


MEMORANDUM

TO: Council, AP and SSC Members

FROM: Clarence G. Pautzke 
Executive Director

DATE: January 8, 1992

SUBJECT: Research Priorities

ACTION REQUIRED

- (a) Review recommendations from Plan Teams and forward to NMFS.
- (b) Review University of Alaska fisheries research initiative.

BACKGROUND

Research Priorities. In October 1988, NMFS requested Council input on research priorities of 1989 to be included in their budget planning process. This has become an annual request and the Council developed a policy for the development of research priorities (Item C-7(a)).

The crab and groundfish Plan Teams have developed a list of priority research topics. This is attached as item C-7(b). Please note that these are areas of general research characterized by a lack of adequate information, as opposed to specific topics. All would require continuing attention and effort over an extended period of time. Consequently, research budgets were not prepared and the cost estimates provided could vary widely depending on the techniques and the level of research undertaken.

UA Fisheries Research. Dr. Vera Alexander, Dean of the School of Fisheries and Ocean Sciences, will give a presentation on a new budget initiative by the University of Alaska to study multi-species fisheries, fisheries oceanography, and fishing gear and technology. She is seeking a letter of support from the Council for the initiative. A synopsis of the program is under C-7(c).

NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

Policy on Development of Research Priorities*

The Council adopted an annual schedule for the development of fishery research priorities. The following schedule is intended to provide NOAA Fisheries with the Council's research priorities as they prepare their agency budget and research plan.

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| Early September | Plan teams prepare list of research topics. These topics would be influenced by ongoing research programs, stock assessment surveys, problems with management of fisheries, industry proposals, and prior Council discussion. |
| October | Research topics are more fully developed and costs estimated (this work could be performed by the plan teams and representatives of NOAA Fisheries (Alaska Region), Alaska Fisheries Science Center, and the Alaska Department of Fish and Game who are knowledgeable with the proposed work). |
| November | Plan teams review topics, finalize list and make priority recommendations. |
| December | Recommended research priorities are presented to the Council, SSC and NOAA Fisheries Regional Office for review. |
| January | Council reviews research topics and comments, and develops their priority recommendations. |
| Late January | Council recommendations for fishery research are forwarded to the NOAA Fisheries Regional Director for use in preparing its annual budget. |

The long lead time in the NOAA Fisheries budget planning process means that major research initiatives approved by the Council in January of one year will not be incorporated by NOAA Fisheries until two years later.

*Approved in January 1989.

**PRIORITY RESEARCH TOPICS
GULF OF ALASKA AND BERING SEA/ALEUTIAN ISLANDS
GROUNDFISH PLAN TEAMS**

November, 1991

The following research areas are recommended by the Plan Teams. The list is not in priority order. These are areas of general research, as opposed to specific research topics. Each area is characterized by a lack of information, but is broad in scope. Consequently, specific research budgets were not developed. The estimated costs associated with research in each area could vary dramatically depending on the techniques employed and the level of research undertaken. Several areas represent long term projects that could be candidates for S-K or Sea Grant funding at various universities. Other topics will likely be carried out at some level under existing programs.

Ecological and Stock Analyses

1. Mortality estimates for bycatch species in each fishery, particularly halibut and sablefish.

An initial approach could consist of analysis of halibut condition data which will be recorded routinely by the new domestic observer program. To include the collection and analysis of condition data for sablefish would require an additional \$10,000 to \$20,000. A more conclusive answer to these questions would best be accomplished by a dedicated research program including tagging programs on survey vessels. Such a program would cost approximately \$150,000.

2. Pollock life history information and improved stock assessment techniques. The Teams endorse research which will provide better information on stock structure and distribution, spawning areas, annual stock production, egg/larvae transport, short and long-term movement, and stock mixing. Areas of specific concern include simultaneous acoustic and trawl surveys in the Central Gulf to better estimate stock strength in that area and additional studies regarding the impacts of continued fishing in the international waters of the Bering Sea on stocks in the U.S. EEZ.

3. Improve techniques and expand capacity for aging sablefish, pollock, and cod.

Field validation of aging techniques require long term research projects. Costs would be on the order of \$200,000 per year.

4. Expanded ecosystem studies of the Bering Sea/Aleutian Islands and the Gulf of Alaska, particularly survey and assessment activities aimed at better identifying predator-prey relationships. Inter-relationships of greatest interest are those between Pacific cod and crab, and those between marine mammals and various fish species.

Expanded survey and assessment work focussing on forage species could be facilitated through expansion of surveys currently addressing commercially valuable species and age classes. This expansion would be on the order of hundreds of thousands of dollars annually. Additionally, for addressing predator roles of commercial groundfish species, collection of stomachs could be carried out through the observer program. Examination of stomach contents and analysis of data would require additions to existing programs of between \$50,000 and \$150,000 annually, for a small number of subject species.

5. Biomass estimates for rockfish throughout the Gulf of Alaska, Bering Sea and Aleutian Islands.

The development of new techniques for rockfish biomass assessment would probably require survey vessels dedicated to rockfish (rather than the current multi-species surveys that are carried out triennially). Cost would be on the order of \$500,000 to \$700,000 annually.

6. Techniques for better assessment of Atka mackerel in the Aleutian Islands.

As with #4 above, costs for a dedicated research effort would likely be on the order of \$500,000 annually. Costs of this survey could be defrayed by combining with #5

7. Marine mammal investigations focusing on marine mammal dependence on commercial fish stocks and quantification of the impacts of commercial fishing on marine mammal populations through direct mortality, disturbance, and commercial harvesting of marine mammal prey species.

Substantial costs could be expected to be incurred by the commercial fisheries if experiments incorporating various reductions in current levels of exploitation are designed. Additional programmatic costs would include expanded field surveys to accurately assess changes in mammal populations and additional analytic personnel. These costs would be in the range of \$50,000 to \$250,000 annually.

8. Improved bathymetric mapping in the Gulf of Alaska, especially the eastern portion, to assist rockfish stock survey planning and implementation. The National Ocean Service should be requested to undertake this work as this agency is best equipped to do so.

Economic and Fisheries Analyses

1. Economic studies of the total value of Alaskan fishery products, including processing, marketing, retailing and consumer demand.

Such a study could probably be conducted over an 18 month period at a cost of approximately \$100,000.

2. Compile and analyze data contained in fishing log books to provide fishery performance information to the industry.

3. Collection and analysis of operation cost data for all groundfish fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska.

Such research has already been initiated for some segments of the trawl fleet. A dedicated research effort over the course of one year would require a budget of approximately \$60,000.

4. Economic impact of Alaskan harvests on the world market, including price impacts of changes in foreign and domestic supplies and demand. Estimated cost of such a project would be \$200,000 over 2 years.
5. Economic evaluation of the consequences of various bycatch management alternatives.
6. Net fishing efficiency studies, including effectiveness of various trawl operations in terms of area swept versus retained catch, fish avoidance, etc.
7. Effects of trawl mesh size on catch and size composition of pollock and other species in order to minimize catch of undersize fish.
8. Economic effects on groundfish fisheries of marine mammal competition, marine mammal incidental take, and marine mammal avoidance regulations.

1991 FEDERAL BUDGET INITIATIVE

CRAB PLAN TEAM

TITLE: Bering Sea/Aleutian Islands Crab Stock Structure, Life History and Survival.

BUDGET: \$600K annually for 7 years

PROBLEM STATEMENT: Essential information on stock structure, life history and survival is unavailable for several species of king and Tanner crabs in the Bering Sea and Aleutian Islands (BS/AI). Until these information gaps are filled, rational management of BS/AI crab stocks will remain only a concept. We manage multimillion dollar fisheries without knowing the underlying stock structure. Accurate definition of stock structure is requisite if we are to avoid overly conservative management and instability in crab quotas that result in dislocation of the fishing industry. Survival of crab through capture, handling and return to the sea and life history data such as natural mortality, size at maturity, fecundity, mating parameters and growth are unknown for several species of crabs. These basic data are needed to project estimates of abundance, insure adequate reproductive capacity of crab stocks, avoid overfishing and fulfill the mandates of the federal fishery management plan for BS/AI crab stocks.

METHODOLOGY/APPROACH: Refinement of the Bristol Bay red king crab stock structure will be continued through a pilot mitochondrial DNA study and additional electrophoretic allozyme analyses. Stock structure will be determined for snow, Tanner and golden king crabs through electrophoretic allozyme analysis and expansion of mtDNA work to these species. Data from ongoing tag recapture studies will be analyzed to determine mortality, size at maturity, fecundity, and growth of Adak and Dutch Harbor golden king crab. A study of Red king crab mating will be conducted. A tag recapture program will be implemented to provide similar life history parameters for Bering Sea snow crab in addition to investigating the occurrence of terminal molt. Survival of snow, Tanner and golden king crab through capture, handling and return to the sea will be investigated through laboratory experiments. Pot gear studies will be conducted to reduce capture and handling (increase survival) of sublegal males, females and other bycatch species while optimizing yield.

SPECIFIC PROJECTS:

1. **Stock Structure:** It is imperative that broadly distributed stocks be distinguished from clusters of restricted stocks. Determination of stock boundaries and gauging of stock status (e.g., depressed, healthy) are necessary to estimate stock abundance and productivity, two prerequisites for sound management strategies. Electrophoretic analysis will be used to distinguish reproductively-isolated stocks of red and golden king crabs, snow and Tanner crabs in the BS/AI area. Tissue samples have been collected for all species of interest except golden king crab. Funds would permit analysis and additional collection of tissue samples for red king crab, snow crab and Tanner crab. A sampling program for golden king crab would be initiated and samples analyzed. Funds will be used to apply mitochondrial DNA (mtDNA) analysis to all BS/AI crab. MtDNA analyses reflect maternal-only inheritance, and because of the rapid rate of evolution of mtDNA, have the possibility of distinguishing closely related groups indistinguishable by allozymes. Several such groups occur within geographic areas of Alaska where auxiliary evidence exists that the groups are composed of multiple stocks. When mtDNA is used together with allozyme analysis, the two techniques are very effective in detecting not only the presence of hybrids, but the direction of hybridization (i.e. what species was the maternal parent). In the BS/AI area, Tanner and snow crabs interbreed and produce a hybrid crab. Management of hybrid crabs would benefit from mtDNA analysis.

Cost: \$100K annually for 7 years.

2. **Life History:** Life history characteristics of golden king crab and snow crab are the least understood of the crab species in the BS/AI area. Information on mating of red king crab is also lacking. Data on mortality, size at maturity, fecundity, mating and growth are indispensable for accurate estimation of abundance. These data enable modeling of future harvestable portions of the stock and tracking of the reproductive segment. Both are necessary components to avoid overfishing. Funds will provide for laboratory mating studies of red king crab and analysis of data currently collected for golden king crabs to estimate life history parameters and crab distribution by depth. A tag-recapture program will be implemented for snow crab during the National Marine Fisheries Service annual survey to estimate mortality. Data relevant to estimation of life history parameters will also be collected and analyzed.

Cost: 50K annually for 2 years for red king crab mating
100K annually for 3 years for golden king crab
500K annually for 4 years for snow crab

3. **Survival:** Survival of crab through the fishing process can be evaluated as a direct impact such as that from capture, handling

and return to the sea and as an indirect impact by avoiding the harmful effects of capture altogether. Optimization of yield from populations depends on accurate assessment of mortality including that experienced by crab that fail to survive encounters with pot gear. In areas where intense commercial fishing activity coincides with depressed populations of legal sized crabs, sub-legal and female crab may be subjected to repeated capture and handling. Multiple capture and handling has been documented to be lethal in Dungeness crab. Accounting for crab loss due to capture, handling and return to the sea is essential for specifying total fishing mortality. Reducing retention of sublegal and female crab in pots through innovative gear design would minimize the deleterious effect current gear imposes on crab. Funds will provide for investigation of handling mortality in golden king crab, snow crab and Tanner crab. Laboratory simulation of capture, handling and return of crabs to the sea will be conducted to estimate potential mortality rates for female and sublegal crab. Impairment of growth, feeding rate, and reproductive capacity of females will be investigated. Gear studies will be initiated to develop a design that minimizes the capture of females and sublegal male crab, other crab species and fishes while striving to optimize yield of target crab species. Pot gear will be designed and tested for red and golden king crab, snow and Tanner crab.

Cost: \$150K annually for 2 years for handling mortality
\$200K annually for 2 years for gear design




School of Fisheries and Ocean Sciences

UNIVERSITY OF ALASKA FAIRBANKS

Fairbanks, Alaska 99775-1080

MEMORANDUM

TO: Dr. Clarence Pautzke, Executive Director
North Pacific Fisheries Management Council
FAX 907/271-2817

FROM: Vera Alexander, Dean 
School of Fisheries and Ocean Sciences

DATE: January 3, 1992

SUBJECT: Budget Increment Request

I am sending a short description of the basic elements of the University of Alaska fisheries budget increment request for FY93. This was abstracted from a rather large package put together at the request of then-Chancellor Pat O'Rourke, who had promised to float a \$2 million special increment as part of his commitments when I accepted the Deanship. Of course, it didn't work out, for a number of reasons. The elements of the package which remain here are among those which have been endorsed by the Advisory Council of the School of Fisheries and Ocean Sciences, by the FITC Policy Council and by the Seafood Processor's Association. The budgets as they remain are inadequate, and can only be considered "seed" money.

It seems to us that the University's contributions can be effective in the area of long-term dynamics of fish stocks, because this is an area requiring sustained multi-disciplinary effort (Element II). On a more short-time-frame basis, the current management assistance rendered by the fisheries faculty can be enhanced - i.e., Terry Quinn on population dynamics, Tony Gharrett on genetics and Bill Smoker of salmon problems, and our production of students with Alaskan experience enhanced (Element I). Finally, the FITC has the capacity to provide assistance with immediate problems in a broader area than currently possible, and the new Fishing Technology Program would be a step in the right direction.

Alaska State Fisheries Needs and the Potential Role of the University of Alaska

Fisheries is a major force in Alaska's economy, and it is imperative that the education and research needed to support and enhance this activity be available within Alaska. None of the other 49 states even approaches Alaska's marine endowment in terms of coastline and continental shelf. Renewable marine resources play a dominant role in the economy of Alaska, a role which has potential for even further expansion. There has been a move from primarily foreign fisheries towards an entirely United States fishery within the 200-mile exclusive economic zone, and changes in the nature and management of Alaska's fisheries over the past decade have strengthened the economic potential of fisheries to Alaska and increased the need for training and knowledge.

The University of Alaska Fairbanks is committed to developing an outstanding program in fisheries and marine science to address these needs. The School of Fisheries and Ocean Sciences is already providing trained personnel for Alaska, but is not able to satisfy the needs. Over the last few decades, the University has developed a strong teaching and research program in oceanography, marine biology and fisheries science. Our scientists are working with the seafood industry to assist in product development, and with federal and state agencies to provide information for management.

There are a number of critical fisheries issues which involve management and enhancement. An improved understanding of fisheries science is essential for the development of better fisheries management strategies and for assisting in enhancement. A great deal of work remains to be done on the factors which affect the health of Alaska's wild fish stocks. The relationship of fish stocks to environmental and economic influences is one critical area, and coordinated oceanographic, marine biological, fisheries and fisheries economics studies are needed to address this issue, through long-term multidisciplinary programs. International cooperation also is essential for such studies of marine ecosystems, since the oceans are a continuum and do not recognize territorial boundaries. The international North Pacific convention, PICES, will enable such work, and the University of Alaska will be involved in the evolution of the program.

Given optimal management and maintenance of the fish stocks, we must still effectively harvest the stocks and produce high quality products. Here, too, there are severe constraints. The effect on fisheries of by-catch issues is extreme, and has recently resulted in abbreviated seasons and greatly reduced take. A gear technology research program, therefore, is a high priority area for immediate development, while continuing the present program on seafood quality.

These enhanced research activities must develop in parallel with strengthened academic programs at the undergraduate and, especially, at the graduate level. There is a ready market for graduates in fisheries, and the University of Alaska needs to increase the output of trained fisheries scientists to meet the Alaskan need.

This support will allow immediate expansion of effort into areas necessary for improving the competitiveness and economic benefits of Alaska's fisheries.

The Elements of the Request:

L. Fisheries Resources: A Program Addressing Alaskan Multi-Species Fisheries Issues

Today, Alaska's most critical fishery issues involve management and enhancement. Conflict is a major constraint. Current examples of this include the marine mammal/pollock fishery issue and the by-catch issue, both of which have the potential for severely constraining fishing. The University, as an objective entity, can examine issues and assist in their resolution, and in particular, provide the knowledge for rational decisions and resolutions.

Many such issues can best be addressed through improved understanding of fisheries science, which in turn requires the advanced training of students and expanded research. Fisheries science, in this context, includes studies and training in recruitment, age structure, life history, age at maturity, natural mortality, population dynamics, stock identification, predator/prey relationships, reproductive biology, bio-energetics, and physical oceanographic interactions with biota, among others. The outcome would be development of strategies for better management (e.g. allocation, exploitation policies, by-catch and interception) and assistance in fisheries enhancement (including spawning, nutrition, and broodstock development). The program would incorporate contemporary techniques in molecular biology as well as state-of-the-art quantitative methods in population dynamics and modeling.

Without question, the strength of Alaska's seafood industry rests on the health and continued production of the State's wild stocks. Almost without exception, the management of these resources has followed the classic "population dynamics of exploited stocks" models pioneered in the European fisheries. These management tools generally ignore the fact that production is also affected by environmental events occurring during various phases of the life history. One solution is to examine critical periods in the developmental stages of fishes and shellfishes (thought to occur mostly in early life history) and ascribe subsequent growth and survival in terms of physical and biological interactions. The research needs are extensive, and such focusing will be necessary. This approach will provide more representative and predictive harvest and management models/tools. This program will operate through a cooperative partnership with state and federal agencies and industry.

This increment includes:

• Faculty salaries and support (18 months) faculty position in fisheries ecology, benefits and support	\$60,000
• Graduate student support to provide the opportunity for training graduate students through research and instruction, includes stipend, tuition and fees, and limited travel for 3 students	60,000
• Vessel support to provide for leased vessels for faculty, staff and students to conduct fisheries research and education in fisheries science	10,000
• Lease and upgrade of space to procure adequate space in support of the program, pending a long-term solution to the facilities needs for fisheries research and education	20,000
SUBTOTAL	\$150,000

The faculty position will be for the Juneau Center, School of Fisheries and Ocean Sciences, as will the majority of the graduate students, although some of the work will actually be conducted in the Bering Sea and Kodiak area in addition to southeast Alaska. The space rental and upgrade will be for the Juneau Center.

II. Launching a Decade of Fisheries Oceanography Studies - the Bering Sea and Gulf of Alaska

A serious gap in our understanding relates to the relationship between the oceanic environment and fisheries resources. As a result, we cannot progress in our management approaches, and, furthermore, will be totally unprepared to address the issue of the effects of global change; even year-to-year variability provides an insoluble problem. Oceanographic data collected in conjunction with fisheries and marine biological observations through a carefully coordinated, integrated experimental design, is needed to understand the factors affecting fisheries resources. Such a program must be multi- and inter-disciplinary, and involve long-term intensive research on the biological, oceanic and climatic interactions which affect fish stocks. The interannual and longer period resource fluctuations in response to environmental forcing should be a major focus. The resulting knowledge will provide insight into recruitment of fish stocks, resource distribution, the role of environmental impacts, and natural environmental variability. The research will also provide knowledge needed to understand and predict the influence of major climatic changes. Past successful marine ecological research has demonstrated the University of Alaska's capability to contribute in this area. In addition to providing knowledge needed for management of marine ecosystems such programs are highly effective for training graduate students.

Marine mammal populations and their interaction with fisheries resources is also critical currently, especially in relation to the Alaskan sea lion population crisis. The School of Fisheries and Ocean Sciences has, in addition to fisheries scientists and oceanographers, an excellent cadre of marine mammal specialists available to work with fisheries scientists to address such problems.

The potential for international cooperation with Pacific Rim nations, especially the USSR and Japan, is great. This research program will probably fit within the PICES agenda. PICES is a new international consortium, the "North Pacific Marine Science Organization" established to promote and coordinate marine scientific research in the northern North Pacific Ocean and the Bering Sea. Research will focus on the ocean environment and its interactions with the land and the atmosphere, its role and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities. Such studies relate not only to the effects of fishing and environmental change on fish stocks, but also to such issues as the impacts of oil spills and other forms of pollution and the eventual consequences of climate change on uses of the ocean and its resources.

Alaska-focused research of this scope under current funding is impossible. The majority of the School of Fisheries and Ocean Sciences budget derives from federal sources aimed at specific projects. This does not allow for broad-based fishery/oceanography programs requiring multi-year continuity. The major fisheries federal agency, the National Marine Fisheries Service, is underfunded even to carry out its legal obligations and cannot support the basic oceanic research needed as a basis for management. Without investment by Alaska, the State's need for knowledge cannot be satisfied.

Funds requested under this increment include:

- Faculty salaries \$60,000
to provide faculty a time to conduct this program, working with federal and state entities such as the National Marine Fisheries Service and ADF&G. It will allow development of new Pacific fisheries research
- Graduate student support 80,000
to allow student participation in thesis research in conjunction with the program. Stipends, tuition and fees for four students

• Vessel support (R/V ALPHA HELIX and future vessel currently under design - 10 days at sea)	150,000
and	
• Travel and lodging (students and staff) to coastal sites and associated expenses	10,000
SUBTOTAL	\$300,000

This budget includes support for SFOS faculty based in Fairbanks, Seward, and Juneau. The ship operations support would be provided by the Seward Marine Center. States are expected more and more to provide support in part for oceanographic vessels assigned to them.

III. A New Fishing Gear and Fishing Systems Program in Support of Technological and Economic Development

Seafood consumption in the U.S. is steadily increasing. The per capita consumption in 1989 was 15.9 lb and it is expected to reach 20 lb by the year 2000. Each pound per capita increase will require an additional 750 million pounds of raw fish and shellfish. We are already seeing greater pressure being applied on Alaska's fisheries resources and it has surfaced as an explosive gear conflict.

During 1989 and 1990, halibut by-catch was responsible for the early closure of bottomfish fisheries in the Gulf of Alaska and Bering Sea. As a result, major bottomfish allocations went unharvested. Halibut by-catch is responsible for a 1990 temporary closure of the Gulf of Alaska to longline blackcod fishing when the cap was exceeded. Similarly, bottom trawling in the Gulf of Alaska was prohibited on November 21, 1990 due to attainment of the 2,000 mt halibut by-catch. Such closures have a major impact on the fishing community as well as on the delivery to shore-based processing plants.

To gather background information, Dr. John French of the Fishery Industrial Technology Center recently visited the Department of Agriculture and Fisheries for Scotland Marine Laboratory at Aberdeen, Scotland, where he discussed research opportunities in fishing gear technology and fish/fishing gear interactions and inspected the facilities. Based on the Aberdeen plan, initial staffing for the FITC program should consist of three positions: a fish behaviorist, a gear technologist, and an instrument specialist. In our case, we will need to develop the facilities and program in consort. In the beginning we will fill two positions, including an expert in fishing gear technology hired to develop comprehensive seafood harvesting technologies best suited for Alaskan waters. The initial charge will be to devise feasible solutions to minimize wastes and discards in all fisheries.

The fishing gear technologist will undertake research and training in modern fishing gear design, construction, vessel rigging, and fishing methods. Research will include developing fishing gear and fishing technology for modern vessels and evaluating and adapting new technologies to the requirements of the Alaskan industry. Immediate research is needed on developing selective fishing gear, and, as mentioned above, reducing the halibut by-catch by trawl and longline fisheries. The fishing systems technologist will have the responsibility of conducting research on the physical operation, engineering and design, and hydrodynamics of fishing gear and vessels. He/she will conduct research on improving fishing vessel machinery and propulsion systems to maximize efficiency and minimize labor, and will train fishermen in the selection and layout of systems for each intended fishery.

This will be a major new initiative for the Fishery Industrial Technology Center in Kodiak, and will represent only the first step in the development of this new program. The FITC long-range plan has identified this program as the next priority; the FITC Policy Council has endorsed this priority, and the urgency to begin implementation is increasing with the current problems faced by Alaskan fisheries.

This request includes:

• Faculty salaries (18 months) to add new faculty positions in fishing gear and fishing systems technology. Includes 9 month salary, benefits and basic support for two positions	\$120,000
• Equipment purchase to provide specialized equipment and monitoring instruments	70,000
• Lease of gear, vessels and space to procure fishing gear, charter vessels and provide work space in support of the program	60,000
SUBTOTAL	\$250,000

BUDGET REQUEST SUMMARY

I. Fisheries Resources Program	\$150,000
II. Marine Systems/Fisheries Oceanography	300,000
III. Economic Development	250,000

TOTAL REQUEST	\$700,000
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