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**1993 Consultations on the
Groundfish Research Program of
DFO Scotia-Fundy Science**

by

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Abstract

Funding pressures in the DFO Scotia-Fundy Region have required a review of the Science Programs. As part of this review, participants of the fishing industry were presented with a profile of the regional groundfish programs and asked for their opinions on overall program makeup, direction of individual projects, and perceived gaps. Representatives from major sectors of the fishery attended meetings held in Yarmouth, Sydney, and Dartmouth in the fall of 1993. This report documents the results of these consultations and serves as a basis for program changes in 1994/95 and future interaction with clients.

Résumé

Les restrictions budgétaires auxquelles fait face le MPO dans la région de Scotia-Fundy ont entraîné un réexamen des programmes scientifiques. A cette occasion, on a présenté un profil des programmes régionaux concernant le poisson de fond aux membres de l'industrie de la pêche, sollicitant leur opinion sur le contenu général des programmes, sur l'orientation des diverses programmes. Des représentants des principaux secteurs de l'industrie de la pêche ont été consultés lors de réunions tenues à Yarmouth, Sydney et Dartmouth en automne 1993. Le présent rapport fait état des résultats de ces consultations et sert de document de base en ce qui concerne les changements à apporter aux programmes en 1994-1995 et les interactions futures avec les clients.

1. Introduction

The Science Branch of the Department of Fisheries and Oceans (DFO) conducts a review of its programs annually in the fall in preparation for the following year's budgeting. Past reviews of the Scotia-Fundy programs have generally depended upon industry comments made at the regional Advisory Committees, as well as the recommendations made in scientific bodies such as the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC).

The current fisheries crisis as well as the dramatic downturn in government operating budgets has called for more focused discussion on the groundfish research program. A series of three meetings was therefore set up with representatives of the Scotia-Fundy groundfish industry to present the DFO Science program in detail and identify its strengths and weaknesses, as perceived by them. This is a similar to an exercise conducted for herring at the St. Andrew's Biological Station and for offshore scallops at the Halifax Laboratory.

The meetings were conducted in Yarmouth (6 October 1993), Sydney (14 October 1994), and Dartmouth (10 November 1993). Each meeting started with presentations on the Regional Science and groundfish program by the Director of Biological Sciences Branch (BSB), Mike Sinclair, and the Chief of the Marine Fish Division (MFD), Bob O'Boyle, respectively. The discussion was then opened to participants. The philosophy of the meetings was to listen to the industry rather than conduct a show and tell. As a consequence, the discussion was very lively and covered a range of subjects. Two rapporteurs were selected for each meeting. This report presents the comments arranged by topic, rather than being a verbatim transcript of each meeting.

A draft report was circulated to participants before being finalized. These discussions will be considered during the 1994 BSB planning process. The results of this exercise will be reported to participants.

2. The Regional Science Context

The Science program of Scotia-Fundy Region is very diverse, representing the efforts of about 440 full time staff operating out of four (BIO, SABS, HFRL, MC - see Appendix II for abbreviations) main facilities and a number of small ones. The groundfish portion of this is relatively small. To provide a regional perspective of the groundfish program, Dr. Mike Sinclair gave a presentation of the Regional program and the funding level of the various elements. Focus was on the Biological Science component, which accounted for about 225 program staff in 1993/1994.

The Scotia-Fundy Region of DFO is composed of a number of different organizational units, all responsible for different parts of the fisheries mandate. For convenience, it can be described as being composed of the following elements:

* Non-Science activities

- this includes fisheries and habitat management, enforcement, and administration

* Science activities

- this includes the Biological Science Branch (BSB), the Physical and Chemical Sciences Branch (PCSB) and the Canadian Hydrographic Service (CHS), but excludes ships and their support

* Ships and Support

- this includes both Science and non-Science platforms

Table 1 provides a breakdown of the 1993/94 budget for the above components. Out of a total regional budget of \$124.0M, about \$32.5M is devoted to Science programs, and out of this, \$24.5M covers salary expenses of about 440 employees. The majority of the salary budget is for the biological component, with the oceanography program in second place.

This leaves \$8M for operational spending on programs. Of this, \$3.7M is associated with so-called B-Base programs which is non-discretionary in funding allocation at the Regional level. Therefore the core of the Science operational budget is composed of \$4.3M, again most (70%) of this, or \$3.0M, for biological programs.

The 1993/94 Science operational budget of \$4.3M represented a cut of about 20% to the 1992/93 level. Indeed, there has been a gradual reduction in budgets since 1987. This resulted in an in-depth review of activities in the winter of 1993 to determine what were the program priorities and thus what programs were to be cut. While some important areas have accumulated a wealth of knowledge over 30 years of research on the Scotian Shelf and could be cut without significant short-term impact, other programs are part of an ongoing monitoring activity, not only of the fish populations, but also of the ocean environment. For instance, the annual July bottom trawl surveys provide the only long-term, consistent, data set of variability in ocean climate on the Scotian Shelf, in addition to providing data on groundfish abundance. Cutting of these activities would dramatically impact Science's ability to fulfil its mandate. Notwithstanding this, extensive budget cuts are predicted for the next two years. It is from this perspective that these consultations are particularly important.

The BSB program is composed of the following elements:

* Harvest Fisheries

- this includes finfish (groundfish and pelagics)/seals, invertebrates, and freshwater programs

* Aquaculture

- this includes finfish, invertebrate and freshwater programs

* Habitat

- this includes research on the base of the food chain such as marine algae

The 1992/93 distribution of funds among these activities is shown in Table 2. Of the approximately \$3.0M A-base funds, about \$2.0M was allocated to harvest fisheries, this being distributed as \$849.0K for finfish/seals, \$485.0K for invertebrates, and \$689.0K for freshwater species.

In its deliberations, the Executive of BSB discussed the principles adopted to meet its budget deficit. The overall strategy required that 1) all research was to be applied, i.e. no non-applied curiosity research was to be supported, 2) 50% of research was to be devoted to stock monitoring and advisory activities, and 3) the remaining 50% would be research supporting item 2. Within these principles, research was prioritized as follows:

1. It must result in some generation of wealth to Canadians.
2. Long-term monitoring activities must be maintained.
3. Research must be responsive to social issues, i.e. native fishermen
4. International/bilateral obligations (Canada/US, JGOFS, OPEN, GLOBEC, ICES) are to be honoured.

Taking into consideration the above conditions, a target split of the operational budget among the three Science activities of 65% harvest fisheries, 15% aquaculture, and 20% habitat was established. At this point, Mike Sinclair asked the participants how they felt about this percentage split and what they thought would be appropriate. Their response to this question is provided in the appropriate section below.

The January 1993 review of programs resulted in targeted reductions of 1992/93 program budgets in BSB (Table 2). The finfish/seal program was cut by about 28%, much of this due to reductions in the BIO seal program. The freshwater program received a small cut due to the requirement to maintain non-discretionary salmon hatchery facilities. Aquaculture programs also received small cuts. Finally, habitat activities were reduced by about 32%.

At this point in the meetings, there was considerable discussion on the overall budget situation. Following this, a more in-depth profile of the groundfish programs and budget was given by Bob O'Boyle.

3. The Groundfish Program

This program is split between the Bedford Institute of Oceanography (BIO) and the St. Andrews Biological Station (SABS) with port sampling activities operating out of five locations (Sydney, Guysborough, Lunenburg, Lockeport, and Yarmouth) around Nova Scotia.

The mandate is to provide advice on the impacts of human activity on the Region's groundfish and seal populations, and to conduct research on the biological and fishery-related processes in support of this advice.

A diverse array of clients receive input from the program. Within DFO, advice is provided on a routine basis to both Ottawa and Regional Science and Management staff, both in Scotia-Fundy and elsewhere. Staff participate in organizations such as CAFSAC (and its successor), NAFO and, more recently the FRCC. Ongoing contact is kept with a number of fishermen's organizations as well as individuals. Finally, considerable effort is expended in education initiatives and answering queries from the general public.

The mandate requires the provision of advice and information for a wide range of commercial and non-commercial species. However, due to budget constraints, research activities are focused on the major commercial species -- cod, haddock, pollock, and silver hake. Work on flatfish (American plaice, witch, yellowtail, and Winter flounder) and Atlantic halibut was initiated in 1993/94. Work on other species, the most prominent being redfish, is restricted to answering requests for information with existing data sets. This distribution of research effort closely matches that of current landings (Figure 1). It is interesting to note the 1989 distribution of Scotia-Fundy landed and processed value by major species group (Figure 2). Whereas shellfish are almost equivalent to groundfish in landed value, such is not the case for processed value.

When considering such a large and diverse program as that for groundfish, it is important to have in mind a conceptual model of a fish stock (Figure 3). The stock grows in size due to recruitment, growth, and immigration from other areas. The stock decreases in size due to fishing and natural mortality, as well as emigration. Our state of knowledge of these processes will vary by stock. For some, we have poor estimates of growth. For others, emigration and immigration are problems that need addressing. Finally, there may be generic questions that affect all stocks. The impact of regulations such as gear type and size is a case in point. Therefore the research programs for each stock will be different depending upon the information requirements.

To answer these questions, the groundfish program undertakes four activities (Figure 4) -- long-term population monitoring, short term process studies, resource modelling (referred to as assessment) and client consultation. A breakdown of the 1993/94 budget is given in Table 3. In this and the following tables, Divisional administrative costs have been prorated across programs. Of the \$611.0K budgeted for finfish/seals, \$425.4K is allocated for the groundfish program, involving the efforts of about 43 staff. The descriptions below are

intended as a brief overview of the activities. More detailed information on each can be obtained from Bob O'Boyle.

3.1 Long-Term Population Monitoring

This activity involves the ongoing, routine collection of information on the finfish and seal resources. Regarding fishery-related activities, both port and at-sea sampling is conducted, the latter being the Observer Program in collaboration with Fisheries Management Branch (FMB). An initiative to involve fishermen more formally in these data gathering exercises has been started as part of a fishermen's network. A number of research vessel surveys are conducted, the most prominent of these being the summer (July) bottom trawl survey, the March 4VsW groundfish survey, and that on Georges Bank, again in the winter. Inshore surveys are also conducted along Eastern Shore and off South West Nova Scotia. A synopsis of these surveys is provided in Appendix III. This was distributed at the meetings.

Also included in the monitoring activity is the determination of fish ages and maturity. This information is critical to the determination of population age structure and thus year class strength estimation.

Finally, resources are expended on the ocean temperature and salinity monitoring program. Much of this is for the upkeep of the equipment used in the program.

Overall, this function involves about 17 staff at a cost of \$216.0K, which is 50% of the available budget (Table 4).

3.2 Short-Term Studies

These are designed to elucidate the processes observed in the long-term monitoring of the populations -- why is recruitment declining, why are growth rates down, what is the impact of a particular gear regulation, and so on. These studies fall into two categories -- those needed to address specific stock questions and those of broader applicability.

a) Species-specific

cod - The 4T/4Vn/4VsW stock mixing question and 4Vn resident stock structure, is the focus of study, as is the distribution of cod on Georges Bank and the implications of transboundary movement on management. Also on the Eastern Shelf, work is being pursued to explain the disappearance of the 4VsW cod spring spawning component and the interaction between cod and seals. Studies are also being conducted to describe the reproductive performance of cod and how this varies with size and age. Extensive collaboration exists with university scientists involved with OPEN on this cod stock as well with studies ranging from cod physiology and genetics to those describing the ocean circulation pattern on the Eastern Scotian Shelf.

- haddock - On the Eastern Shelf, work is being conducted on the impact of the 4W closed area. In South West Nova Scotia, an inshore survey is being conducted both to supplement the offshore survey as well as test the application of acoustics to stock assessment. On Georges Bank, tagging is being conducted to enhance our knowledge of transboundary distributions and thus aid in the establishment of management policy.
- pollock - The main issue is the development of a reliable index of abundance. Past attempts at initiating a Shelf-wide acoustics survey were unsuccessful. Current effort is focused on more in-depth interpretation of the log-book information.
- silver hake - Staff are cooperating with FMB in the development of a Canadian fishery on the Scotian Shelf. Also, a juvenile survey is conducted in the fall of each year to provide an estimate of in-coming recruitment.
- flatfish - The main project is on the improvement of the quality of the catch statistics. Until this can be done, it will be very difficult to determine the level of exploitation on this species complex.

b) General

- Population Processes - Research is being conducted on the impact of environment on stock distribution, growth and recruitment. Also, new methods, based on ear bones, biochemistry and genetics, are being developed to aid in stock definition. Studies of the deep-water communities are also being pursued.
- Management Issues - Gear (trawler and longliner) selection studies are ongoing in cooperation with C. Cooper of Development Branch. A number of different studies have been conducted on the impacts of regulatory measures as and when they arise.
- Fleet Dynamics - A number of studies are being undertaken to improve our understanding of fleet behaviour and thus facilitate the use of this information in stock assessment.

This function involves about 24 staff for a cost of \$158.0K (Table 5).

3.3 Assessment

Assessment is normally thought of as the annual exercise in which scientists meet to discuss the most recent information on resource status. It is largely a modelling exercise where the scientist makes hypotheses about the population dynamics and then sees how these are reflected in the collected information. Virtually all staff expend at least part of their time

in the assessment process. In addition, two staff are devoting their attention to the improvement of the assessment models that are used. Length-based approaches, spatial analyses, and measures of risk and uncertainty are all under investigation.

The budget breakdown is given in Table 6. Of the \$37.0K total, about \$30.0K is for assessment meetings. The remainder is for model research.

3.4 Client Consultations

The provision of information to clients is an important aspect of the mandate. All staff are involved to some extent in this activity. About \$15.0K is spent, mostly for travel to meetings.

4. The Marine Mammal Program

There is also a research program on marine mammals, particularly grey and harbour seals, and their parasites. More recently, duties have been assigned to address harbour porpoise issues in the Bay of Fundy. While the focus of these discussions was groundfish, due to the potential interaction of seals with these species, the marine mammal program was briefly described.

The program conducted out of BIO is referred to as the Seal/Sealworm Ecology Program (SSEP). This program, initiated in 1989, is designed to elucidate the dynamics of the grey and harbour seal populations on the Shelf and the impact of these on the fish populations. A complementary program, called the Sealworm Intervention Program (SWIP), is being conducted by Dalhousie University under the sponsorship of DFO. This program is designed to provide biochemical tools to allow control of the seal population and its parasites. Therefore, the use of the products of SWIP is linked to the findings of SSEP.

The SSEP is composed of four elements:

1. Sealworm Ecology - This involves the examination of the life-cycle of the sealworm parasite and its infestation of the fish populations, both in time and space.
2. Seal Diet and Energetics - Studies are being conducted to describe the food requirements of seals and their feeding behaviour, most importantly being the diet composition.
3. Seal Population Dynamics - This research allows description of the growth of the seal herds and their distribution. More recently, this program has been enhanced to examine the presence of toxic chemicals in seal blubber.

4. Seal Program Support - This is the 'ship' of the SSEP and involves maintenance of facilities on Sable Island and the travel necessary to get there.

The budget for the marine mammal program includes 6 staff with an operating fund of \$98.0K (Table 7). This budget was in excess of \$275.0K in each of the last three years. Therefore this program was significantly reduced in 1993/94.

5. Consultations in Yarmouth -- Colony Inn, 10:00-16:00, 6 October 1993

This meeting was attended by representatives of the South West Nova Scotia fishing industry. A list of participants is given in Appendix I. There was the general observation that in the past few years, the communication gap between fisherman and scientist has narrowed. One industry participant mentioned that more could be done, perhaps using the English model where fishing captains and scientists work closely together. Notwithstanding this, meetings such as the present one were considered very useful and would lead to greater confidence in scientists on the part of fishermen. It was felt that this type of consultation on programs should be conducted more than once per year, perhaps on a quarterly or semi-annual basis.

5.1 The Regional Science Context

Participants were very interested in the Regional overview of the budget. Indeed, this is the first time that many had seen anything like this. There was a general sentiment that the Regional budget pie was too small and that the most effective allocation of funds was on research. Many felt that good research was the only way we can avoid future crises similar to the one that we are now experiencing. This was the only comment related to the Regional budget split. The majority of comments dealt with the BSB and groundfish program budgets directly.

In response to the question on the BSB budget split, some felt that this was an unfair question. They stated that presumably the 65/15/20 allocation had been based on the best available information and was the result of a rational decision process. One participant felt that the split should be 70/15/15, an enhancement of harvest fisheries funding. Certainly there was a recognition that funding for this program should be increased with consideration that the industry and the province should lobby for this. In relation to aquaculture, it was felt that the salmon industry was well established after years of DFO input and that now was the time for the industry to take over those aspects still maintained by DFO. Industry participants felt that whatever funding is available for aquaculture should be diverted towards the development of non-salmon species.

Concerning harvest fisheries, the group felt that funding should be diverted to those species in trouble (groundfish and scallops) and diverted from programs such as salmon and

lobster. There was considerable discussion on how the industry can help in improving the budget situation. In particular, the issue of cost recovery was raised. If industry benefits, it should pay. Alternatively, DFO could put aside a percentage of the overall TAC, say 1% for example, as a means to fund joint Science/industry projects. Much of this discussion was in the context of surveys and is reported below.

5.2 The Groundfish Program

Regarding the mandate, there were only a few comments. Specifically, it was considered that it may be necessary to reduce work on some species to allow the study of new ones. The rest of the comments were specific to individual programs.

a) Long-Term Monitoring

There was considerable discussion on the survey program. Overall, there was a strong consensus that the surveys were a central part of the mandate and should not be cut. This is particularly true for the current fisheries which are dominated by small fish and thus very dependent on in-coming recruitment. Surveying these resources less than once per year was not thought wise. If the population structures were different (composed of older fish), it may be possible to survey less frequently. If anything, the survey program should be enhanced. It was recognized that these surveys were the primary source of information on the environment. Discussion then focused on the use of commercial vessels to supplement survey operations. There was the conviction that DFO cannot run its vessels as cost effectively as the industry could. Money could be saved by making more use of industry platforms. As well, fishing vessels come equipped with a variety of fishing gear and expertise. These vessels could be used in joint Science/industry index fishing programs. Such programs would have to carefully measure inter-vessel variability to allow the generation of long-term indices of stock abundance. There was some thought that SCANMAR technology could help in this regard.

The issue of cost recovery and the idea of using a percentage of the TAC as a research fund was raised. This may require changing some of the Treasury Board guidelines on compensation, although there is some indication that this may have already happened. This needs to be confirmed. It was recommended that the issue of using industry vessels in lieu of those of DFO should be discussed as part of the research vessel fleet replacement plan. DFO staff noted that DFO vessels support a range of programs, not just those for groundfish.

There was an in-depth discussion on the fishery-related sampling programs. Many felt that the local port technicians were the best sources of information to DFO on the fishery. Their years of experience and expertise are well regarded. Regarding the Observer Program, while this has recently received criticism, it was felt that the observers for the most part do a good job. It was mentioned however, that the program has too many coordinators and could benefit from fewer of these. As well, while the program collects a great deal of information, it is the industry's perception that they see little of this. More feedback on the results of this program is needed. The discussion on IOP raised the issue of the foreign fishery with many

meeting participants again questioning why this was allowed. In addition, recent comments on the unreported capture of small fish in this fishery were reiterated. These were countered by other industry members that the foreign silver hake fishery is one of the cleanest in the zone and most highly observed.

b) Short-Term Studies

There was general support for the research activities undertaken by the groundfish program. Specifically, the Georges Bank tagging study was seen as a sensible initiative given our knowledge of cod and haddock transboundary distributions and the need for a management policy. Industry wished to see more input in the planning and execution of this program. This would increase its chances of success. Further comments were made on movement of cod between Browns and Georges and the apparent increase of their movement in 1993.

There was interest in the feeding behaviour of cod. There were comments made on the presence of large numbers of scallop meats in the stomachs of Georges Bank cod. As well there were questions on the extent of the spawning period in relation to the proposed January-June closure.

Regarding haddock, there were a number of questions on the spawning period, both on Browns and Georges, and the impact of fishing on the spawning grounds. There was the sense that while the 4X haddock resource appears more abundant in 1993, the number of local spawning grounds is much smaller than observed historically. This raised an interesting discussion on the history of the South West Nova Scotia fishery. In the past, haddock spawning was seen on Roseway, Little LeHave, off Jordan river, and at other locations. Industry could help scientists in identifying these historical spawning sites as a means of documenting changes in population richness. The discussion also covered the distribution of cod and haddock juveniles and the use of the inshore survey.

Fishermen were concerned with the condition of the pollock resource. While there appeared to be lots of small pollock both inshore and offshore, it was felt that these would be caught by the offshore fleet. There were calls for a closure of the winter fishery in 4X on LaHave Bank.

Due to time constraints, there was little discussion on flatfish other than mention of the cooperative winter flounder study. Participants felt that the next meeting should be arranged so as to allow discussion of this resource.

Participants questioned the need for a silver hake survey when the fishery is prosecuted by foreigners. The place of silver hake in the food chain was briefly described by DFO staff. This raised comments on the need for Science to study more explicitly the feeding interactions. For instance, what are the implications of the recent increases in sand lance and decreases in herring on Georges Bank? Some participants perceived declines in

herring -- what are the implications for groundfish? These questions raised others on the growth dynamics of groundfish and what factors influence recruitment. There was a general concern that more work needs to be done on feeding interactions.

Throughout the meeting, comment was made on the necessity to describe the impact of fishing gear on the stocks. Reference was made to the work of Chris Cooper which was generally supported. Chris noted that due to funding pressures, much of the planned work on the gear technology could not proceed. Industry reiterated its support for these activities.

c) Assessment

The discussion focused on the need for annual assessment, at the very least to determine what have been the trends in recruitment. Participants felt that scientists are only seeing part of the catch and again mentioned their offer to help in the catch sampling.

d) Client Consultations

There was a lot of discussion on the pros and cons of various regulatory measures -- TAC's should not be changed, yes to effort controls, no to effort controls, fixed catch levels and so on. There was a general sentiment that management is at best a coarse instrument and that we should not have to depend on the precision of annual projected TAC's. As well, there was a desire to see a management strategy developed for Georges Bank.

5.3 The Marine Mammal Program

There was a lot of discussion on what to do about the seal population. There was a general recognition that the population had dramatically increased and was indeed now feeding in areas not seen previously, i.e. off the Annapolis power station. As well, worm burdens in fish have steadily increased. Whereas in the early 1980s, only few worms could be found in thousands of pounds of fish, now worms are common in haddock and all fish have to be routinely candled. Therefore, something has to be done about seals. It was recognized that whatever is done has to be based on the best possible scientific information, given the political sensitivities of the issue. It was noted by industry participants that the seal program has accumulated a considerable amount of knowledge on seals since the late 1980s on seal distribution, population dynamics, feeding behaviour and so on. More recently, the program has experienced a substantial funding cut with most of the budget now going to the Dalhousie University SWIP. Notwithstanding this, the participants felt that now was the time to bring all the information together to determine the impact of the seal herds on the groundfish.

6. Consultations in Sydney -- Coast Guard College, 10:00 - 16:00, 14 October 1993

The meeting was attended by representatives of the Eastern Shore fishing industry. A list of participants is given in Appendix I. The comments in the meeting covered a broad range of topics, not restricted to any agenda. For convenience, these comments are herein reported according to the format of the talks given by Mike Sinclair and Bob O'Boyle.

6.1 The Regional Science Context

Comment on the Regional budget situation was restricted to the split within the Biological Science Branch. Regarding the 65/15/20 issue, there was a feeling that more money should be spent on aquaculture and that more should be done to foster the positive interaction between aquaculturists and fishermen. Within the Harvest Fisheries budget, it was felt that the recreational fishermen should put more funds into the maintenance of the fish hatcheries. Also, they would like to see more money spent on food web research and less on the generation of TAC's. Generally they felt that the Science budget should be increased to represent a larger proportion of the Regional DFO budget.

6.2 The Groundfish Program

There were very few comments on the overall make-up of the program and its mandate. Discussion focused on the individual program elements.

a) Long-Term Monitoring

Regarding surveys, the participants considered that this was a very important ongoing initiative and that it provided one of the few reliable views of changes in resource size. Every tow contained good information. The Fisherman's Report was mentioned. This was well received by the industry and is now anticipated once a survey is completed. The participants felt that the format of the March survey report was superior to that produced for the July survey. The numbers and weight of fish caught per tow should be provided.

The value of the port sampling program was recognized and supported. It was thought that the recent CANSEA proposal would dramatically enhance Science's information on the fish resources and lead to long term improvements in both management and the interaction between industry and scientists.

b) Short-Term Studies

There was considerable discussion on the cod resource. The value of the 4T/4Vn/4VsW mixing work was noted. There is a need to supplement this with the study of potential Subarea 4/Subarea 3 movement. There have been recent observations of 3Pn cod in 4Vn in the spring, as noted by the presence of Newfoundland tagged cod. It was mentioned however that not all tags are being returned on account of the fear of regulatory sanction.

This conversation pointed out the requirement for better information on the stock boundaries and the stock sub-population structure. In particular, there was concern for the absence of the 4VsW spring spawners and the obvious recent changes to spawning activity. There is a need for more research on the location and timing of cod spawning.

It was thought that juvenile pollock were less abundant this past year and that overall the pollock fishery was in trouble. There has been a lack of larger fish as well. There are no pollock inshore anymore. While this is somewhat related to the inshore seasonal movements of pollock, participants implicated the perceived destruction of inshore habitat by draggers. It was noted by DFO staff that trawling in the North Sea has occurred for a long period of time and the stocks still appear productive. Notwithstanding this, industry participants considered that either trawling be stopped or be restricted through the use of closed areas. During this discussion, Science staff emphasized that the information on pollock stock size was poor. Past attempts at establishing an inshore index of year-class strength were confounded by the catchability of the mackerel traps used in the study as well as the dispersed nature of the inshore juvenile grounds. It was mentioned by industry participants that currently mackerel trap fishermen tend to dump small pollock. Consideration should be given to alternative ways of developing a juvenile pollock abundance index.

Silver hake received some attention. It was questioned why we needed to research this species at all. In response, Science staff mentioned that the silver hake population has historically represented one of the largest in biomass on the Shelf and that as a consequence, it may be playing an important role in the ecosystem. Mention was made of the potential seal/silver hake interaction as well as its cannibalistic feeding behaviour.

There was a lot of discussion on flatfish. Science staff reiterated the need for more reliable catch statistics, broken down by species. Industry felt that more work needed to be done on flatfish, including Atlantic halibut in particular. There is an urgent need for a conservation plan before it is too late. Effort displaced from the regulated species is being expanded on species such as flatfish (which is essentially unregulated due to the high TAC), cusk and white hake, an important inshore fishery. This will likely continue next year. For plaice, yellowtail and witch, a 2-3 fold increase in dragger effort is thought to have occurred. For halibut, the problem is excessive fixed gear effort. Halibut catch rates which peaked in 1988, after the introduction of the more efficient circle hook have subsequently declined. There is a need in all these stocks to document the trends in fishing effort. Fishermen offered their assistance in the explanation of the trends in catch, effort and catch rate in these fisheries.

There was some discussion on Science's environmental program and its use in assessment. Science staff noted that water temperatures now are almost two degrees colder than they were in the early 1980s. These conditions were seen in the 1960s. Questions were raised on what are the impacts of this on spawning. Could the problems in 4VsW be related to temperature change? Participants considered that this was an important research issue.

In relation to management issues, the group queried the impact of the closed area, and mentioned the need for selectivity studies on flatfish. Also, they saw a need for more gear-specific closed areas.

c) Assessment

There was a desire to see more information from fishermen used in stock assessment. This followed from the sentiment that scientists and fishermen need to work more closely together to resolve the problems in the fishery.

d) Client Consultation

Participants stated their desire to have more involvement in the FRCC process.

6.3 The Marine Mammal Program

There was considerable discussion on the size of the seal herds and the interaction with the fish populations. Science staff reported that seals are eating small fish, including capelin and herring. The impacts of this on the groundfish communities need to be determined. Industry participants considered that the program's budget was very large compared to that of groundfish and indeed seemed out of proportion. There was also limited discussion on seal/fishing gear damage which is prevalent along Eastern Shore.

7. Consultations in Dartmouth -- BIO, 10:00 - 16:00, 10 November 1993

This meeting was attended by representatives of the offshore fleets. A list of participants is given in Appendix I. Peter Underwood from the Province of Nova Scotia could not attend and therefore sent his comments by letter. These have been incorporated into the text below.

7.1 The Regional Science Context

Participants were very interested in seeing the regional breakdown of the budget. This was the first time that any had seen information such as this. While they were happy to have it, for future meetings, they would prefer to see a finer breakdown of the expenditures by Science, enforcement, etc.

During comments on the regional Science budget, it was mentioned that the CHS had upgraded perfectly good navigation charts. The new charts are not considered as useful as the old ones. Also, there were strong comments on the duplication of activities. For instance, one participant reported that recently a vessel had landed 5000 lbs of cod. The vessel had an observer, and was weighed out at dock-side under the supervision of a port monitor. Also, a

port technician sampled the catch. Finally, a Fisheries Officer oversaw the entire operation. This was seen as an example of government waste.

There was recognition that the overall Science budget was small. There were suggestions on how industry could help. Science staff mentioned that in Australia there is an industry/government board which is responsible for the management of a jointly contributed fund. On an annual basis this fund is used to pay for high priority projects (e.g. the orange roughy survey). It was further noted that the Australian equivalent of DFO has its own funding as well. However, the industry/government fund is useful for emerging high priority projects that government cannot respond to. As well, it is a means of making industry a true, responsible partner of the research programs. Namibia has implemented a "science tax". Other ways industry could help is through survey activities, which is covered below.

Within the BSB budget and in response to the question on the 65/15/20 split, there was surprise expressed at the relative size of the salmon enhancement program (about 60 PYs costing almost \$700.0K). This program is predominantly for the angling industry which is worth about \$52.0M to the province of Nova Scotia. This includes not only the value of the fish, but also value added through the local economies. This was compared to the \$400.0M of processed value for groundfish. The meeting participants felt that Science should seriously consider moving the salmon enhancement component of the program to the private sector. There was some discussion on the possibility of turning the hatcheries over to the provinces. In general, salmon were viewed as an exotic species with little or no interest to the offshore fleets. There was the recommendation that Science should actively pursue a program to plant nursery-reared cod and haddock in the productive offshore areas. This is similar to the ocean ranching program underway in Norway.

7.2 The Groundfish Program

There was overall agreement with the balance of the program except for two areas. Questions were raised on the lack of focused research on redfish. As well, under the criteria of prioritizing research for the benefit of Canadians, it was queried why the silver hake program receives funding. In response, Science staff noted that the silver hake population is one of the largest in the Region and from a biological standpoint alone is worthy of study. Also, there have been recent initiatives to Canadianize this fishery.

a) Long-Term Monitoring

There was considerable discussion on the costs of the survey program. More information than that provided was desired on the costs of these surveys, including vessel costs, operating costs, salaries of crews and so on. The general question was raised -- can these surveys be done with industry vessels and still maintain the historical continuity? How can we make more effective use of fishing vessels as part of on-going monitoring activities? Science staff responded that the research vessels are flexible platforms that are designed to serve a variety of tasks. It would be very expensive and ultimately false economy to transfer

this functionality to fishing vessels. Rather, it made more sense to further develop industry/science cooperative initiatives on data collection as part of routine fishing operations. This would add significantly to our information on the resources.

This led to discussion on the need to resurrect the Index Captain Program designed by the DFO scientist, Paul Fanning. The problems with the first attempt to get this program started were mentioned. In particular, there is a need to develop an incentive system for the captains to ensure their participation in the project. Perhaps compensation could be on a tow by tow basis. There was also discussion on a potential inshore-midshore index fishing program for the Eastern Shore.

The quality of the landings statistics was discussed. It was felt that this has been uniformly high during the last two years, different from the situation 2-3 years ago. Attitudes have changed and amendments to the Fisheries Act have led to the improvement in fishing practices. The now almost 100% coverage of the offshore, midshore fleets has also been a factor.

b) Short-Term Studies

There was agreement that the cod projects were appropriate, specifically those designed to elucidate the movements into and out of the Gulf and the migrations across the Canada/US boundary. Questions were raised on the historical distribution of haddock in 4Vs compared to today's patterns. More research on this issue was requested. The need to study the cod and particularly haddock by-catch in the silver hake fishery was reiterated. Finally, there was a recommendation to focus resources on the Unit 2 and 3 redfish populations. Science staff noted that the Unit 2 population was part of a shared mandate with the Newfoundland Region.

A number of topics were raised in the general discussion on population dynamics research. Some of these were mentioned in the letter from Peter Underwood. Consistent with recent statements by the Fisheries Resource Conservation Council (FRCC) more work is required on multispecies interactions. Also, the importance of variability in recruitment was noted as well the need to describe its causes (early life survival and mortality) and effects. The Science programs to describe the influence of environment on distribution and abundance were encouraged.

In relation to management measures, the impact of the 4W closed area was queried. Research on its efficacy is needed. This is a general requirement for all such closed area regulations. Also the work of Chris Cooper on gear technology and selectivity was supported and encouraged with more research in this area required.

c) Assessment

There were little or no comment on the assessment process or models other than the general desire to enhance industry's participation.

d) Client Consultation

There was little or no comment on this aspect of the program.

7.3 The Marine Mammal Program

There was recognition that the seal herds were creating significant problems for the fishing industry. The efforts of DFO Science, both through SSEP and SWIP were acknowledged. It was felt however that relative to other program areas, the information base for seals seemed extensive and that now was the time to synthesize this into meaningful statements on the impact of seals on the fish populations. From this perspective, the expenditures in the Marine Mammal Program could be reduced and diverted to other areas. This would have to be carefully evaluated by Science.

8. Concluding Remarks

This report documents the first formal input by the Scotia-Fundy fishing industry into DFO's Regional groundfish program. This process would not have been a success without their enthusiastic participation. For this, Science offers its thanks.

Much of the time in the meetings was spent providing participants with details of the program elements as well as discussing recent events in the fishery. Consequently, not all programs could be covered to the same extent. Future interactions will endeavour to resolve this. Notwithstanding this, the comments from the three separate meetings were remarkably consistent. These will be incorporated to the degree possible in the 1993/94 Program Review and Planning (PREP) exercise to be undertaken by DFO Science in January 1994.

Table 1. Estimate of 1993/94 budget (\$ million) (A and B-base combined) for the Scotia-Fundy Region of DFO.

Program	Operations/ Capital	Salary	Total
Science	8	24.5	32.5
Non-Science	24.5	26.2	50.7
Ships			
Science	5.8	7.3	13.1
Non-Science	1.9	5.4	7.3
Total	7.7	12.7	20.4
TOTAL	47.9	76.1	124.0

Table 2. Generation of 1993/94 A-base budget (O&M and overtime) (\$000's) as a consequence of cuts to 1992/93 funding. Does not include administrative costs.

	1992/93 PYs	1992/93 Budget	Cuts	1993/94 Budget	% Reduction
Finfish/seals Stock Assessment	61.8	849	238	611	28.0
Invertebrate Stock Assessment	30.5	485	118	367	24.3
Freshwater Stock Assessment/Enhancement	59.0	689	106	583	15.4
Aquaculture	23.5	405	35	370	8.6
Habitat/Climate	50.8	699	223	476	31.9

Table 3. 1993/94 budget (O&M and overtime) (A-base) of groundfish programs. Staff allocations are approximate.

Activity	Program	Staff	Budget (\$000s)
Long-Term Population Monitoring	Commercial Sampling	8	68
	Surveys	2	72
	Ocean Measurement	3	61
	Ageing and Maturity Studies	4	15
Short-Term Studies	Species-Specific	18	116.4
	General	6	41.3
Assessment Models		2*	36.7
Client Consultation		ALL	15
TOTAL		43	425.4

* Almost all scientists are involved conducting assessments. These staff have focused research on assessment methods.

Table 4. 1993/94 budget (O&M and overtime) (A-base) of long-term monitoring program. Staff allocations are approximate.

Program	Staff	Budget (\$ 000s)
Port Sampling	6	37
At-Sea Sampling	2	31
Ageing and Maturity Studies	4	15
Fish Survey	2	72
Ocean Measurement	3	61
TOTAL	17	216

Table 5. 1993/94 budget (O&M and overtime) (A-base) of short-term studies.
Staff allocations are approximate.

	Program	Staff	Budget (\$000s)
Stock Specific	Cod	8	61.2
	Haddock	5	29.3
	Pollock	2	11.0
	Silver Hake	1	3.2
	Flatfish	2	11.7
General	Population Processes	3	36.7
	Management issues	2	4.6
	Fleet Dynamics	1	-
TOTAL		24	157.7

Table 6. 1993/94 budget (O&M and overtime) (A-base) for assessments. Staff allocations are approximate.

	Staff	Budget (\$ 000s)
Annual Assessment	Various	30.0
Model Research	2	6.7
TOTAL	Various	36.7

Table 7. 1993/94 budget (O&M and overtime) (A-base) for marine mammal program. Staff allocations are approximate.

Program	Staff	Budget (\$ 000s)
Sealworm Ecology	2	8.0
Seal Diet and Energetics	2	31.6
Seal Population Dynamics	2	6.0
Seal Support Program	-	52.4
TOTAL	6	98.0

SCOTIA-FUNDY GROUND FISH

CATCH/PRISE 1992

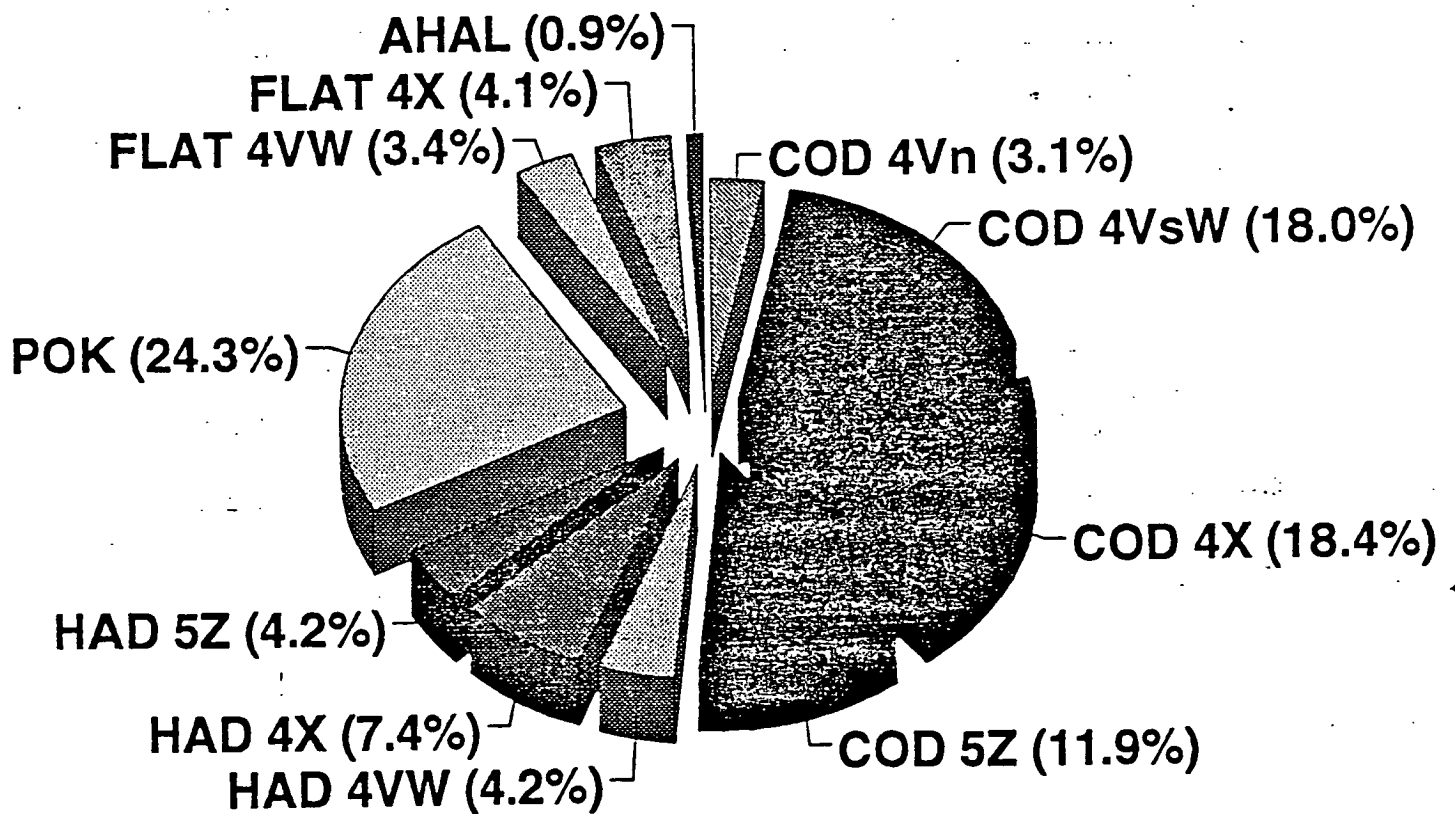


Figure 1.

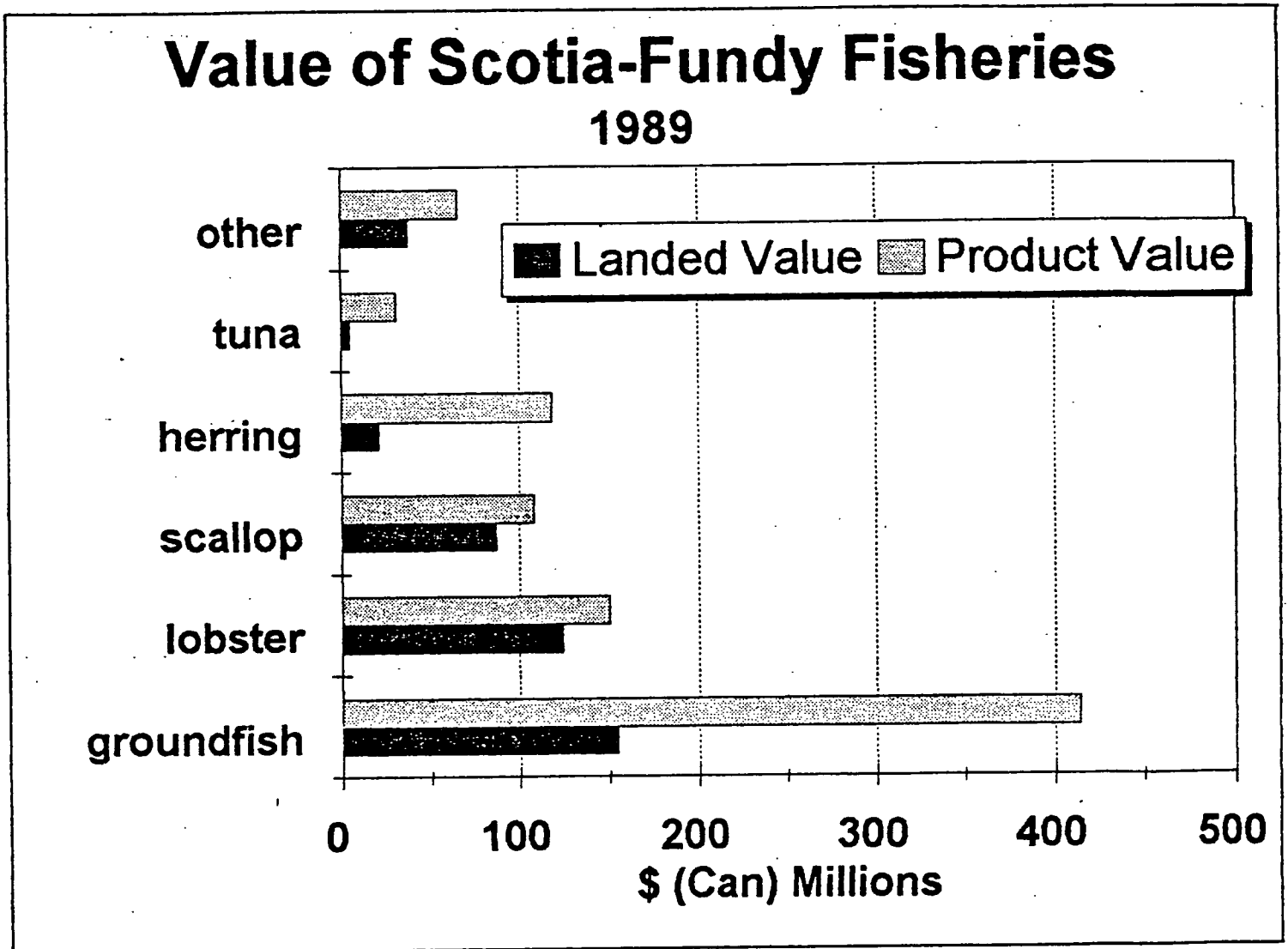


Figure 2.

Model of Fish Stock

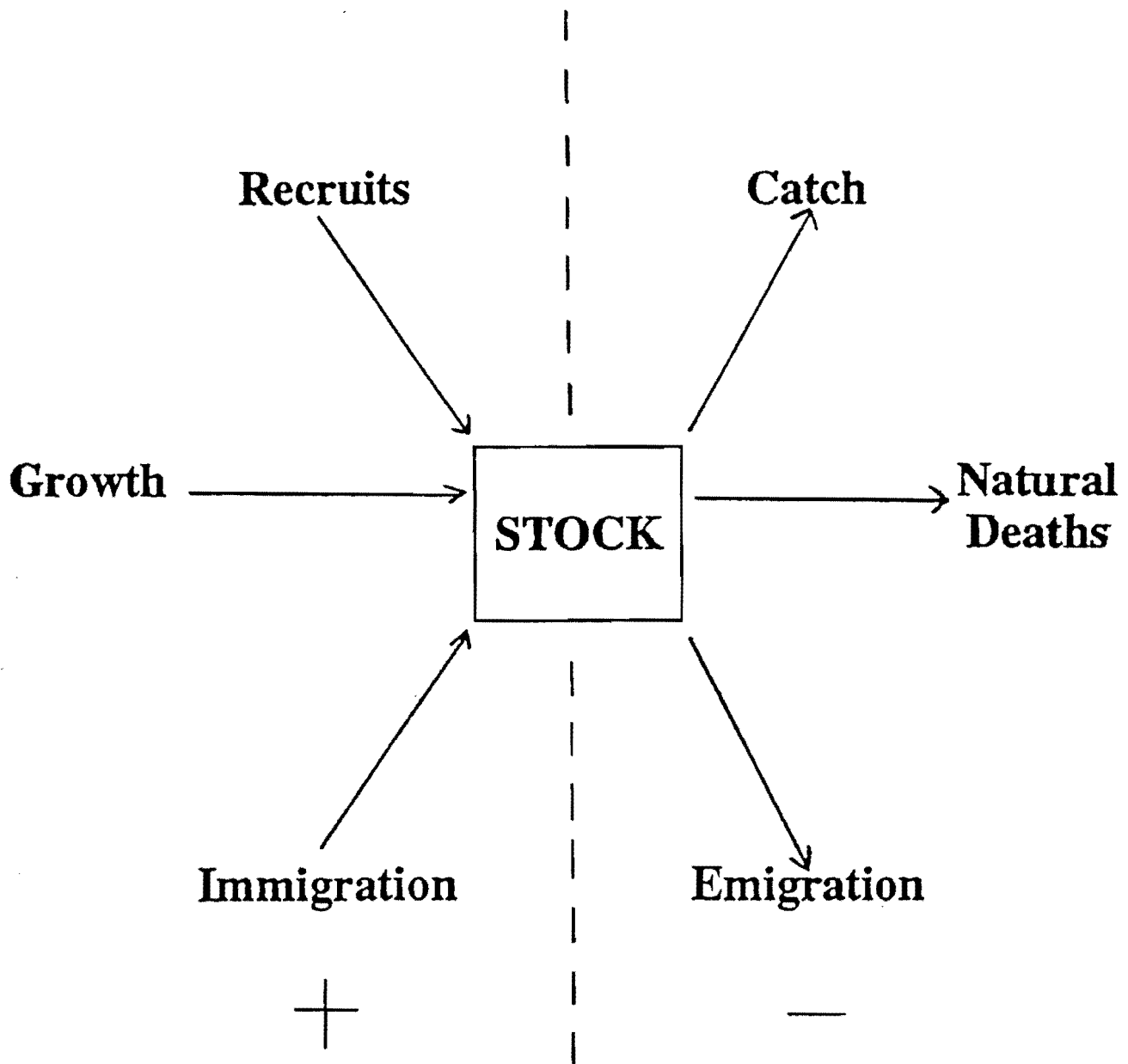


Figure 3. Model of a fish stock used to define research needs for each resource.

Activities

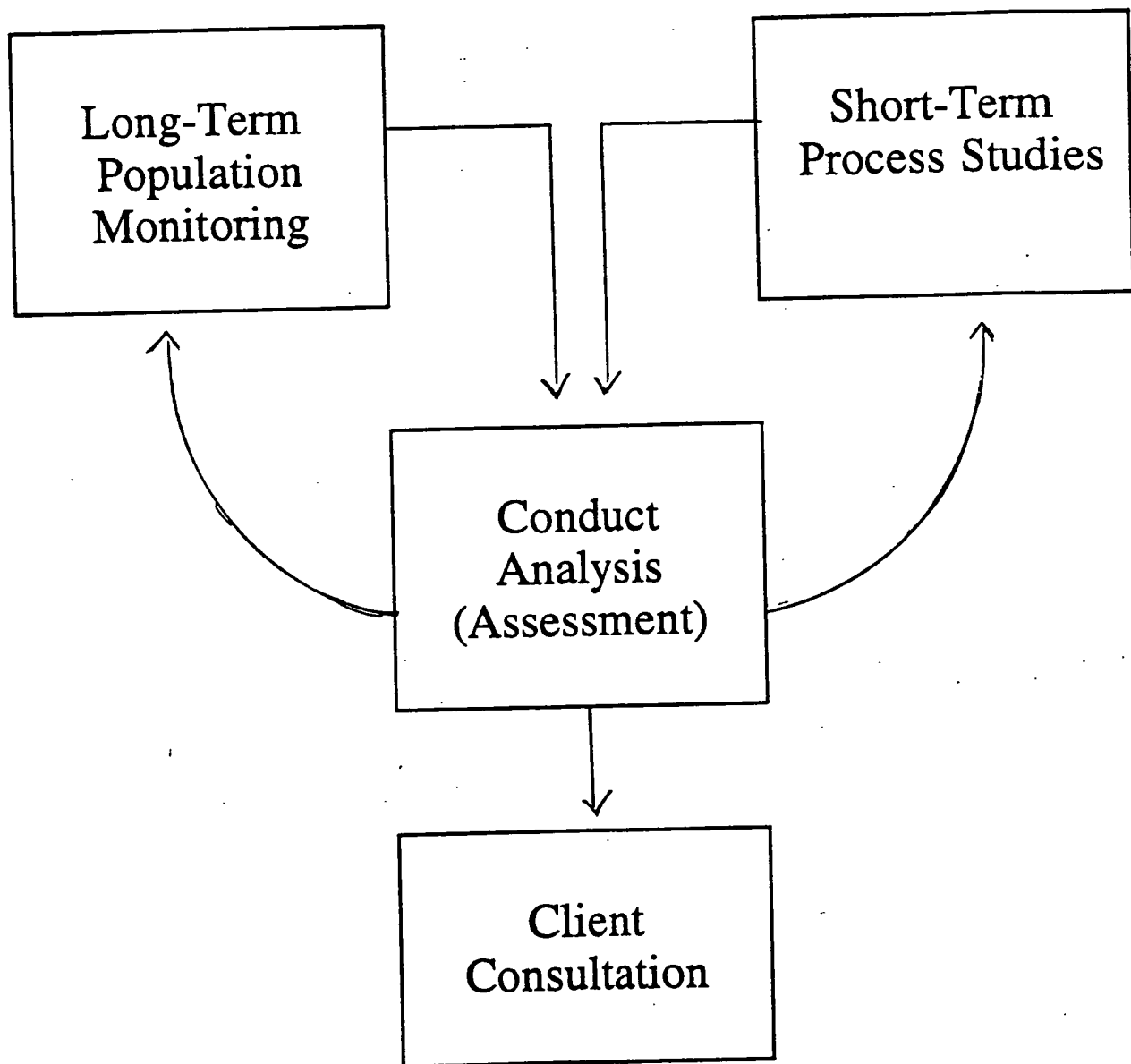


Figure 4. Activities of the groundfish research program.

APPENDIX I. List of participants.

A. Yarmouth Consultation

<u>Name</u>	<u>Affiliation</u>	<u>Telephone No.</u>
GOVERNMENT -		
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Davis, Glen	Upper Bay Mobile 'Flatfish'	
Wadman, Glenn A.	D.B. Kenney Fisheries Ltd.	(902) 839-2023
Walters, Evan	S-F Inshore Fishermen's Assoc.	(902) 745-3134
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APPENDIX I. (Continued)

B. Sydney Consultations

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APPENDIX I. (Continued)

C. Dartmouth Consultations

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Himmelman, David	LaHave Seafoods	(902) 688-2773
O'Connor, Michael	National Sea Products	(902) 634-3565
Roe, Eric	Clearwater Fine Foods	(902) 443-0550
Snarby, Ulf	M.V. Osprey Ltd.	(902) 354-3305

APPENDIX II. List of abbreviations.

DFO	- Department of Fisheries and Oceans
CAFSAC	- Canadian Atlantic Fisheries Scientific Advisory Committee
SABS	- St. Andrews Biological Station
BSB	- Biological Science Branch
BIO	- Bedford Institute of Oceanography
HFRL	- Halifax Fisheries Research Laboratory
MC	- Maritime Centre
PCSB	- Physical and Chemical Sciences Branch
CHS	- Canadian Hydrographic Service
JGOFS	- Joint Global Ocean Flux Study
OPEN	- Ocean Production Enhancement Network
GLOBEC	- Global Ocean Ecosystems Dynamics
ICES	- International Council for the Exploration of the Sea
NAFO	- North Atlantic Fisheries Organization
FRCC	- Fisheries Resource Conservation Council
FMB	- Fisheries Management Branch
MFD	- Marine Fish Division

APPENDIX III.

**Briefing Package on
Groundfish Surveys of
DFO Scotia-Fundy Region**

by

**R. O'Boyle
Marine Fish Division
Bedford Institute of Oceanography
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20 September 1993

Surveys Leading to Indices of Abundance:

Timeframe	Location (NAFO Div.)	Vessel Used	Type of Survey	Stocks Covered
5-16 July 1993 19-30 July 1993 (two leg cruise)	Scotian Shelf (4VWX)	Alfred Needler	Bottom trawl survey	4VWX groundfish
19 July - 6 August 1993	St. Mary's Bay to Cape Sable Island (4X)	J.L. Hart	Inshore groundfish trawl and dual beam acoustic survey	4X haddock
3-13 August 1993	Scotian Shelf (4VWX)	Alfred Needler	Sealworm index survey	American plaice
23 October - 10 November 1993	Browns Bank to Sable Bank (4X, 4W)	Alfred Needler	Juvenile silver hake trawl survey (IGYPT trawl)	4VWX silver hake
7-25 February 1994	Georges Bank (5Ze)	Alfred Needler	Bottom trawl survey	5Ze cod and haddock
26 February - 11 March 1994	4VsW	Alfred Needler	Groundfish trawl	4VsW cod
July 1994 (two leg cruise)	Scotian Shelf (4VWX)	Alfred Needler	Bottom trawl survey	4VWX groundfish
July - August 1994	St. Mary's Bay to Cape Sable Island (4X)	J.L. Hart	Inshore groundfish trawl and dual beam acoustic survey	4X haddock
August 1994	Scotian Shelf (4VWX)	Alfred Needler	Sealworm index survey	American plaice
October - November 1994	Browns Bank to Sable Bank (4X, 4W)	Alfred Needler	Juvenile silver hake trawl survey (IGYPT trawl)	4VWX silver hake

Surveys Related to General Research:

Timeframe	Location (NAFO Div.)	Vessel Used	Type of Survey	Stocks Covered
28 June - 2 July 1993	Grand Manan (4X)	J.L. Hart	Bottom trawl survey	4X-5Y cod
30 June - 15 July 1993	Sydney Bight (4Vn)	Navicula	Bottom trawl survey	4Vn Cod
22 September - 4 October 1993	Sydney Bight (4Vn)	Navicula	Bottom trawl survey	4Vn Cod
27 January - 2 February 1994	Emerald Bank (4W)	Alfred Needler	Observer training	Various groundfish
14-26 March 1994	Georges Bank (5Ze)	Alfred Needler	Acoustic/trawl/ cod tagging	5Ze cod
April 1994	(4W)	Alfred Needler	Observer training	Various groundfish
May 1994	(4Vn)	Navicula	Bottom trawl survey	4Vn cod
June - July 1994	Grand Manan (4X)	J.L. Hart	Bottom trawl survey	4X-5Y cod
June - July 1994	Sydney Bight (4Vn)	Navicula	Bottom trawl survey	4Vn cod
September - October 1994	Sydney Bight (4Vn)	Navicula	Bottom trawl survey	4Vn cod

Summer Bottom Trawl Survey

* Objectives

- bottom trawl survey of marine resources in 4VWX
- survey of oceanographic conditions
- special collections as required

* Design

- stratified-random
- 200 sets in about 50 strata

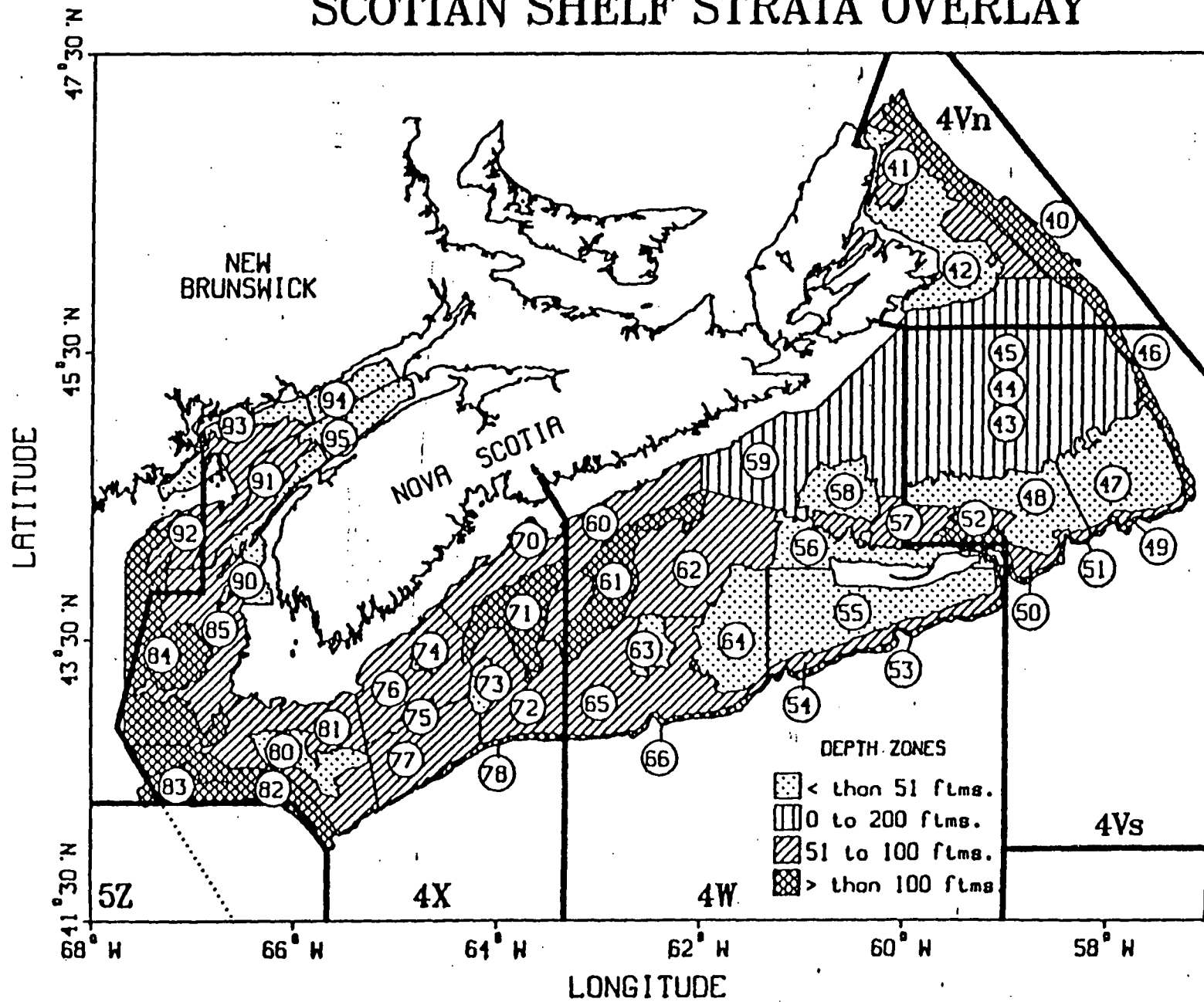
* Schedule

- July-August
- initiated in 1970
- longest time series of abundance on east coast

* Operation

- *A.T. Cameron (1970-81); Lady Hammond (1982); Alfred Needler (1983-)*
- Western IIA trawl (3/4" liner) equipped with SCANMAR
- experimenting with acoustics
- CTD and temperature/salinity sensors

SCOTIAN SHELF STRATA OVERLAY



Inshore Groundfish Trawl Survey

* Objectives

- locate concentrations of haddock in inshore "untrawlable" areas of 4X
- investigate use of acoustics to determine abundance

* Design

- exploratory based on fish finder, commercial fishing activity, anecdotal information
- about 50 sets

* Schedule

- June-July to coincide with summer survey
- initiated in 1991

* Operation

- *J.L. Hart*
- 286 Rockhopper trawl (1/2" liner)
- dual-beam hydroacoustics system with 50 Khz transducer

Set Locations J108 - July 1992

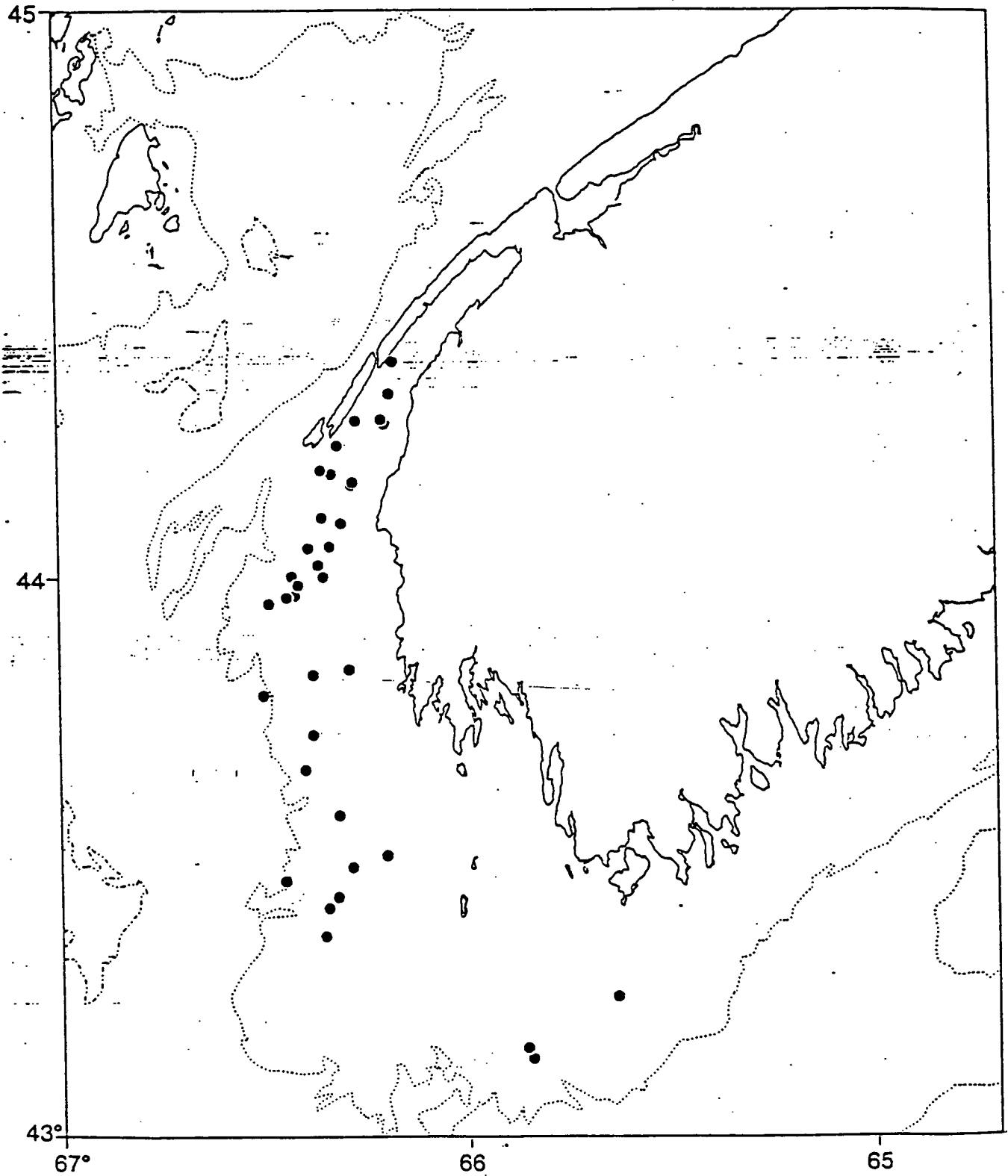


Figure 1. Location of successful sets made during cruise J108.

Sealworm Index Survey

* Objectives

- monitor abundance of sealworm parasite in flesh of American plaice
- collect fish samples necessary to elucidate sealworm ecology

* Design

- plaice 31-40 cm collected on 15 locations on the Scotian Shelf
- about 80 sets

* Schedule

- varies due to vessel availability; more recently in August
- initiated in 1980; conducted every 2-3 years

* Operation

- *Alfred Needler*
- Western IIA (3/4" liner)

Juvenile Silver Hake Survey

* Objectives

- develop index of age 0 silver hake abundance

* Design

- stratified-random using strata 60-78 of summer survey
- about 75 sets

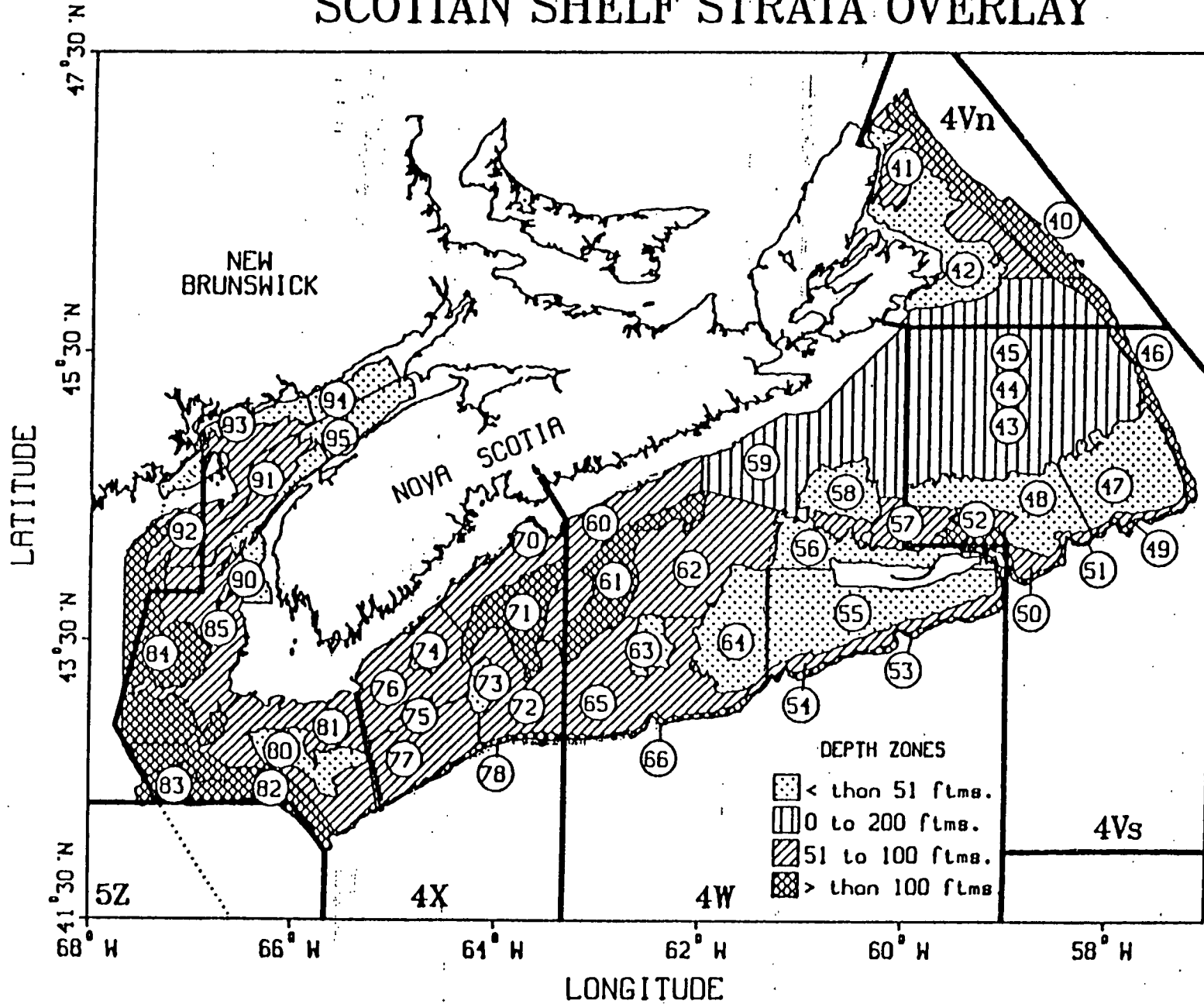
* Schedule

- October-November; silver hake peak spawning occurs in August-September

* Operation

- various USSR research vessels (1981-1991); *Alfred Needler* (1993)
- IGYPT juvenile midwater trawl

SCOTIAN SHELF STRATA OVERLAY



Georges Bank Groundfish Survey

* Objectives

- bottom trawl survey of cod and haddock on Georges Bank
- special collections as required

* Design

- stratified-random
- about 140 sets

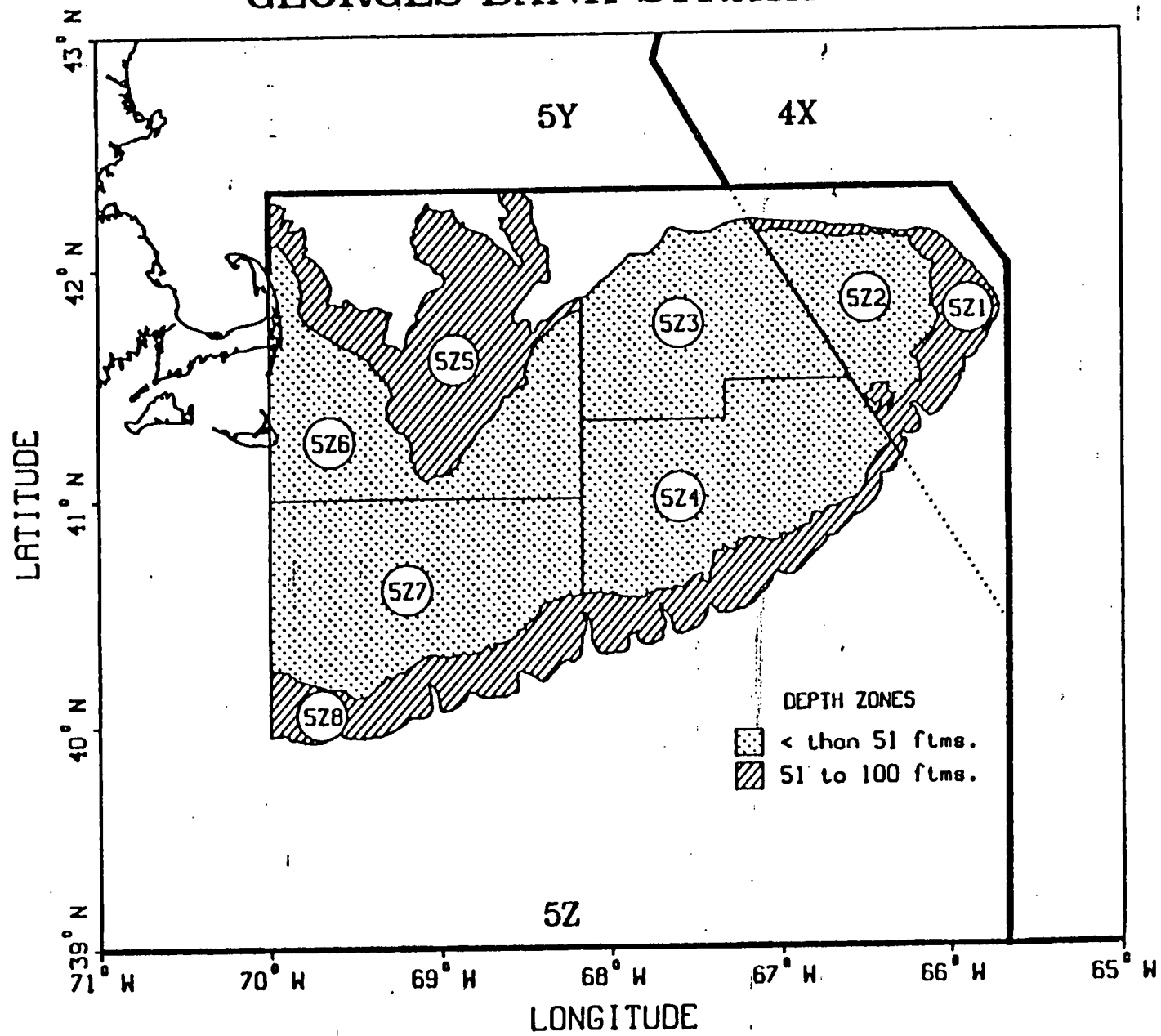
* Schedule

- February-March; coincides with spawning activity

* Operation

- *Alfred Needler* (1986+)
- Western IIA trawl (3/4" liner) equipped with SCANMAR
- experimenting with acoustics

GEORGES BANK STRATA OVERLAY



4VsW Cod Survey

* Objectives

- bottom trawl survey of cod and haddock abundance in 4VsW

* Design

- stratified-random
- about 80 sets

* Schedule

- March; coincide with spawning activity

* Operations

- *A.T. Cameron (1979-1984); Alfred Needler (1986+)*
- Western IIA trawl (3/4" liner)

4VsW SPRING STRATA OVERLAY

