US-USSR
JOINT FISHERIES RESEARCH IN THE NORTHWEST ATLANTIC
1967-1976

Woods Hole, Massachusetts
November 1, 1976

US DEPARTMENT OF COMMERCE
Elliot Richardson, Secretary

National Oceanic and Atmospheric Administration
Robert M. White, Administrator

National Marine Fisheries Service
Robert W. Schoning, Director

A message from the Administrator of the National Oceanic and Atmospheric Administration on the occasion of the tenth anniversary of US-USSR cooperative fisheries research in the Northwest Atlantic.

I wish to extend my sincere congratulations to the Directors and staff of the Northeast Fisheries Center and the Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO) for the successful completion of a very productive decade of joint US-USSR fisheries research in the Northwest Atlantic. In particular, I wish to express appreciation for the hard work and cooperation by the scientists, officers, and crews of the numerous research vessels which have taken part in joint cruises since 1967. These cooperative cruises helped lay the groundwork for a significant new approach in the assessment of fish stocks--namely, the development of a research vessel survey program which can provide quantitative annual inventories of the structure, biomass, and distribution of finfish resources.

These inventories proved invaluable in helping the US and USSR conserve and manage the Mid-Atlantic fisheries. But even more important, the joint US-USSR studies served as a model for the development of a coordinated survey program for the International Commission for the Northwest Atlantic Fisheries (ICNAF). Research vessel data on species distribution and abundance, particularly pre-recruit indices, have now become a vital and integral part of the data base used for stock assessment for the entire ICNAF area.

It is my sincere hope that future cooperative studies between the United States and the Soviet Union in the world oceans can be carried out as successfully and smoothly as have the joint studies by the Northeast Fisheries Center and AtlantNIRO. My congratulations to all for a job well done.

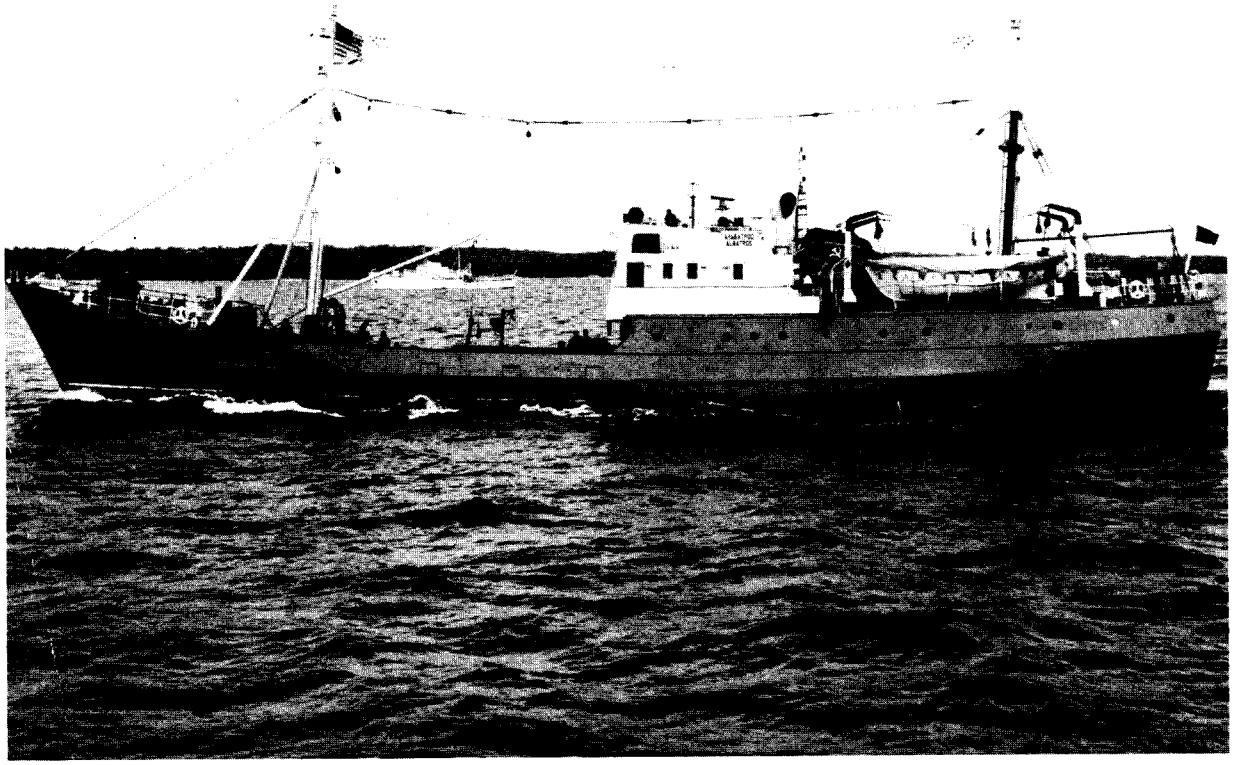
Robert M. White
Administrator
National Oceanic and Atmospheric Administration

CONTENTS

Page

INTRODUCTION 1
BOTTOM TRAWL SURVEYS 5
TRAWL TESTING AND COMPARISONS 7
ADDITIONAL STUDIES 9
BENEFITS 13
APPENDIX A — JOINT FISHERIES RESEARCH CRUISES 19
APPENDIX B — SCIENTIFIC PERSONNEL INVOLVED IN JOINT FISHERIES RESEARCH CRUISES 21
APPENDIX C — MAJOR PAPERS GENERATED BY THE JOINT FISHERIES RESEARCH PROGRAM 23

An attempt was made to include all individuals, papers, and vessels in the respective descriptions. An apology is extended for those unintentionally omitted.



ALBATROS, a side trawler and first Soviet vessel to visit Woods Hole. This same class of vessel conducted the US-USSR joint bottom trawl surveys until 1973 when BELOGORSK, a factory stern trawler, took over the task.

INTRODUCTION

On September 18, 1967, the American research vessel ALBATROSS IV departed Woods Hole and rendezvoused in the Vineyard Sound fog with the Soviet research vessel ALBATROS. Research vessels from the United States and the Soviet Union had thus joined forces for the first time for fisheries research. This cooperative cruise launched a successful joint US-USSR fisheries research program in the Northwest Atlantic Ocean which lasted a decade.

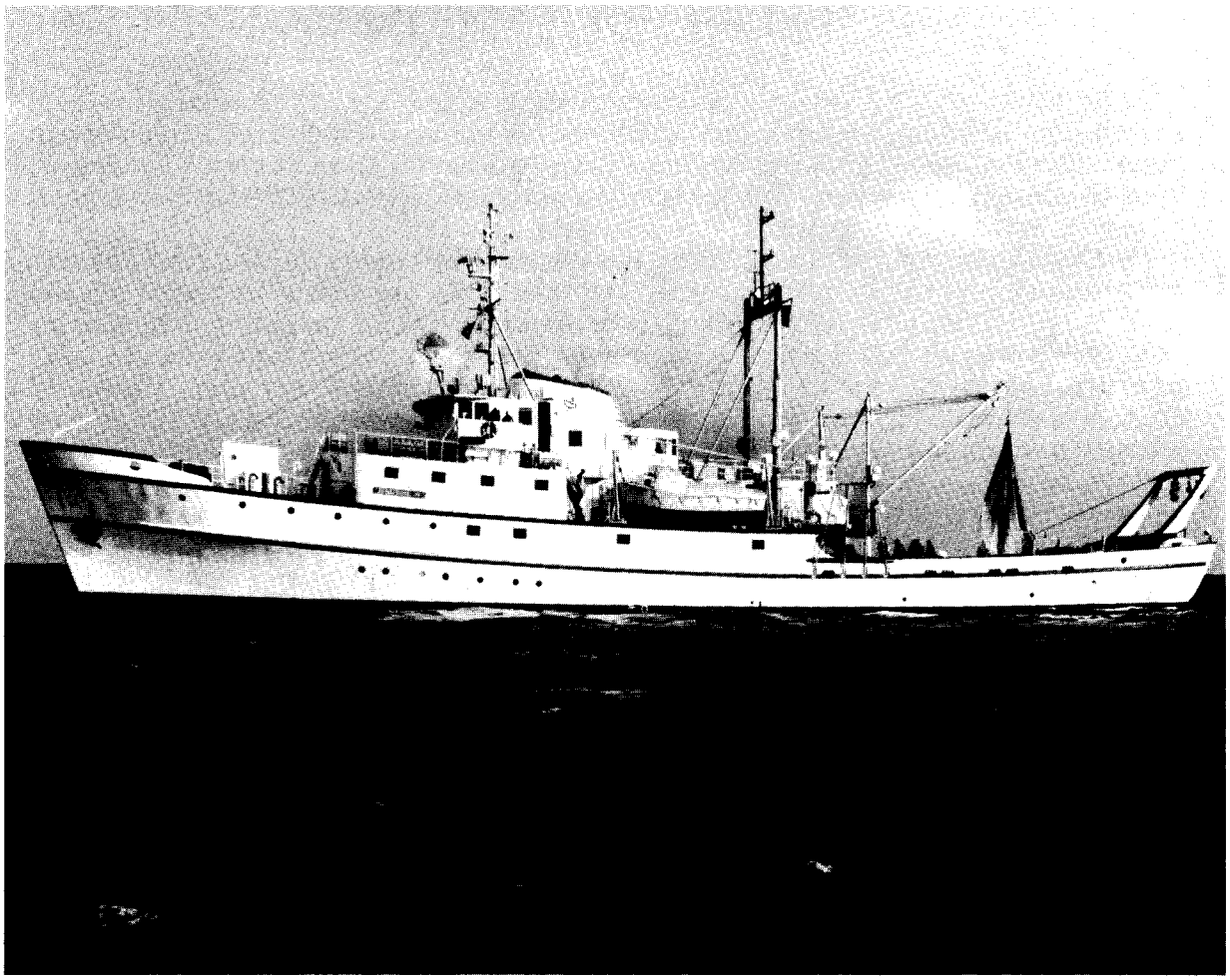
The United States and the Soviet Union undertook the cooperative program as an integral part of a 1967 bilateral fisheries management agreement between the two nations for certain fisheries resources of the Northwest Atlantic Ocean. Both nations recognized the need to determine the impacts of increasing fishing pressures on the fish stocks, and to limit the harvests to levels commensurate with the productive capacity of those stocks. To achieve these goals, the bilateral partners needed better estimates of fish abundance and a better understanding of the influence of fishing and natural factors on fish production.

American and Soviet scientists emphasized the need for a common understanding of these elements in order to more rapidly and effectively develop necessary management measures. The first step was the creation of a common data base that scientists of both nations could use in their analyses, thus eliminating a prime source of potential differences. Such a large and complex problem called for a well coordinated joint fisheries research program. It was logical that the United States and the Soviet Union begin this program, since both nations had an interest in these fisheries resources and the sophisticated scientific communities to study them.

The program scientists initially stressed the development of bottom trawl surveys with fisheries research vessels to provide comprehensive annual inventories of the distribution and abundance of fish stocks. The surveys and related studies on the fishing power of various trawls remained the key element of the cooperative program throughout the decade. In addition, the program included hydroacoustical studies for the development of hydroacoustical abundance surveys of pelagic fish stocks, and biological studies on the spawning, growth, feeding, and mortality of major species.

Over the 10-year period, approximately 50 cooperative fisheries research vessel cruises took place in the Northwest Atlantic Ocean from Nova Scotia to Cape Hatteras. Hundreds of scientists and technicians took part in these cruises. (See Appendices A and B.) Soviet scientists and vessels came primarily from the Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO) in Kaliningrad on the Baltic Sea. American scientists and vessels came primarily from the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, Northeast Fisheries Center (NEFC) in Woods Hole, Massachusetts. However, many volunteer scientists, technicians, students from universities, and federal, state, and private environmental organizations participated in the program.

This booklet summarizes the major components of the joint fisheries research program, highlights the principal scientific achievements, and notes the overall benefits. In commemoration, this booklet is dedicated to the many scientists and crew members whose hard work, patience, and good humor successfully solved the many problems and carried through the program of joint fisheries research between the United States and the Soviet Union for 10 years.



ALBATROSS IV, one of two American stern trawlers (the other DELAWARE II) used in cooperative program. Both vessels were designed for fisheries research.

AtlantNIRO scientists welcomed to Woods Hole at start of US-USSR joint fisheries research program in September 1967. Pictured are (left to right): Dr. Arkady Noskov (Director of Fisheries Laboratory, AtlantNIRO, and cruise chief aboard ALBATROS), Mr. Valentin Bryantsev (AtlantNIRO oceanographer), and Dr. Herbert Graham (Director of Woods Hole Laboratory).

One of the first pre-cruise meetings in conference room at the Woods Hole Laboratory. Pictured are (left to right): Mr. Cyril Muromcew (US interpreter), Dr. Robert Edwards (Assistant Director of Woods Hole Laboratory), Dr. Arkady Noskov (Director of Fisheries Laboratory, AtlantNIRO, and chief of Soviet scientific party), Ms. Florentza Matuzko (USSR interpreter), and Mr. Valentin Bryantsev (AtlantNIRO oceanographer).

Soviet crewmen and American scientists examine American trawl aboard ALBATROS prior to first trawl comparison experiments. Pictured are (foreground, left to right): Dr. Frank Schwartz (University of Maryland), Dr. Ed Joseph (Virginia Institute of Marine Science), and Soviet trawl master.

Large catch of spiny dogfish on deck of ALBATROSS IV. Both American and Soviet scientists were convinced that the catchability coefficient for this species was greater than "1." Pictured are (left to right): Mr. Robert Hersey (Woods Hole Laboratory fishery technician), Captain Walter Beatteay (ALBATROSS IV vessel master), and Mr. Valery Efanov (AtlantNIRO biologist).

Weighing and measuring even a representative sample of each species in a large trawl catch is hard work. Dr. Arkady Noskov (Director of Fisheries Laboratory, AtlantNIRO) and Mr. Richard Hennemuth (chief of fishery management program at Woods Hole Laboratory) wonder where to start on this first trawl comparison experiment.

BOTTOM TRAWL SURVEYS

The major component of the joint fisheries research program was the expansion and further evaluation of a bottom trawl survey system established by the Woods Hole Laboratory in 1964. The principal objective of these surveys was to estimate the distribution, relative abundance, and population structure (age and size) of the demersal finfish populations of the Northwest Atlantic Ocean. These surveys uniquely incorporated a stratified random sampling design and a multispecies approach. These unique incorporations provided statistically unbiased estimates of the relative abundance of all species available to the trawl, and at the same time, provided a geographical picture of the density distribution and total population structure (including juveniles) of each species. Such information was absolutely necessary to supplement the commercial fishery statistics which did not provide data on all species or sizes, and which often could not provide unbiased measures of population abundances. However, a key problem was to determine the accuracy of the research vessel surveys, where the fishing effort was extremely small compared with that of the commercial fleets.

The initial effort surveyed the Northwest Atlantic Ocean from Cape Cod to Cape Hatteras during October 1967. The ALBATROSS IV and ALBATROS simultaneously trawled the region with their own nets and independent sets of randomly chosen stations. Despite significant differences in the design and size of the trawls and in the type of vessels, both the ALBATROSS IV and ALBATROS produced similar pictures of the species composition, distribution, and relative abundance of the demersal finfish populations. These results encouraged both American and Soviet scientists that the approach was feasible. The results indicated that population density distributions could be meaningfully described with such surveys, and they implied that annual survey abundance indices might also be sufficiently accurate to help assess the status of the stocks. Furthermore, the survey provided for the first time a truly comprehensive picture of the demersal finfish stocks south of the Hudson Canyon (where the United States had not bottom trawl surveyed before) and revealed, among other things, some significant relationships between temperature and fish distribution.

The success of the 1967 survey prompted the expansion of the 1968 survey to include Georges Bank and the Nova Scotian Shelf. Main emphasis of joint bottom trawl surveys thereafter was in the area from Cape Hatteras to Georges Bank. By the early 1970's, the cooperative surveys showed a distinctly downward trend in abundance indices for the finfish biomass as a whole. This trend was one of the principal scientific bases for the subsequent total finfish catch limitations imposed by the International Commission for the Northwest Atlantic Fisheries (ICNAF) in its Subarea 5 and Statistical Area 6 in 1974.

The success of the joint fisheries research program was noticed and appreciated not only by the participants, but also by ICNAF. In January 1971, an 18-member working group from 9 of the 17 nations in the organization met in Copenhagen, Denmark, to discuss the possibility of multilateral cooperative surveys in the Northwest Atlantic Ocean. The working group investigated both the accuracy of the relative abundance indices gained by groundfish surveys and the techniques and gears used by the research vessels. The ICNAF working group concluded that a coordinated multilateral program of research surveys with standardized sampling methods and designs was the best way to get the distribution and relative abundance information needed to assess the fish stocks. In May 1971, the working group met in Halifax, Nova Scotia, and launched the multilateral ICNAF survey program. Since 1972, the bilateral bottom trawl surveys between the United States and the Soviet Union have been part of the larger ICNAF effort.

In addition to the invaluable data on population density distributions provided by the joint bottom trawl surveys, American and Soviet scientists gained much additional biological information by sampling scales, otoliths, lengths, and stomach contents, and by recording abundances of juvenile fishes retained by the finely meshed liners in the cod ends of the nets. The age-length data provided estimates of growth and mortality rates, and the juvenile catches yielded valuable prerecruitment estimates of the strength of incoming year classes for several major fish species.

Seven vessels logged approximately 20 bottom trawl surveys during the 10-year program. Two American vessels, the stern trawlers ALBATROSS IV and DELAWARE II, and five Soviet vessels, the side trawlers ALBATROS, BLESK, EKLIPTIKA, KVANT, and stern trawler BELOGORSK, took part in these surveys.

Members of the first American and Soviet scientific parties in Woods Hole during September 1967.

Mr. John McEachran (Virginia Institute of Marine Science) and Ms. Olga Krylova (AtlantNIRO plankton specialist) examining echo traces of fish schools on ALBATROSS IV during October joint bottom trawl survey.

Plankton sampling with American bongo nets on ALBATROSS IV in September 1967. These samplers were later used as standard equipment for the ICNAF larval herring surveys on Georges Bank. Pictured are (foreground, left to right): Ms. Ruth Stoddard (Woods Hole Laboratory plankton biologist) and Ms. Olga Krylova (Atlant-NIRO plankton specialist).

TRAWL TESTING AND COMPARISONS

A primary problem faced by the American and Soviet scientists was the interpretation of the joint bottom trawl survey results. Since the catch rates of the given trawls fished with given methods varied significantly among different species and among different ages and sizes of the same species, the scientists could not convert the catch-per-haul data into absolute species abundances or total biomass. The bilateral partners attacked this problem of different catchability coefficients of the various species by comparing the catch rates of different trawls whose rigging, configuration, and towing performance were thoroughly known and carefully controlled. Thus, both mensuration (measurement of towing performance) and trawl comparison experiments became an integral part of the joint fisheries research program.

Mensuration tests hydroacoustically measured headrope height and wingspread at various vessel speeds, directions of tow, and scopes. Relative catch rate or fishing power comparisons were designed and conducted so each vessel fished at randomly chosen locations within a small experimental area, and with both trawl types for an equal number of times during daylight and darkness. Such studies provided good estimates of the differential fishing power of various nets and useful data on the diurnal changes in catchability coefficients.

An abbreviated two-day cruise in 1967 laid the groundwork for the first trawl comparison experiment. On September 28 and 29, 1967, the crews of ALBATROSS IV and ALBATROS familiarized themselves with the operation of each other's trawls. The waters southwest of Martha's Vineyard were the setting for a diligent effort by both crews which set the high standards for later operations. The 1967 comparison experiments indicated that effects on the catches due to the vessels and the vessel-trawl interactions were small compared to the actual differences between the trawls. The differences in the two trawl catches were not only of total weight but of relative species composition. The differential fishing power of the two trawls upon the various species confirmed some ideas on the suspected differential behavior of species and sizes of fish to particular nets.

During the course of the 10-year research effort both nations worked with eight basic trawls — the Soviet 27.1, Soviet 23.5, Atlantic Western II, Atlantic Western IV, Universal, Yankee 36, modified Yankee 36, and modified Yankee 41. Six vessels — four Soviet (ALBATROS, BELOGORSK, BLESK, and KVANT) and two American (ALBATROSS IV and DELAWARE II) — conducted trawl testing and comparison research. In the early years of the program, the American and Soviet cooperators primarily studied the differences in the relative fishing power of the American and Soviet trawls. Since 1973, however, the program focused exclusively on the comparison of the Yankee 36 and modified 41 trawls, and, in general, emphasized the selection and refinement of a single standard survey net.

The 1972-1975 joint trawl research data on the Yankee 36 and Yankee 41 comparisons were analyzed and the development and testing of the newer modified Yankee 41 trawl was described in a report to be published in early 1977. (See Appendix C for this and other papers generated by the cooperative program.) Soviet scientists on the BELOGORSK and BLESK played a key role in the production of the voluminous body of data necessary for these studies. As a consequence of these experiments, the modified Yankee 41 became the prime candidate for a new standard survey trawl in ICNAF Subarea 5 and Statistical Area 6.

Mr. Lev Berezkin, Captain of ALBATROS in 1967 and several other vessels in later years, including BELOGORSK, the only fisheries research vessel to visit Woods Hole during the tenth year of the program, and Dr. Robert Edwards, former Assistant Director of the Woods Hole Laboratory and current Director of the NEFC. The perseverance and dedication of these two men were vital to the success of the joint fisheries research program.

Soviet scientists on ALBATROS in November 1967 preparing for departure from Woods Hole after a successful beginning to a decade of joint fisheries research.

Scientific party aboard ALBATROSS IV on first US-USSR cooperative cruise for sampling plankton. Pictured are (left to right): Ms. Ann McTiernan (Woods Hole Laboratory biological technician), Dr. Kenneth Sherman (Boothbay Harbor Laboratory biologist), Mr. James Crossen (Woods Hole Laboratory electronics technician), Ms. Florentza Matuzko (USSR interpreter), Mr. Valentin Bryantsev (AtlantNIRO oceanographer), Ms. Olga Krylova (AtlantNIRO plankton specialist), Mr. Henry Jensen (Woods Hole Laboratory biological technician), Mr. Edward Afnagel (AtlantNIRO fish taxonomist), Ms. Ruth Stoddard (Woods Hole Laboratory biological technician), and Mr. Arthur Posgay (Woods Hole Laboratory biologist and chief of scientific party aboard ALBATROSS IV).

ADDITIONAL STUDIES

Spawning and Early Life Stage Studies

The initial cruise of the joint fisheries research program between the United States and the Soviet Union dealt with different gear and sampling techniques for zooplankton. The fall of 1967 study with the ALBATROSS IV and the ALBATROS yielded information on the effects of sampler size, towing speeds, and diurnal influences on the number and types of zooplankton captured. American and Soviet scientists also measured the variability in zooplankton samples collected by the two vessels operating both independently and side by side in the same waters. This work led to expanded plankton surveys with research vessels of many other nations and with a standard technique and gear.

Canada teamed with the United States and the Soviet Union in 1968 for fish egg and larval studies. Scientists aboard the ALBATROSS IV, BLESK, and Canadian research vessel THETA studied the effects of sampler size, mesh size, tow speed, tow time, and tow type on the estimates of fish egg and larval abundance. The following spring the ALBATROSS IV and the PROGNOZ pursued similar studies by comparing grid sampling to random sampling techniques for ichthyoplankton.

In the fall of 1969 the ALBATROSS IV, EKLIPTIKA, and ALIOT searched the northern edge of Georges Bank to locate and describe Atlantic herring spawning areas and egg densities, and to evaluate the egg sampling methods used. Extensive photography of the cruise operations documented the results. The principal findings of the survey were the great variability in the sample densities of eggs, the constant presence of sand and/or gravel in all dredge-collected samples, and the predation on herring eggs by several groundfish species.

The fall of 1970 witnessed more work on the Atlantic herring with the ALBATROSS IV, ALFERAS, and Canadian submersible PISCES concentrating on herring eggs along the northern edge of Georges Bank. The trilateral team of scientists studied the range and distribution of herring eggs, sampled larval and adult herring, and recorded environmental data over the spawning grounds. During that study the ALFERAS located and mapped egg patches and the ALBATROSS IV served as mothership for the PISCES dives. Tape recordings, motion pictures, and still pictures documented the sightings. Major observations were sheet-like formations of larvae about eight inches above the bottom, attachments of eggs to colonial hydroids and bryozoans over gravel and cobble bottoms, and an abundance of predators amid the egg concentrations. This study was part of NEFC's (and National Oceanic and Atmospheric Administration's) Manned Underseas Science and Technology Program, and the first offshore use of a submersible to study spawning activity of fish.

In 1971, the United States and the Soviet Union joined several other ICNAF nations in a cooperative survey of larval herring in the Georges Bank-Gulf of Maine area. These ICNAF larval herring and mackerel survey programs and the joint US-USSR participation in them continued through 1976. American and Soviet vessels involved in the program were ALBATROSS IV, DELAWARE II, BELOGORSK, PROGNOZ, and VIANDRA. Other vessels participating in these efforts were the French CRYOS, the Polish WIECZNO, and the West German WALTHER HERWIG (later renamed ANTON DOHRN). The primary objectives of these surveys were to study the production, dispersal, growth, and survival of larval herring on Georges Bank and in the Gulf of Maine, and to study the effect of water circulation on larval herring and plankton distribution.

In the fall of 1976 the BELOGORSK took on board several NEFC scientists for a special ICNAF tagging program of spawning Atlantic herring. The Soviet purse seiner UBILEINIY assisted in the 30,000-fish tagging effort to study herring movements and mortality rates.

Hydroacoustical Studies

An informal meeting of American and Soviet scientists on board the POISK at a 1973 hydroacoustics symposium in Bergen, Norway, fostered joint US-USSR investigation of hydroacoustical assessments of fisheries resources. Cooperative field investigations started in 1974 when American and Soviet scientists on board the DELAWARE II and KHRONOMETER studied target strengths of individuals and aggregations of commercially important fish species, particularly Atlantic herring off southern New England. A second joint cruise in 1975 with the POISK and DELAWARE II hydroacoustically surveyed pelagic fish schools which were subsequently sampled by midwater trawls from the Polish research vessel WIECZNO and the East German research vessel ERNST HAECKEL. And finally, in a late 1975 conference on hydroacoustical fisheries research in Woods Hole, Massachusetts, Soviet scientists arranged for and invited their American counterparts to join an experimental hydroacoustical survey aboard the KHRONOMETER off the northwestern coast of Africa.

Scientific party aboard ALBATROSS IV during 1969 joint bottom trawl survey. Pictured are (left to right): Mr. Henry Jensen (Woods Hold Laboratory biological technician), Mr. Tom McKenney (Woods Hole Laboratory zooplankton specialist), Mr. Yuri Grinkov (AtlantNIRO biologist), Mr. Vladimir Sauskan (AtlantNIRO fishery biologist and chief scientist aboard EKLIPTIKA), Mr. Anatole Vovk (AtlantNIRO invertebrate specialist), Dr. Marvin Grosslein (Woods Hole Laboratory fishery biologist and coordinator of bottom trawl surveys), Mr. John Poole (New York State Department of Conservation), Mr. Valerie Efanov (AtlantNIRO biologist), Mr. Sam Nickerson (Woods Hole Laboratory biological technician), and Mr. Robert Hersey (Woods Hole Laboratory biological technician).

Reception for National Oceanic and Atmospheric Administration's (NOAA's) Marine Fisheries Advisory Committee on board BELOGORSK in 1974. Also present to sample a bevy of squid recipes were Dr. Robert White (center, Administrator of NOAA) and Robert Schoning (far left, Director of the National Marine Fisheries Service).

First driving lesson on BELOGORSK for Mr. H. C. Boyar (NEFC scientific vessel coordinator). Looking on are Captain Lev Berezkin and first mate Mr. Viktor Stepanov.

Open house on Soviet vessel in Woods Hole. Captain Berezkin greets Phillip, son of Mr. Robert Marak (NEFC plankton biologist). Standing behind Berezkin are US Coast Guard Officers. Captain Fred Hancox, Commander of the US Coast Guard Base in Woods Hole, is on the right, and Commander Donald Cobaugh, former Deputy Group Commander is on the left. Captain Hancox and his personnel assisted with the joint work in many ways. Initially, Soviet vessels berthed at the US Coast Guard Base in Woods Hole, and Coast Guardsmen shared their recreational facilities with Soviet crewmen.

Children from a Falmouth school wave at Soviet visitors. Scientists and crew members of Soviet vessels enjoyed visits to shops, schools, and homes of their American colleagues during port calls in Woods Hole.

Occasionally there was time for a party. Here the participants appeared to be thinking, "Now what did he really mean?" Pictured are (left to right): Dr. Vladimir Rikhter (chief of Soviet scientific party), Mr. Vasily Tjunin (AtlantNIRO biologist), Dr. Robert Edwards (Assistant Director, Woods Hole Laboratory), and Mr. Boris Baidakov (USSR interpreter).

BENEFITS

The success of the 1967-1976 joint fisheries research program can be measured by its contributions to science, to the two participating nations, and to the individuals involved in the program.

The chief scientific benefit is the substantial increase in our basic knowledge of the distribution, biomass, population dynamics, and ecology of the fisheries resources of the Northwest Atlantic — knowledge that is necessary to manage those resources wisely. The bilateral effort provided the first estimates of such population dynamics as recruitment, growth, and mortality for major species like cod, silver hake, red hake, yellowtail flounder, and redfish. The cooperative program also provided descriptions of the density distribution of the demersal finfish community with a comprehensiveness and precision previously unavailable. These joint fisheries research data allowed an approximation of the total demersal finfish community biomass, documented the nature of species associations, and, when combined with commercial fisheries data, permitted the first predictions of population size for many major species.

Other scientific benefits are newer and/or better research techniques. Participants designed new trawls to minimize the problem of differential behavior of various species to particular nets, tested and refined sampling designs to insure accurate and unbiased estimates of distribution and abundance, and acquired advanced methods for data recording and processing in response to the increased volume of data and necessity for immediate analyses.

Many of these scientific benefits will be realized in future years because much of this fisheries information, unique in its thorough spatial and temporal coverage, has yet to be extracted from the data. It will take years to publish this information completely. However, the benefits to date are quite worth the efforts. Approximately 100 major works have been generated entirely or in part by the accumulated data.

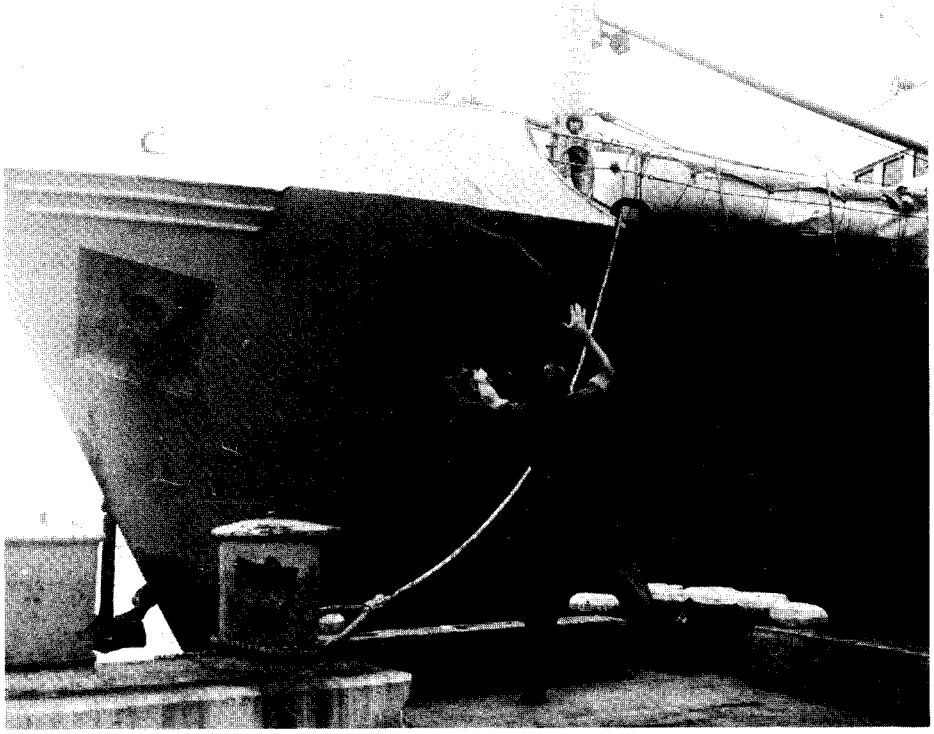
Although some of this scientific information could have been acquired outside the framework of the cooperative program, the magnitude of the data would have certainly been less. However, the more overriding benefit is the basis of common understanding developed among American and Soviet scientists by the close cooperation and side by side work. Thus, the entire series of data collected by the American research vessels ALBATROSS IV and DELAWARE II has a credibility attached to it that would not exist if the joint research had not been completed.

Two primary benefits to the American and Soviet scientists involved in the bilateral effort are the greater access to the scientific literature of the other nation and the development of bilingual scientific expertise. The additional awareness of the research of those in other countries helped to avoid duplication of effort on several problems that scientists from both nations wished to investigate. And, new approaches to problem solving became available or evolved, strengthening many American and Soviet scientists' work with experimental design concepts.

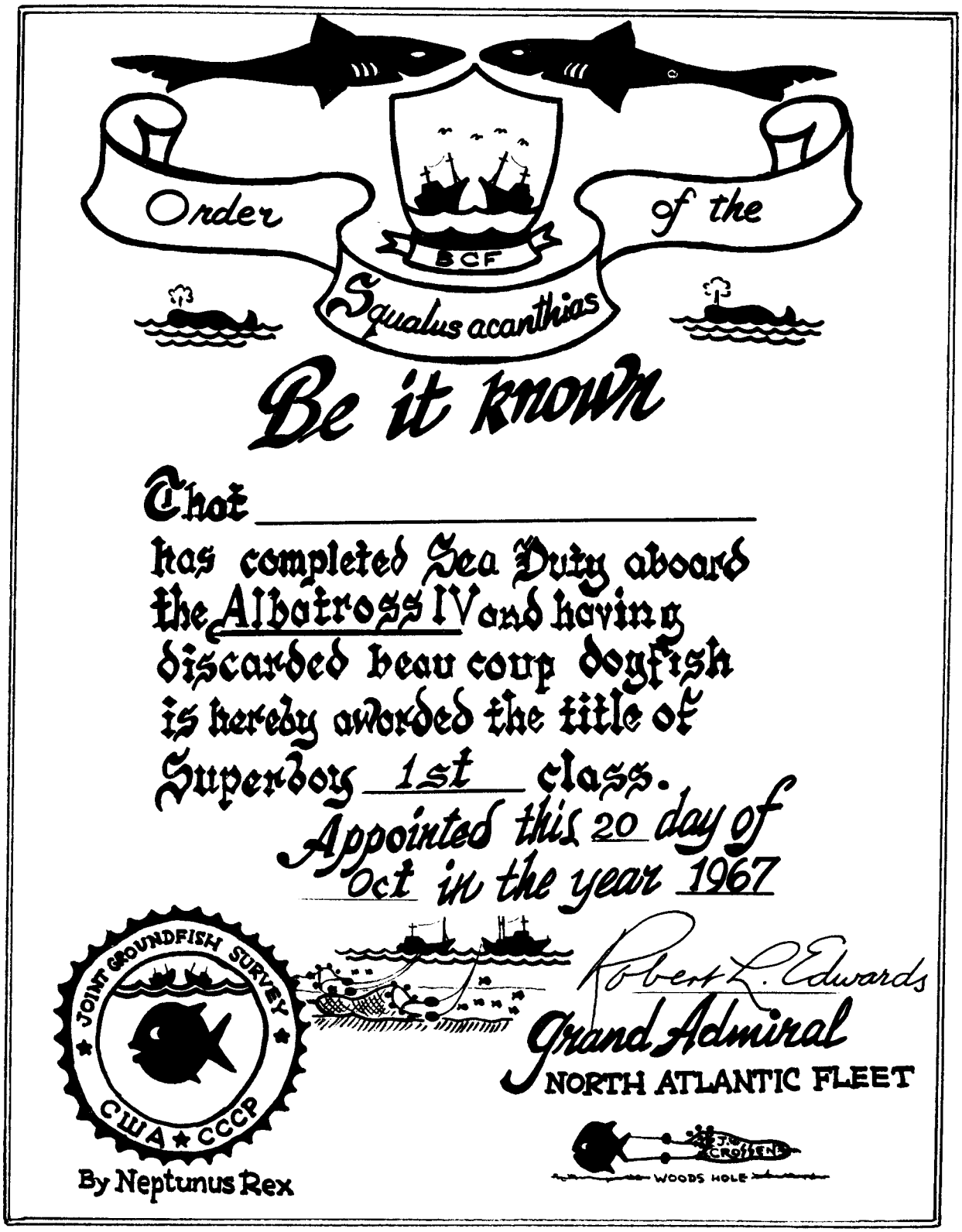
In addition to the scientific benefits, another less tangible but nonetheless important product of 10 years of US-USSR cooperation in fisheries research is the enhancement of the friendship and respect the two peoples have for each other. This successful cooperation probably also stimulated international cooperation in other important areas.

And finally, the rewards of the cooperative program benefit the entire international community. The fine cooperation and increased knowledge derived from this bilateral program certainly served as a model for cooperative research in ICNAF, for not only did the program work administratively, but it also showed that the knowledge and experience the program provided produced a better basis for more effectively managing the Northwest Atlantic fisheries.

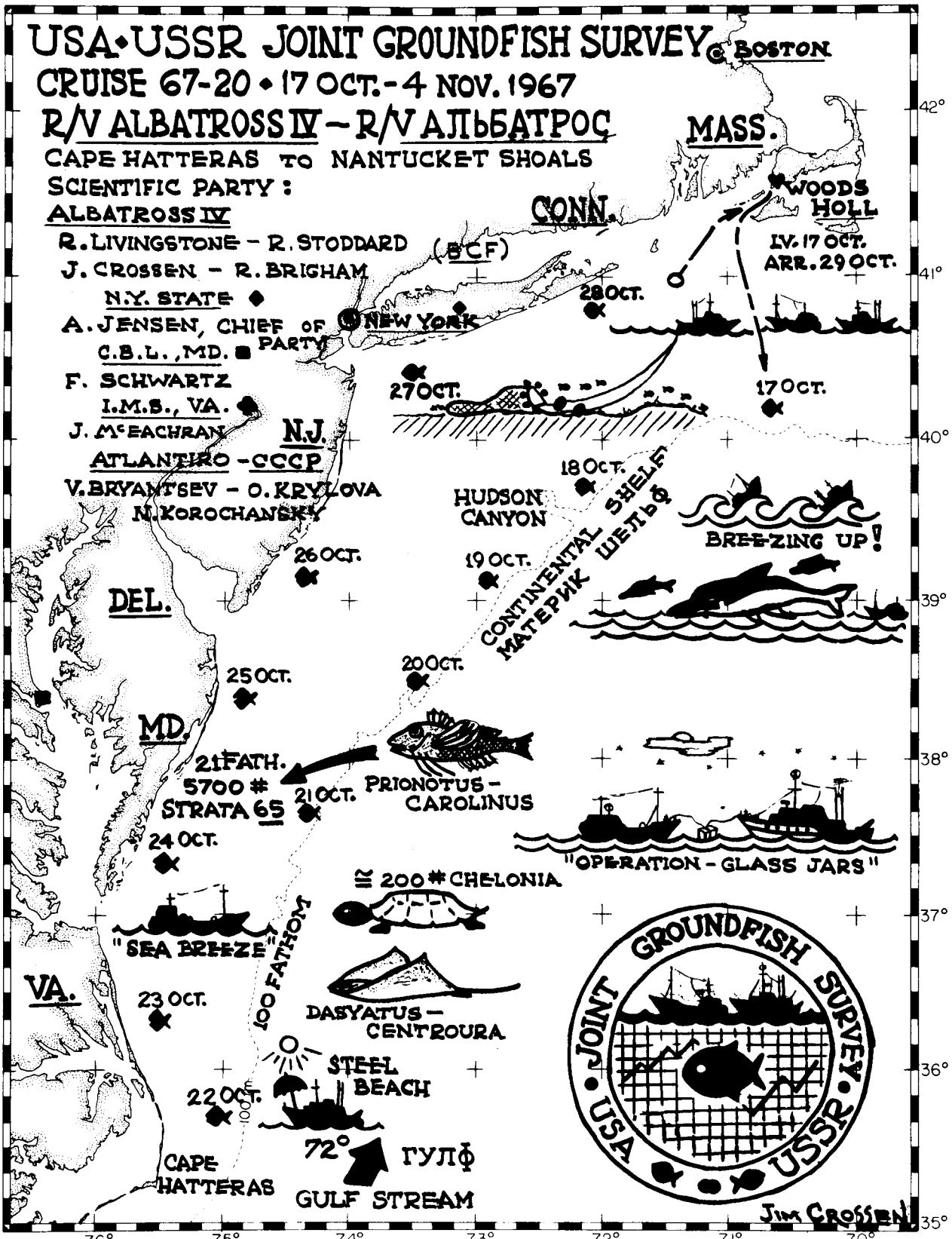
The 1975 BELOGORSK soccer team. They played hard but lost the the Falmouth Elks, 1-0. Spectators as well as players enjoyed the game. Three weeks later the team had a one-goal lead over Massachusetts Maritime Academy (MMA) with four minutes to play, but settled for a 4-4 tie. Someone said that in 1976 Captain Lev Berezkin came back with some of the roughest looking sailors ever seen in Woods Hole. In any case, the BELOGORSK team again saw a one goal lead over MMA disappear with three minutes to play for a 3-3 tie.



Mr. Dick Edwards, Marine Superintendent for Woods Hole Oceanographic Institution (WHOI), tossing a line to BELOGORSK upon arrival in Woods Hole in September 1976 for start of tenth year of cooperative work. Cooperation of Mr. Edwards and WHOI in providing docking space and numerous other services, often on an emergency basis, greatly facilitated the joint fisheries research.



Participants on first cooperative cruise in 1967 were saddled with the dubious distinction of being first-class superboys in the Order of the Dogfish. Scientists and crew members on board ALBATROSS IV and ALBATROS were the victims.



Graphical description of cruise track and operational highlights of initial cooperative effort in 1967. Such certificates were presented to participants on board both ALBATROSS IV and ALBATROS.

Commemorative certificate presented to participants in joint fisheries research program following completion of tenth successful year.

APPENDIX A

JOINT FISHERIES RESEARCH CRUISES

Date	Vessel		Study Objective	Study Area
	American	Soviet		
Sept. 18-22, 1967	ALBATROSS IV	ALBATROS	Zooplankton gear and sampling studies	South of Nantucket Island
Sept. 28-29, 1967	ALBATROSS IV	ALBATROS	Groundfish survey procedure studies	South of Martha's Vineyard
Oct. 3-11, 1967	ALBATROSS IV	ALBATROS	Trawl testing and comparison	South of Martha's Vineyard
Oct. 17-29, 1967	ALBATROSS IV	ALBATROS	Groundfish survey	Nantucket Island to Cape Hatteras
Nov. 7-Dec. 10, 1967	ALBATROSS IV	ALBATROS	Groundfish survey	Nova Scotia to Cape Cod
July 4-Aug. 6, 1968		ALBATROS	Groundfish survey	Nova Scotian Shelf
Sept. 23-27, 1968	ALBATROSS IV	BLESK	Ichthyoplankton gear and sampling studies	South of Martha's Vineyard
Oct. 2-6, 1968	ALBATROSS IV	BLESK	Trawl testing and comparison	South Channel and Georges Bank
Oct. 10-Nov. 6, 1968	ALBATROSS IV	BLESK	Groundfish survey	Gulf of Maine to Cape Hatteras
Apr. 15-19, 1969	ALBATROSS IV	PROGNOZ	Ichthyoplankton sampling studies	Georges Bank
May 19-29, 1969	ALBATROSS IV	PROGNOZ	Ichthyoplankton sampling studies	Georges Bank
Sept. 30-Oct. 10, 1969	ALBATROSS IV	EKLIPTIKA	Herring spawning ground studies	Georges Bank
Oct. 8-Nov. 8, 1969	ALBATROSS IV	EKLIPTIKA	Groundfish survey	Georges Bank to Cape Hatteras
Nov. 13-Dec. 10, 1969		EKLIPTIKA	Groundfish survey	Nova Scotian Shelf
Aug. 10-Sept. 3, 1970		KVANT	Groundfish survey	Nova Scotian Shelf
Sept. 2-12, 1970	DELAWARE II	KVANT	Groundfish survey	Cape Cod to Cape Hatteras
Sept. 23-Oct. 10, 1970		KVANT	Trawl testing and comparison	South of Nantucket Island
Sept. 24-Oct. 8, 1970	ALBATROSS IV	ALFERAS	Herring egg studies	Georges Bank
Oct. 15-31, 1970	ALBATROSS IV	KVANT	Groundfish survey	Georges Bank
Aug. 9-30, 1971		BLESK	Groundfish survey	Georges Bank
Aug. 31-Sept. 11, 1971	ALBATROSS IV	BLESK	Trawl testing and comparison	Southwest of Martha's Vineyard
Sept. 14-25, 1971	ALBATROSS IV	BLESK	Trawl testing and comparison	South of Nantucket Island
Sept. 30-Oct. 23, 1971	ALBATROSS IV	BLESK	Groundfish survey	Georges Bank to Cape Hatteras
Sept. 21-Oct. 4, 1971	DELAWARE II	VIANDRA	Ichthyoplankton survey	Georges Bank and Gulf of Maine
Oct. 9-25, 1971	ALBATROSS IV	VIANDRA	Ichthyoplankton survey	Georges Bank and Gulf of Maine
Dec. 2-17, 1971	ALBATROSS IV	VIANDRA	Ichthyoplankton survey	Georges Bank and Gulf of Maine
Aug. 10-Sept. 2, 1972		BLESK	Groundfish survey	Nova Scotian Shelf
Sept. 19-25, 1972	DELAWARE II	BLESK	Trawl testing and comparison	South of Nantucket Island
Sept. 30-Oct. 23, 1972	ALBATROSS IV	BLESK	Groundfish survey	Georges Bank to Cape Hatteras
Aug. 27-Sept. 5, 1973	ALBATROSS IV	BELOGORSK	Trawl testing and comparison	South of Nantucket Island
Sept. 17-24, 1973	ALBATROSS IV	BELOGORSK	Juvenile fish survey	Georges Bank
Sept. 26-Oct. 12, 1973	ALBATROSS IV	BELOGORSK	Groundfish survey	Cape Cod to Cape Hatteras
Oct. 1-Nov. 30, 1973	ALBATROSS IV	BELOGORSK	Ichthyoplankton survey	Georges Bank and Gulf of Maine
Mar. 20-Apr. 18, 1974	ALBATROSS IV	KHRONOM-ETER	Hydroacoustical survey	Georges Bank to Cape Hatteras
Aug. 14-27, 1974		BELOGORSK	Groundfish survey	Nova Scotian Shelf
Oct. 18-30, 1974	ALBATROSS IV	PROGNOZ	Larval herring survey	Gulf of Maine and southern New England
Sept. 6-17, 1974	ALBATROSS IV	BELOGORSK	Trawl testing and comparison	South of Nantucket Island

APPENDIX A (cont.)

Date	Vessel American	Vessel Soviet	Study Objective	Study Area
Sept. 20-Oct. 21, 1974	ALBATROSS IV	BELOGORSK	Groundfish survey	Georges Bank to Cape Hatteras
Oct. 26-Nov. 1, 1974	ALBATROSS IV	BELOGORSK	Juvenile herring and mackerel survey	Georges Bank to Hudson Canyon
Mar. 20-Apr. 13, 1975	DELAWARE II	POISK	Hydroacoustical survey	Georges Bank and Mid-Atlantic
Aug. 6-26, 1975		BELOGORSK	Groundfish survey	Nova Scotia to Hudson Canyon
Sept. 4-19, 1975	ALBATROSS IV	BELOGORSK	Trawl testing and comparison	South of Nantucket Island to Georges Bank
Sept. 24-Oct. 10, 1975	ALBATROSS IV	BELOGORSK	Larval herring survey	Georges Bank and Nantucket Shoals
Oct. 15-Nov. 16, 1975	ALBATROSS IV	BELOGORSK	Larval herring survey	Georges Bank and Nantucket Shoals
Aug. 5-23, 1976		KVANT	General ecological survey	Nova Scotia to Hudson Canyon
Sept. 4-13, 1976	ALBATROSS IV	BELOGORSK	Groundfish survey	Georges Bank
Sept. 4-13, 1976		BELOGORSK UBILEINIY	Herring migration studies	Georges Bank
Oct. 4-18, 1976		BELOGORSK	Larval herring and groundfish survey	Georges Bank
Oct. 20-Nov. 23, 1976	ALBATROSS IV	BELOGORSK	Groundfish survey	Georges Bank to Nova Scotia

APPENDIX B
SCIENTIFIC PERSONNEL INVOLVED IN JOINT FISHERIES RESEARCH CRUISES

National Marine Fisheries Service (formerly Bureau of Commercial Fisheries)

A. Adams
E. Anderson
S. Anderson
V. Anthony
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F. Bailey
R. Baker
B. Beers
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G. Bolz
E. Bowman
R. Bowman
H. Boyar
R. Brigham
R. Brooks
B. Brown
B. Burns
T. Burns
W. Cain
W. Callahan
P. Carlson
A. Carter
P. Chase, Jr.
S. Chenoweth
D. Christianson
R. Clifford
E. Cohen
B. Collette
R. Collier
K. Converse
M. Corbett
A. Covaleski
J. Craven
J. Crossen
L. Doggett
C. Davis
C. DeGorge
G. Derring
L. Dery
L. Despres
J. Devenney
J. Dohrmann
G. Dubé
R. Edwards
D. Flescher
A. Flood
H. Foster
B. Franklin
P. Gerrior
C. Gibson
H. Globa
J. Graham
B. Griswold
M. Grosslein
W. Handwork
H. Hartman
E. Hasbrouck
J. Hendricks
R. Hennemuth
R. Hersey
R. Heuser
E. Heyerdahl
E. Holt
K. Honey
E. Howe
H. Jensen
J. Kane
K. Kantola
G. Kelly
T. Kessler
R. Kirschner
P. Laughead
R. Lewis
T. Lincoln
R. Livingstone, Jr.
P. Loiseau, Jr.
P. Loners
G. Lough
F. Lux
J. Mahoney
E. Maltzeff
C. Mantzaris
R. Marak
R. Maurer
R. Mayo
M. McBride
K. McCarthy
T. McKenney
A. McTiernan
J. Medeiros
H. Merry
R. Mertens
E. Montiero
R. Morrill
T. Morris, Jr.
W. Morrow
S. Munroe
C. Newell
F. Nichy
S. Nickerson
J. Nicolas
V. Nulk
A. Obolensky
A. Pacheco
J. Palmer
M. Palmer
K. Pecci
J. Penttila
H. Perkins
P. Phillips
J. Posgay
D. Potter
J. Prezioso
C. Rogers
M. Romansko
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F. Sargent, Jr.
W. Sargent
R. Schlitz
R. Schultz
S. Sherburne
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J. Sibunka
M. Silverman
L. Sloan
A. Smiligielski
K. Smith
H. Stern, Jr.
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V. Alshin
V. Andronov
V. Babaryka
B. Badulin
B. Baidokov
V. Balkovoy
M. Belevich
Y. Belskiy
V. Bryantsev
Y. Budnik
A. Buichikov
V. Dementei
V. Efanov
P. Gasyukov
A. Gribkov
Y. Grinkov
M. Grundtsev
V. Guretsky
M. Guzanov
V. Isakov
A. Ivanov
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A. Karyakin
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N. Korochansky
B. Kotelnikov
O. Krylova
Y. Kurlyandski
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A Makligin
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S. Melchakova
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B. Motuzenko
Nadezdin
N. Naumov
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A. Pankratov
B. Panov
V. Payalov
V. Perekhovoy
N. Puzhakov
V. Rikhter
A. Romanchenko
I. Sagaev
V. Sagdeev
L. Samchik
V. Sauskan
V. Shatskich
V. Shnar
V. Slepokurov
E. Smirnov
V. Soldat
S. Soushin
A. Strela
V. Suchin
Tcheznishkov
V. Tjunin
V. Tsitsorski
V. Turok
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L. Volkova
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I. Berian, V. Dorofeev, N. Klimenko, S. Saranchov, M. Truskanov, K. Yudanov, I. Zarikhin

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C. Campbell, R. Dorsett, W. McCann, R. McCrea

Fish and Wildlife Service (formerly Bureau of Sport Fisheries and Wildlife)

J. Clark, S. Wilk

Atlantic Environmental Group

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Department of State

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R. Anderson, A. Carr, J. Hickey, E. Kelly, K. Rebek

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C. Cichra, L. Claggett, C. Edwards, M. Gesner

University of Connecticut

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C. Barans, R. Burbidge, V. Burrell, J. Chambers, L. Chao, C. Cooke, J. Davis, E. Joseph, J. Lyzkowski, J. McEachran, L. Mercer, J. Musick, S. Rhodes, J. Weaver, C. Wenner

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P. Scott, T. Stanton

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Vessel Captains

A. Azeokhin (UBILEINIY 1976)
W. Beatteay (ALBATROSS IV 1967-1976)
L. Berezkin (ALBATROS 1967, 1968; BLESK 1968; BELOGORSK 1975, 1976)
V. Kotoshinkov (KVANT 1976)
A. Kutcherjak (VIANDRA 1970)
R. Lendsvik (DELAWARE II 1971, 1972, 1975)
V. Litun (PROGNOZ 1969; KVANT 1970)
M. Pechelintsev (POISK 1975)
N. Shevshenko (KHRONOMETER 1974)
L. Slepsov (EKLIPTIKA 1969)
S. Svyatkin (BLESK 1971, 1972)
I. Vikharev (ALFERAS 1970)
A. Zentsov (BELOGORSK 1974)
V. Zuev (BELOGORSK 1973)

Other Key Personnel Involved in the Joint Fisheries Research Program

H. Graham (National Marine Fisheries Service, formerly Bureau of Commercial Fisheries)
H. Mustafa (National Marine Fisheries Service, formerly Bureau of Commercial Fisheries)
D. McKernan (Department of State)
F. Hancox (US Coast Guard)
P. Fye (Woods Hole Oceanographic Institution)
R. Edwards (Woods Hole Oceanographic Institution)
Citizens of Woods Hole and Falmouth who welcomed our visitors into their homes.

APPENDIX C

MAJOR PAPERS GENERATED BY THE JOINT FISHERIES RESEARCH PROGRAM

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