encourage multidisciplinary cooperative efforts among research scientists within the academic community, NOAA, and other agencies interested in the SE Bering Sea.

3) Provide an open process in establishing research objectives and proposal selection to ensure quality and diversity.

Scientific pursuits use four approaches, retrospective analysis, observational analysis, process-oriented studies, and numerical modeling, to examine biophysical domains, juvenile pollock productivity, and relationships between them and the ecosystem of the southeastern Bering Sea.

II. FY 1996 Implementation Plan

A. Background

The southeast Bering Sea shelf is a major region for groundfish, other commercial species, and marine mammals. It contains 50-85% of the pollock biomass of the Bering Sea, depending on authors' estimates. For 1994 this pollock biomass estimate for the SE Bering Sea is ~8 million metric tons (mmt), compared to 0.7 mmt for the Gulf of Alaska. Walleye pollock is a nodal species in the Bering Sea ecosystem, i.e., it dominates the pelagic guild and in its juvenile stage it serves as a major forage fish. Adult pollock are a major commercial asset for the United States. Because population dynamics processes that determine abundance appear to be chaotic, they are especially sensitive to initial conditions. The success of age structured models for pollock in the Bering Sea shows that much variability in year class abundance is established by age two. There appears to be top-down predation control of pollock recruitment, spatial and temporal variability in food supply, and variability in transport processes affecting larval and juvenile pollock. The sequence of survival processes is non-linear.

Southeast Bering Sea Carrying Capacity will test the hypothesis that interannual ocean variability influences the availability of prey, growth rate, predation, and distribution of juvenile pollock and higher trophic level species. Although we already know that ocean variability can influence fisheries, what is not known is how these factors specifically co-occur in the Bering

Sea. We use the phrase "carrying capacity" in a general context as to what limits the potential size of the pelagic guild. From the results of testing these hypotheses we will develop annual recruitment indices for pre-recruit pollock.

B. Objectives for FY 1996

The project has five objectives for the coming year:

1. Refine scientific priorities
2. Recruit research staff
3. Assemble a research council
4. Begin monitoring efforts
5. Begin retrospective and modeling studies

C. Approach

SEBSCC will attain these five objectives by the following approaches:

1. Develop World Wide Web pages exploring the theme of the Southeast Bering Sea. (1st Quarter)

2. Conduct a workshop to define specific 2-year and 5-year research objectives for retrospective, observational, process, and modeling studies. The SEBSCC workshop will attract a substantial group of potential PIs, members of the Technical Advisory Committee, and assembled experts from disciplines associated with ecology of the Bering Sea. (1st Quarter)

3. Release a Request for Proposals based on the SEBSCC Concept Paper, discussion at Workshop, the NRC review of the Bering Sea ecosystem, and the PICES Workshop on the Bering Sea. (2nd Quarter)

4. Evaluate proposals and award selected investigators. (2nd Quarter) Some components would start in FY96 to allow participation in the field season or to begin development of numerical models. Most grants would fund FY97 research starts.

5. Assemble a Research Council. (3rd Quarter)

6. Conduct initial monitoring based on available ship resources and selected proposals for monitoring studies. (3rd, 4th Quarters)

7. Begin modeling and retrospective studies. (3rd, 4th Quarters)

D. Management Structure and Operation

1. The Project Management Team (PMT)

The Project Management Team provides active leadership for the scientific conduct of SEBSCC, maintains financial and project accountability, and directs project administration. A primary function of the PMT is to assemble a multidisciplinary research team for a multi-year investigation of the SE Bering Sea ecosystem. The PMT will assure that balance and integration is maintained among subprojects, and that academic, NOAA, and resource manager viewpoints are included. The PMT, with guidance from the TAC and RC, will prioritize research. The PMT will adjust the mix of investigators during the progress of the study to reflect the evolving needs for observation, modeling, and synthesis. The PMT is responsible for ensuring that integrated results are passed to management organizations.

The primary way for the PMT to achieve the SEBSCC research and management goals is through clear guidelines of accountability. The PMT will act as COTRs (monitors) on the accepted proposals. The expertise within the PMT includes integrative approaches to modeling fisheries stock structure, lower trophic process-oriented research, and a regional oceanographic approach. The PMT also balances a research orientation with a NOAA perspective of providing scientific products to the North Pacific Fishery Management Council. The PMT members will not directly compete for funds from the program, and will receive one month of salary compensation.

All members of the Management Team agree to undertake the following:

a) Actively manage the scientific conduct of this research.
b) Participate in meetings for planning and coordination of the program.
c) Evaluate and report on interim progress and steps required to meet the project objectives.
d) Prepare annual implementation plans.
e) Ensure that quality-controlled data are made available to other investigators in a timely manner.
f) Participate in synthesis and interpretation of research results and the development of products of value to environmental and scientific communities.
g) Participate in selected fora to encourage communication between the resource management and scientific communities.
h) Encourage the publication of research results in the peer-reviewed literature for the benefit of the marine scientific community.
i) Prepare a data management plan and schedule.

2. Technical Advisory Committee (TAC)

The TAC provides independent oversight to the PMT. Members review the science implementation plan and suggest how to better coordinate the program to meet its goal and objectives. They also provide peer-review of proposals.

3. Research Council

The Research Council will consist of project-funded Principal Investigators (the science team) and Associate PIs. The Associate PIs, although not directly funded through the Coastal Ocean Program, will be scientists with a major interest in the SE Bering Sea ecosystem. The Council provides a forum for exchange of information on the multidisciplinary aspects of the SE

Bering Sea. Several smaller interdisciplinary scientific working groups are expected to evolve from the Research Council. A representative subgroup will work with the PMT and the coordinators on field operations. The continuity of the Council will provide for extensive cross-disciplinary cooperation.

4. Project Coordination and Communication

SEBSCC will support a small office to coordinate communication among 1) project investigators, 2) other agencies and researchers studying the SE Bering Sea ecosystem, and 3) NOAA's Coastal Ocean Program and National Marine Fisheries Service. Products provided are data management, World Wide Web theme page, personnel directories, seminar series and announcements, publication and presentation lists, reports and documents, minutes of meetings, production of conferences and workshops, a graphic archive, and cruise plans and schedules. This office will maintain a catalog of investigators, and encourage interdisciplinary contact among investigators.

E. Proposed Budget

The first year of funding for SEBSCC is proposed to be $500K. The budget is divided into two parts: Management and Research. Project Management ($90K) will provide for PMT activities, the planning workshop, advertisement and selection of proposals, communications, and formation of the Research Council. Research contracts ($410K) will be awarded to principal investigators for two or three-year proposals beginning in spring 1996 to address retrospective studies, modeling, or monitoring.

Project Management	
Project Management Team	$30K
Planning Workshop	$30K
Science Policy and Management Interactions	$30K
Research	
Retrospective Studies/Synthesis	$100K
Monitoring	$210K
Modeling	$100K
TOTAL	$500K

III. <u>Outlook</u>

The 1970s and the 1980s were marked by dramatic changes in abundance for many groups of upper-trophic level species. Populations of piscivorous seabirds, such as murres and kittiwakes, underwent significant declines. Similarly, estimates of Steller sea lions and northern fur seals show a declining trend, particularly in the 1970s. Biomass of adult walleye pollock decreased during the 1970s, increased in the 1980s, and has approached a median value in the 1990s. The common link between these upper-trophic level predators is their reliance on juvenile walleye pollock as a food source.

Information on eastern Bering Sea pollock and its interactions with the remaining ecosystem will include population estimates and time series of regional biophysical parameters and research results. One program goal for the end of six years (five years plus a start-up year) is to provide improved knowledge of the Bering Sea ecosystem and the role pollock play within it. A second program goal is to develop and test annual indices of survival for pre-recruit pollock in the eastern Bering Sea. The FOCI program has successfully provided such indices for Shelikof Strait for the previous three years. As intermediate results become available, they will be forwarded to appropriate management and policy groups. Specification of these intermediate objectives will be a result of the 1996 workshop.

Information from SEBSCC will increase the ability of the North Pacific Fishery Management Council (NPFMC) and International Convention on Conservation and Management of Pollock Resources in the Central Bering Sea to improve the reliability of traditional fisheries assessment methods, evaluate alternate management approaches, anticipate changes in the environment, and balance fisheries and other environmental/economic concerns. The research results involving

short-term forecast of walleye pollock recruitment will be incorporated into stock assessments used by AFSC to recommend allowable biological catch (ABC) estimates to the Council. Other research results involving factors influencing horizontal and vertical distribution of juvenile walleye pollock to upper trophic level predators would assist Council decisions regarding restriction of fishing around marine mammal rookery areas. Results on the relative contributions of various pollock sub-stocks to successful recruitment into the eastern Bering Sea fishery could also be useful in formulating management options for the timing and location of pollock fishing. The NPFMC is attempting to move in the direction of ecosystem management and information provided by SEBSCC will expedite this effort by improving knowledge of the role of pollock in the SE Bering Sea ecosystem.

Sustainable Fisheries is the first goal listed in NOAA's Strategic Plan. Southeast Bering Sea Carrying Capacity meets the requirement of the Advance Fisheries Prediction element of the Strategic Plan: The Bering Sea is a major ecosystem and economic resource where there is a large year-to-year pollock recruitment and upper-trophic level variability which is not well understood. SEBSCC's proposed management structure is a proven NOAA-academic-international partnership, effective in providing scientific leadership and subsequent transition to management.

A. Annual Steps

SEBSCC will conduct an annual workshop of investigators to facilitate the exchange and synthesis of scientific results, to promote the formation of small working groups, and to facilitate planning of scientific operations. As necessary, the PMT with the guidance of the TAC will refocus the scientific focus and mix of investigations. The project will develop a product that will help manage resources of the Bering Sea: an index of juvenile pollock abundance. Steps in this process, exploratory hypothesis testing, development and testing of the index, are distributed chronologically throughout the life of the project. To support research, SEBSCC will deploy biophysical platforms measuring a suite of atmospheric, oceanic, and biological information. Measurements from these platforms are used by themselves and are adjunct to information determined on annual spring through fall cruises documenting developmental stages of pollock and their environment.

	FISCAL YEAR					
	96	97	98	99	00	01
Workshop	*	*	*	*	*	*
Proposal Cycle	*		*			
Exploratory Hypothesis Testing	I ---------- I					
Develop Survival Index		I ---------- I				
Validate Survival Index					I ---------- I	

Measurement Program

Biophysical Platforms	I -- I	I -- I	I ---I	I---I	I -- I	I -- I
Larval Ecology Cruises	I I	I I	I I	I-I	I I	I I
Juvenile Ecology Cruises	I I	I I	I-I	I I	I I	I-I

B. Collaborative Planning

Southeast Bering Sea Carrying Capacity will be a highly leveraged program. It plans to work collaboratively with ongoing research by other National Marine Fisheries Service (NMFS) programs examining pollock resources and ecology of the Bering Sea (fishery acoustics group, stock assessment group, and Marine Mammal Protection Act Studies), programs at the University and State of Alaska, EPA, Shelikof Strait FOCI, Japan Far Seas Fisheries Laboratory, Ocean Research Institute of Tokyo University, Faculty of Fisheries, Hokkaido University, the Japanese Marine Science and Technology Center, Tokai University in Sapporo, Tohoku National Fisheries Institute, Korean Ocean Research and Development Institute and the Institute of Marine Biology, Far East Branch of the Russian Academy of Sciences. We will also coordinate with the inhabitants of St. Paul Island. We will promote collaborative research with the ONR, NSF, and NASA. Marine mammalogists from the AFSC, ornithologists from the University of California-Irvine, and bioacousticians from the Southwest Fisheries Science Center (NMFS) and Scripps Institute of Oceanography are already collaborating on ecosystem studies as part of a sister project, Bering Sea FOCI. An example of existing leverage is that Japanese researchers are providing facilities for Bering Sea FOCI aboard two cruises in the early summer of 1995; future collaborative work is being planned for SEBSCC in 1997. When combined with NOAA cruises, this will allow several larval cohorts to be followed through their period of maximum mortality. There is ongoing University of Alaska Fairbanks and Hokkaido University collaboration on climate change and Bering Sea productivity. Japanese researchers (JAMSTEC) also are cooperating with University of Alaska scientists in research on the northern Bering Sea and Chukchi Seas in consort with Russian participants, and are providing financial support for ship time. Southeast Bering Sea Carrying Capacity will be considered a component in the PICES-GLOBEC Climate Change and Carrying Capacity (CCCC) Program.

C. Projected Resource Issues

SEBSCC will require at least 50 days of NOAA fishery research vessel (Miller Freeman) and 30 days of Class I vessel time each year, 1996-2001. Cruises need to coincide with ecosystem events such as the spring bloom and with larval and juvenile life stages of walleye pollock.

Appendix. Personnel

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