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Atlantic Halibut Research: Report of Planning Meeting

Recherche sur le flétan de l'Atlantique: Rapport de la réunion de planification

24 – 25 August 2004
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Meeting Chairperson :
Robert O'Boyle

Fisheries and Oceans Canada
Bedford Institute of Oceanography
1 Challenger Drive, P.O. Box 1006
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24 et 25 août 2004
Institut océanographique de Bedford
Dartmouth, Nouvelle-Écosse

Président de réunion :
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SUMMARY

Members of the Atlantic Halibut Council and the fishing industry at large met with the Department of Fisheries and Oceans (DFO) and other agency scientists on 24 – 25 August 2004 to discuss information needs for Total Allowable Catch (TAC) decisions with the aim to enhance the research currently directed at Atlantic halibut. Participants also included the International Pacific Halibut Commission, and DFO Fisheries Management. Presentations included decision-making framework for fisheries, the assessment and management of the Pacific halibut fishery, the precautionary approach framework for management of fisheries in DFO, the biology of Atlantic halibut, the Industry/DFO Longline Survey, and a research proposal outlining potential direction of research efforts for the next 5 – 10 years. The discussions resulted in a proposal for a research and assessment approach to meet the needs for future TAC management of the fishery. Next steps include the acquisition of funding for this program.

SOMMAIRE

Des membres du Conseil du flétan de l'Atlantique et de l'industrie de la pêche ont rencontré des scientifiques du MPO et d'autres organisations afin de discuter des besoins en informations pour l'établissement du TAC en vue d'améliorer la recherche qui se fait présentement sur le flétan de l'Atlantique. Des représentants de la Commission internationale du flétan du Pacifique et de la Gestion des pêches du MPO étaient également présents. Des présentations ont été faites sur un cadre décisionnel pour les pêches, l'évaluation et la gestion de la pêche du flétan du Pacifique, l'approche de précaution dans la gestion des pêche au MPO, la biologie du flétan de l'Atlantique, le programme de pêche à la palangre industrie-MPO et une proposition définissant l'orientation des efforts de recherche pour les 5 à 10 prochaines années. Les discussions ont donné lieu à une proposition sur une approche de recherche et d'évaluation qui répondrait aux besoins futurs liés à la gestion du TAC. La prochaine étape consiste à trouver des fonds pour concrétiser cette proposition.

INTRODUCTION

The chair welcomed the participants (Appendix 1) to the meeting. He made particular note of the presence of Bruce Leaman from the International Pacific Halibut Commission (IPHC) and John Brattey from the Northwest Atlantic Fisheries Centre, who were invited due to their knowledge and expertise on issues to be discussed at the meeting. Dr. Leaman is an expert on Pacific halibut biology, assessment, and management, while Dr. Brattey is an expert on the use of tagging studies to derive population vital rates. The chair then provided some background to the meeting.

Prior to the late 1990s, the Department of Fisheries and Oceans (DFO) Science assessment of the status of the Atlantic halibut stock had been hampered by the lack of a reliable survey time series of relative abundance. The DFO summer bottom trawl survey does not monitor the complete geographic range and age groups in the population. Thus, in cooperation with DFO Science, the halibut industry initiated a new survey in 1998. Over recent years, industry and the Fisheries Resource Conservation Council has been requesting DFO Science to produce estimates of absolute abundance and fishing mortality to aid in setting Total Allowable Catch decisions.

At the fall 2003 review of this survey (DFO, 2003), it was concluded that while the new survey has the capacity to monitor the relative abundance of the halibut population, there was still a need for an assessment framework to guide resource management decisions. This framework may require elements additional to the industry survey time series such as an assessment model incorporating the commercial catch sampling information, growth data, and both the DFO and industry survey information. It was also suggested by the industry that a tagging program be undertaken to provide independent estimates of biomass and fishing mortality, which could also be included in the framework. In early 2004, the Atlantic Halibut Council (AHC) approached DFO Science with an offer to seek financial support for research initiatives to improve estimates of stock size. In response, DFO Science provided an outline of a comprehensive research program. The current meeting was called to discuss and deliberate the elements of this research program.

Following this brief background, Gary Dedrick, who, along with a number of other fishermen, has been working with Kees Zwanenburg on the development and implementation of the industry survey, gave some additional thoughts on the basis for the meeting. He commented that the Fisheries Resource Conservation Council (FRCC) had first suggested the industry survey in 1998. After six years, the industry's perception was that there should be enough information to consider an increase in the Total Allowable Catch (TAC). He also commented that this was the first time industry and DFO Science has been in the same room together to discuss research plans to improve estimates of stock size, which he was pleased to see.

The terms of reference and agenda are provided in Appendices 2 and 3, respectively. On the morning of August 25, Kees Zwanenburg presented an overview of the Industry/DFO Longline Survey. The list of documents circulated as background both prior to and during the meeting are provided in Appendix 4. Shelley Armsworthy was the meeting rapporteur.

CONSERVATION ISSUES FOR ATLANTIC HALIBUT

Presentation Highlights

By R. O'Boyle

A presentation was prepared by R. Claytor and R. O'Boyle (presenter) on the need for and use of decision-making frameworks in fisheries. Decision frameworks include an explicit statement of the objectives of management, indicators, and reference points to meet these objectives; these supplied from various sources (e.g. assessment) and management controls. For the industry, there are a number of advantages for having a decision framework, including having clearly defined decision rules and a rationale for stock management, taking a longer-term view to stock management, which in turn leads to more certainty on decisions. For DFO, having decision rules allows more proactive rather than reactive responses to fishery situations, and financial resources are applied to improving the decision framework rather than firefighting. Regarding the objectives, DFO has agreed to a set of national objectives to address the conservation of an ecosystem's biodiversity, productivity, and habitat. How these could be applied to the halibut fishery was illustrated. For each national objective, a potential issue was suggested; for instance under the conservation of population productivity, lack of recruitment might be the most important issue. The operational objective that the fishery would have to address might then be the minimization of fishing mortality of juvenile halibut. It would then be necessary to develop an indicator of juvenile halibut fishing mortality e.g. either from a stock assessment model or tagging study with an associated reference point based on our understanding of the population's productivity. The last step would then be to outline controls to meet the objective e.g. establish hook sizes, nursery areas, etc. While much of this is already being done in a number of fisheries, outlining the decision framework brings the elements of the management system together. Indeed, there is real benefit in either doing this using qualitative box diagrams or quantitative models as they explicitly state our understanding of the cause-effect relationships influencing the population's biological processes.

Discussion

The concern was raised that decision frameworks seem to be highly regimented with decisions tightly coupled with the indicators i.e. no flexibility to make decisions. The discussion then focused on the Atlantic halibut situation, with the

need for an absolute estimate of population biomass highlighted to evaluate whether or not the current Total Allowable Catch (TAC) is too low. In response, the decision framework would have to stipulate the limits of the productivity of the population which should lead in turn to appropriate decisions on TACs.

The desire of DFO to take a broader view of the conservation objectives of fisheries management was acknowledged. However, the suggested issue of the cusk by-catch in the fishery was considered premature.

ASSESSMENT AND MANAGEMENT OF THE PACIFIC HALIBUT FISHERY

Presentation Highlights

By B. Leaman

The history of the Pacific halibut fishery was outlined by B. Leaman. In response to a declining resource, the International Pacific Halibut Commission (IPHC) was created in 1923 at the request of the harvesters. The first management tool used by the IPHC at that time was seasonal restriction. Since 1930, management policy continued to evolve using limits and restrictions on catch limits, area closures, licensing, gear, and protocols of MSY and OY. Historically, the commercial Pacific halibut productivity has been relatively constant, ranging between 50 and 70 million lbs/year, except from 1970 to 1985, during a period of uncontrolled foreign by-catch mortality. Presently the total Pacific halibut removals are approximately 97million lbs.

Major features of Pacific halibut management include accommodation of underlying biology, accounting of all removals, a continually evolving assessment, the development and evaluation of harvest policy, and maintaining an iterative consultation process. The success of IPHC is attributed to the Halibut Treaty and Protocol, strong commitment by government, high-quality science and independent recommendations, formal harvesting privileges Individual Quotas (IQs), restricted harvesting and management, and stakeholder's support. A high level of communication is facilitated through the consultative process that includes recommendations from scientific staff and several advisory bodies including harvesters, processors, and the Research Advisory Board.

Some new initiatives within the IPHC include the PIT (passively integrated transponder) tag program, PSAT (pop-up satellite archival tagging) program, otolith elemental fingerprinting, and DNA testing for population mixing. The PIT tag program revealed that the tags are collected generally in the area of release. The PSAT tags transmit fish location at the point of pop-off to satellite; of 12 tagged and released fish, four were collected very near their summer tagging location and six moved considerably north. Through the PSAT program, Pacific halibut were observed moving to deep water for a short period, and is thought to be related to spawning migration. The pop-up archival tags are used to determine

adult Pacific halibut seasonal movements to help in deciding how a winter fishery might need to be structured. Another new initiative, an otolith chemistry study was initiated to determine if otolith chemical composition of early juvenile halibut could be used as a natural tag to study dispersal. Otoliths are analyzed at Woods Hole for mass spectrometry estimation of metal composition. Finally, DNA testing for genetic population structure was set up to asses whether the Bering Sea supports a sub-population that is independent from the Gulf of Alaska. The method will also serve to examine the possibility of a finer-scale population structure within the summer fishery.

Discussion

The commission provided numerous examples that could be emulated with respect to Atlantic halibut, especially the fact that there is a high level of communication through the Research Advisory Board on all aspects of the Pacific halibut fishery. Unlike the Atlantic Halibut Research Program, the Pacific halibut program conducted by the International Pacific Halibut Commission is relatively well funded (from the Canadian government, US congress, and others) and has a permanent staff of 27, plus approximately 30 seasonal field staff.

Pacific halibut distribution is determined from surveys and tagging programs and is driven by the need to allocate the TAC between Canada and the US. Production processes are estimated by using a population model that has been simplified from previous highly-parameterized versions; growth is now externalized rather than calculated as part of model. Recruitment is thought to be determined mainly by environmental factors. There was discussion on the comparative production of Atlantic and Pacific halibut. Catch of Pacific halibut was thought to be about an order of magnitude greater than that of Atlantic halibut. The utility of PIT tags was discussed for use in verifying model estimates of fishing mortality, but was considered too expensive for use in the Atlantic halibut program.

Changes to assessment models can result in changes in TAC independent of the true variability of the resource. The industry desire to stabilize yield led to the development of a draft conditional constant catch (CCC) policy, on which there was a lengthy discussion. The CCC is based on long-term productivity, reduced annual variability, and different catch ceilings by area. The CCC requires conservation of the spawning biomass and explicit setting of both threshold and limit reference points, which can mean not taking the full quota. A need for defined objectives and having them actually implemented through management actions was mentioned.

DFO FISHERIES MANAGEMENT POLICY

Presentation Highlights

By A. McMaster

The 2004 Working Draft of the Precautionary Approach (PA) Framework for Management of Fisheries in DFO was presented.

Discussion

The relationship of the precautionary approach to the decision framework presented earlier was noted. The decision framework requires both indicators and reference points to be linked to management controls. The precautionary approach stipulates two levels of reference points, with the buffer reference point indicating the initiation of management controls that would become increasingly severe to avoid reaching the limit reference point.

BIOLOGY OF ATLANTIC HALIBUT

Presentation Highlights

By S. Armsworthy

A brief summary of various aspects of Atlantic halibut biology was presented and included some information on surveys, distribution, life cycle, growth, migration, and diet composition. Surveys include over 30 years of DFO standardized otter trawl surveys conducted from research vessels, and the relatively new (since 1998) Industry/DFO Longline Survey. Both otolith collection and the tagging and release of undersized halibut occur on these surveys. Information on the survival of undersized (<81cm) Atlantic halibut caught by both longline and trawl was presented. Atlantic halibut distribution is widespread in the north Atlantic, but mainly is found in depths of 200 – 500 m in channels between banks and on the continental slope. The early stages of Atlantic halibut life cycle are thought to occur on the Scotian Shelf, but the location and occurrence is poorly understood. Since there is a lack of information on the growth of Atlantic halibut from the western Atlantic (Scotian Shelf and southern Grand Banks), growth and maturity information for halibut from Faroes was presented.

Historical information on Atlantic halibut migration was presented. Small fish moved greater distances than large ones and the majority of tagged fish were recaptured within 200km of release site. Fish released on the Scotian Shelf tended to move to the northeast, while those released on the Grand Banks showed no preferred direction of movement.

A US study on the diet composition of various flatfishes in the Gulf of Maine showed that Atlantic halibut in the Gulf of Maine consume mainly fish, but also prey on squid, crab, shrimp, and other invertebrates.

There are basic unanswered questions about stock structure, growth, age of maturity, distribution of early life history stages, spawning location, and trophic relationships.

Discussion

A discussion on gaps in our knowledge of halibut stock structure and migration included a specific point made about halibut in the shallow waters in the Bay of Fundy. Currently, some commercial catches are being made in the upper Bay of Fundy, including in the upper reaches in the Minas Basin. There was concern that these halibut might not be accounted for in the current surveys. A discussion of this point indicated that the survey was designed to estimate population size and structure at a particular time of year and the changes in distribution at other times of the year would not have an impact on the validity of the survey overall. Halibut eggs and larval biology was also discussed; a point was made that we really don't know where Atlantic halibut spawn or much about their early life history, partly because halibut eggs and larvae have never been found in any quantity in ichthyoplankton surveys. A comment was then made that this information is not currently essential in the research program and that the best spent research money is already being directed at the Industry/DFO Longline Survey to uncover where the adults are and to estimate the population abundance and age/size structure. Discussion of this point indicated that determining spawning and nursery areas are essential to overall management of this species. This is true not only of halibut but of all commercially harvested fish species.

Growth was identified as an important issue; as such there is a need for aging data. Otoliths and weight-length data have been collected both historically and during the Industry/DFO Longline Survey, but both require further analysis. There was a discussion on the utility of the DFO summer survey, which catches small halibut, does not cover the complete stock area, and exhibits an abundance time series with considerable variability. This is in contrast to the Industry/DFO survey, which catches the full age/size structure over much of the stock area. It has been previously concluded that the DFO trawl survey gives some indications of numbers and locations of incoming recruits.

INDUSTRY/DFO SCIENCE LONGLINE SURVEY

Presentation Highlights

By K. Zwanenburg

Information was presented on the Industry/DFO Longline Survey. More complete documentation on the survey is provided in DFO (2003) and Zwanenburg and Wilson (2003). The survey is providing the first comprehensive results on population boundaries/abundance, spatial distribution, age structure, population removals, migratory patterns, diet composition, and by-catch profiles.

Discussion

There was a question about whether survey gear (hooks, line spacing, etc) being used among Industry/DFO survey has been standardized. It was indicated that gear has been standardized but that bait has not been standardized. Survey coverage was discussed; catches of halibut are occurring in the Bay of Fundy, as far up as the Minas Basin, consequently some participants thought there may be a need to sample shallow waters (e.g. Bay of Fundy). It was indicated that adding in additional sets in the Bay of Fundy would be discussed with the survey participants. Additional sampling may require the participation of fishermen from that area during the survey time period. Anecdotal evidence was provided that Atlantic halibut abundance has increased; fishermen are seeing an increase in the ease of catching Atlantic halibut and have been using less gear to catch the same amount. It was thought that statistics of catch, CPUE, and total fishing effort should be examined to confirm this trend. A suggestion was made to tag fish inshore during the Industry/DFO survey, which would require design and implementation by industry and DFO. A comment was made that the survey may be accounting for the halibut in the Bay of Fundy; the fishery in the Bay occurs outside of the survey period, thus halibut may be migrating from the survey area into the Bay of Fundy. The cost of sampling certain Industry/DFO stratified random sampling sites was mentioned. Sites at great distances from popular commercial fishing sites are expensive to steam to and from for the expected catch. The apparent rapid disappearance of males in the survey over the past five years was noted but no explanation was apparent. There was also an extensive discussion concerning the interpretation of the stability of the survey CPUE index. It was noted that the CPUE stability follows a very large reduction in the TAC and that no recruitment to the stock had occurred since this reduction, so that the productivity implications of the lower TAC could not yet be assessed. There is general support for the survey from all participants, and a consensus that the survey is providing excellent information.

RESEARCH PROPOSAL FOR ATLANTIC HALIBUT

Presentation Highlights
By K. Zwanenburg

Atlantic halibut is one of the remaining viable fisheries since the closure of the cod fisheries (1992 – 1993). Based on industry/DFO surveys (6 yrs), there are indications that present landings may be sustainable, however, its population (status/productivity) relative to historical levels is not known. An experimental management proposal is suggested for an incremental increase in landings over a 3-5 year period to the long-term historical average (1900t) while monitoring trends from the survey for negative indications.

Canada has indicated that fisheries must be sustainable not only with regard to target species but also with regard to the ecosystem within which the fishery takes place (by-catch of other biota, impacts on habitat, etc.). Objectives for target species include maintaining meta-population structure (as identified through genetics) and use of the precautionary approach to harvest rates (don't fish at the limits of population productivity). Objectives for non-target species include maintaining communities, species, and populations within the bounds of natural variability, conserving each component so that it plays its historic role in the foodweb, and observing physical and chemical properties of the ecosystem.

As a signatory to the Convention for Biological Diversity (CBD), Canada has an obligation to make inventories of, monitor, and make plans to conserve its biological diversity. The Species at Risk Act (SARA) is now in effect and requires screening of species for risk and developing recovery plans for those at risk. SARA has implications to all fisheries including Atlantic halibut.

The research environment of DFO has changed; reductions in people and money within the department are having significant impacts on how research is conducted. A new model of business may include establishing long-term precautionary catch levels where industry funds research into refinement of allowable catches (i.e. fishing closer to limits of productivity which is more information intensive).

DFO Science initiatives are being directed at larger scale conservation issues including ecosystem functioning, definition of ecosystem management objectives, impacts of fisheries on ecosystems, integrated management (i.e. Eastern Scotian Shelf Integrated Management (ESSIM)) and as such support for traditional stock assessment is reduced.

Estimation of ecosystem costs of the Atlantic halibut fishery needs to be determined. We currently have some estimates of by-catch in restricted time and space, but it is necessary to broaden estimates on the whole fishery, which

should be an industry-wide requirement, not for just halibut. A proposal is being developed for broader estimation of impacts (see Zwanenburg, K. 2004 in Appendix 4).

Our current understanding of ecosystem impacts on Atlantic halibut is rudimentary, though there is some new diet information from the Comparative Dynamics of Exploited Ecosystems in the Northwest Atlantic program (CDEENA).

The proposed management scheme may be viable over the medium term, but determining the limits of productivity is essential to longer-term management, especially if fishing is conducted at or near the limits of productivity. A refined knowledge of present population status is required for longer term management. This implies improved knowledge of:

- population numbers
- age structure
- spatial distribution
- productivity
- exploitation rate
- other life-history parameters

Gaining a better understanding of growth and population age structure can be achieved by conducting aging analysis on recent and archival otolith collections. Age information can be used to create an age model that will allow comparison of historic and present survival rates, which are essential to the development of models for population estimates.

Population size can be estimated through the use of tagging data (existing or augmented), and survival rates through the use of mid-term using archival tags. Currently we have a reliable “fishery independent” estimate of population trajectory through an excellent survey that is already in place; however, the survey requires some refinements such as more consistent coverage of the Grand Banks.

Discussion

There was discussion on the basis of the proposed decision rule, particularly the 1900t level. This led to discussion on the need to better understand the stock’s growth, recruitment, and mortality processes. In particular, it was noted that this would be experimental management, and it would take several years for the stock to respond to each step increment, since growth and recruitment would be the response parameters. Regarding the former, the need to characterize the age/size structure of the catch and the population, as noted in the presentation, was again highlighted. Regarding the fishing mortality, there was a proposal from industry to develop an estimate of this from the available 1995 – present tagging information. However, based on the information provided (Fowler, 2004), these data were not considered sufficient to derive estimates of fishing mortality. The

tagging activities were designed to provide better understanding of the spatial processes of the population, not to provide estimates of fishing mortality. The latter would require a redesign of the tagging program. In particular, it was noted that only juvenile fish are tagged in the current and previous programs, and that such tagging would provide very limited information on the exploited portion of the stock. It was suggested, and accepted, that a new tagging program to provide estimates of fishing mortality could use the industry survey as a sampling platform.

The broader question of the utility of point estimates of fishing mortality without the necessary understanding of resource productivity to give this a context was raised. What level of fishing mortality is appropriate? It was concluded that a broader understanding of the population's productivity was needed to interpret a point estimate of fishing mortality from a tagging study. The IHPC is undertaking a tagging study to derive estimates of fishing mortality to validate the estimates from the population model. However, due to the complexity of the problem surrounding mortality estimation from tagging data, the cost of the project is high ($750K over 5 years).

RESEARCH PROPOSAL FROM MEETING

Proposal

Based on the presentations and ensuing discussions, the chair prepared a list of potential research projects with associated activities and a proposed priority. The need to identify who would be responsible (i.e. lead the project), its time frame (over next 2 -3 years), and cost were highlighted. As a result of the discussion on this proposal, a few potential projects were dropped as they were considered low priority or already underway. Principal among these was the characterization of stock structure and seasonal migration patterns. This was proposed through an analysis of the 1995 – 2003 tagging information. Since the stock structure is well enough known to guide management, the group agreed that early analysis of these data was not a high priority. The final agreed-to list of research projects is in Table 1. It should be pointed out that the group's desire was to develop a list of the most cost effective projects to meet the needs of a TAC-setting framework for the management of Atlantic halibut.

Data Handling

There is a need to enhance the input of halibut information into DFO's Virtual Data Centre (VDC) and develop new output products. These would support a number of projects listed below. This is an on-going task which is estimated to cost about $20K annually. While MFD is leading this, there is no funding to sustain this activity.

Growth Processes

This project is critical to understanding the productivity processes of the halibut stock. While an age validation study has been completed by MFD, there is a need to develop an understanding of growth changes in the population. This project would age 500 otoliths from each of two time periods (historical and current) to characterize how growth and mortality) might have changed over time. The IPHC offered assistance in the project as it had committed itself to an otolith exchange program. It could either age a subset of these otoliths or send someone to train Maritimes staff, as there is a desire to develop regional expertise on halibut aging. This will require further dialogue. Preparations for the project would take place during the rest of 2004 with implementation during Jan-March 2005 at an estimated cost of $5K, depending on the number of otoliths to be aged.

Commercial Fishery

Using the aging information, the current fishery's age/size composition of the catch by area, season, and depth should be characterized. There is unfortunately little historical sampling available to provide a complete time series although it was considered worthwhile to begin to construct this information through an effective data monitoring and sampling program. This project would also produce a profile of the by-catch (all species) of the halibut fishery (by area, season and depth). It would commence in early 2005 and development activity would cost about $5K. This was acknowledged as an on-going activity.

Abundance Index Development

No new developments were felt necessary for the industry survey. However, it was noted that there is uncertainty about all on-going activity in the current budgetary environment within DFO, which raises the potential for future funding requirements. MFD currently bears the cost of salaries and data handling for the survey and resulting data analysis (about 0.8PY and $10K annually).

Tagging

While the need for tagging to better understand stock structure was discussed, tagging to obtain that for the provision of estimates of fishing mortality and biomass was considered a higher priority. This would complement the modelling of the population processes (see below) in a similar manner to the IPHC approach. It was noted that the industry survey provides an excellent platform for delivery of this project. IPHC has a tagging project underway to respond to a number of issues, but is costly; it was suggested that a more modest project might suffice for the smaller Atlantic population. The first step in this project would be development of a research plan, which would occur prior to May 2005 and before the 2005 industry survey, if funding became available to support its

development. It was suggested that this plan be compiled through a contract with a local university for $5K with the input of DFO Science.

Understanding Productivity

The need to synthesize the information on Atlantic halibut stock productivity was highlighted. This project would create an assessment model of the population to investigate the underlying productivity processes and could lead to development of indicators and reference points to guide stock management. It was suggested that the IPHC model be used as a starting point, modified appropriately. Processes such as recruitment being a function of environment and density-dependent growth might ultimately be investigated with this model; the estimates of fishing mortality from the tagging project would be an important element. It was expected that this project would require a minimum of 6 months of dedicated time (March – October 2005) of a post-doctorate fellow (PDF) at a cost of about $30K, along with input from DFO Science staff. There was an offer for an IPHC scientist to assist in this project, which would be of great benefit.

Decision Rules

The assessment model should lead to insight on the productivity processes of the resource. This knowledge would be used in this project to investigate a number of harvest scenarios, including the 1900t proposal, either through a separate modelling exercise or through extensions to the assessment model. This project would require an additional 3 months of the PDF's time, along with DFO Science support at a cost of $15K and would overlap the end of the modelling project (August – December 2005).

The estimated total cost of all components of the proposal was $80K. However, these costs estimates were created with a cursory consideration of the individual project elements and was considered a significant underestimate. It was agreed it would be prudent to plan for costs to be increased as high as 50%. The suggested maximum funding level was raised to 120K. While completion of the project as identified is planned for December 2005, it is expected that there would be on-going costs on the order of $80 - 120K annually at least for the next 3 – 5 years.

Table 1. Proposed Atlantic Halibut Research Program

Project	Activity	Responsibility	Time Frame	Cost
Data Handling	Halibut information into VDC & new VDC products	MFD, but unfunded	Ongoing	$20K
Growth Processes	Aging of otoliths (total sample of 1000 otoliths from two time periods)	MFD& IPHC	Jan-Mar, 2005	Contract IPHC for $5K or in house
Commercial Fishery	Estimation of current fishery size/age composition, CPUE, and by-catch profile	MFD & Industry	Ongoing; commencing early 2005	$5K
Abundance Index Development	Estimation of Industry survey CPUE by size; no new developments needed	MFD & Industry	Currently being done	No additional cost; subject to DFO $ constraints
Tagging	Planning for fishing mortality, absolute abundance, migration information using industry survey	MFD & Industry	Prior to May, 2005	Planning; $5K
Understanding Productivity	Construction & Fitting of Atlantic Halibut Models	MFD & IPHC	Mar-Oct 2005	In house + $30K for pdf
Decision Rules	Examination of Decision Rule Scenarios	DFO & Industry	Aug-Dec 2005	In house + $15K for pdf
	Total			$80K

Next Steps

It was agreed that finding funding for the research proposal additional to current levels was absolutely essential. Otherwise, little can be achieved. Thus, the most important next step is to secure the funding before any work commences. It was suggested that discussions be initiated with DFO Fisheries Management to determine if an additional 50t be added to the current permissible catch to provide this research funding. It was noted that for some other stocks, proceeds from catches have been used to fund research. The issue on who would manage this fund was not addressed. The Research Advisory Board associated with the IPHC could provide a useful organizational model. While Atlantic Halibut Council members at the meeting noted that management of a research fund would be within its mandate, there is a need to ensure that the process and approach is transparent to all fishermen's organizations, whether members of the AHC or not. Additional thought needs to be given to the management of the project and its funding.

It was agreed that R. O'Boyle, W. Stobo, and B. Chapman draft a funding proposal for the consideration of regional DFO management.

CONCLUDING REMARKS

The Atlantic halibut fishery is one of the most important in Atlantic Canada. Until the initiation of the Industry/DFO Longline Survey in 1998, there was not a solid base of information on which to develop harvest advice. This base now exists and can form the core of a research program over the next 3 – 5 years to guide management efforts. The workshop was successful in outlining the needs of a research program. The challenge now is to find the funding required to implement it, which will take the combined efforts of both the fishing and scientific communities.

Appendix 1 : List of Participants

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Appendix 2. Meeting Terms of Reference

Background

The assessment of the Atlantic halibut resource has been hindered by a reliable survey time series of abundance. The DFO summer survey does not monitor the complete geographic range and age groups of the population. Therefore, in cooperation with DFO Science, the halibut industry initiated a new survey in 1998, the results of which were reviewed in fall 2003. While it was concluded that the halibut industry survey has the capacity to monitor the halibut population, there is still a need for an assessment framework to guide resource management decisions. This framework may require elements additional to the industry survey time series, for example an assessment model incorporating the survey times series, commercial information, etc. The industry has also suggested that a tagging program be undertaken to provide independent estimates of fishing mortality, which could also be incorporated into the assessment framework.

In early 2004, the Atlantic Halibut Council approached DFO Science with an offer to support targeted and cost-effective research initiatives to develop a new assessment framework in support of management decisions. In response, DFO Science outlined a number of potential research areas to pursue. Through further dialogue, it became evident that the design of a research program to support a new assessment framework would benefit from experience and expertise elsewhere, particularly that available in other DFO regions and on Pacific halibut. It was therefore agreed to convene a two-day workshop at BIO to brainstorm on the research and assessment program requirements of Atlantic halibut.

Objective

- To discuss assessment and decision support frameworks used both generally and for Pacific halibut

- To outline a research program in support of an assessment and decision support framework for Atlantic halibut

Topics for Discussion

Potential topics for discussion are outlined below by elements of the decision process. This is not an inclusive list but rather is to indicate the breadth of the expected discussion.

Population Model

The population model summarizes our understanding of the processes governing the halibut population – from the biology through to the fishery.

Regarding the population, a key issue is what is known about its production and mortality processes. What is to be learned from its growth processes? Through analogies with Pacific halibut and related species and stocks, what can be said about recruitment production? What do we know and need to know about the role of halibut in the Scotian Shelf ecosystem.

Regarding the fishery, there is a need to understand its impacts on the ecosystem. What do we know and what research is required?

In summary, what is our understanding of the processes governing Atlantic halibut and what research is required?

Assessment Model

The assessment model includes both observational activities, such as the industry survey, and procedures used to supply indicators for management decisions.

The industry survey currently provides the best available indicator of population abundance trends. Would adding on-going tagging associated with this survey be a cost-effective means to increase our knowledge on this stock? What is the most appropriate means to analyze the current tagging data set to provide estimates of fishing mortality? What other information (e.g. index logbooks) would be beneficial for management?

Regarding indicators for management, fishing mortality and biomass from an assessment model have traditionally been used. There are a number of possible assessment models to pursue, all of which have their strengths and weaknesses – from Surplus Production, through Delay-Difference to Age/Size Models. Information requirements and thus costs vary dramatically by model. What are the program requirements of the most appropriate and cost-effective assessment approach?

Decision Support

Management decisions are linked to particular levels or directions of the indicators termed ‘Reference Points’ and ‘Reference Directions’ respectively. These decision points depend upon the objectives that one hopes to achieve. Can we state these, at least in a preliminary way? What research do we need to undertake to define appropriate reference points?

Appendix 3. Meeting Agenda

Tuesday 24 August 2004 (Hayes Boardroom, BIO)

09:30 – 09:45	Introduction & Background / R. O'Boyle & G. Dedrick
09:45 – 10:15	Conservation Issues for Atlantic Halibut / R. O'Boyle
10:15 – 10:30	Break
10:30 – 11:30	Assessment and Management of Pacific Halibut Fishery / B. Leaman
11:30 – 12:00	Fisheries Management Policy / A. McMaster
12:00 – 13:00	Lunch
13:00 - 14:00	Biology of Atlantic Halibut / S. Armsworthy
14:00 – 14:45	Research Proposal for Atlantic Halibut / K. Zwanenburg
14:45 – 15:00	Break
15:00 – 17:00	Initial Discussion on Knowledge Gaps, Needs and Research Requirements

Wednesday 25 August 2004 (MicMac Canoe Club)

09:00 – 10:15	Industry/DFO Survey / K. Zwanenburg
10:15 – 10:30	Break
10:30 – 12:00	Discussion on Knowledge Gaps, Needs and Research Requirements (cont'd)

Appendix 4. List of Documents

Anon. 2003. Tagging Research. IPHC Report of Assessment and Research Activities. Unpublished.

Anon. 2002. Tagging Research. IPHC Report of Assessment and Research Activities. Unpublished.

Anon. Draft. The Analysis of IPHC Tagging Experiment. International Pacific Halibut Commission Report. Unpublished.

Clark, W. Statistical Distribution if IPHC Age Readings. International Pacific Halibut Commission Report. Unpublished.

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Clark, W. and D. Chen. Draft. Simulation Studies of Mark-recapture Estimates. International Pacific Halibut Commission Report.

Clark, W. and S. Hare. Effects of Climate, Stock Size, and Region on Recruitment and Growth of Pacific Halibut. International Pacific Halibut Commission Report. Unpublished.

Clark, W. and S. Hare. 1998. Accounting for Bycatch in Management of the Pacific Halibut Fishery. North American Journal of Fisheries Management.

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Clark, W., B. Vienneau, C. Blood, and J. Forsberg. 2000. A Review of IPHC Catch Sampling for Age and Size Composition from 1935 Through 1999, Including Estimates for the Years 1963-1990. International Pacific Halibut Commission, Technical Report No. 42.

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Fowler, M. Halibut Tagging Data Overview 1995-2003.

Leaman, B., W. Clark, S. Hare, and D. Chen. 2002. Aims of the Proposed IPHC Marking Experiment. IPHC Report of the Assessment and Research Activities.

Parker, S., C. Schwartz, and J. Skalski. 2002. Technical Review of the Proposed IPHC PIT-Tag Marking Experiment. IPHC Report of the Assessment and Research Activities.

Sullivan, P., A. Parma, and W Clark.1999. The Pacific Halibut Stock Assessment of 1999. International Pacific Halibut Commission, Technical Report No. 79.

Zwanenburg, K.C.T. and S. Wilson 2003. Halibut on the Scotian Shelf and Southern Grand Banks – Current Estimates of Population Status. CSAS Research Document 2003/46.

Zwanenburg, K., S. Wilson, R. Branton, and P. Brien. 2003. Expert Opinion on Current Estimates of Population Status of Atlantic Halibut on the Scotian Shelf and Southern Grand Banks. Maritimes Region Expert Opinion 2003/05.

Zwanenburg, K., S. Wilson, R. Branton, and P. Brien. 2003. Halibut on the Scotian Shelf and Southern Grand Banks – Current Estimates of Population Status. Canadian Science Advisory Secretariat, Research Document 2003/046.

Zwanenburg, K. 2004. Atlantic Halibut (*Hippoglossus hippoglossus*) Long-term Approach to Research in an Ecosystem Context. Marine Fish Division/Centre for Marine Diversity.