Review and Recommendations Regarding the Research Program for Atlantic Herring (*Clupea harengus harengus*) and Atlantic Mackerel (*Scomber scombrus*) of the Southern Gulf of St Lawrence

By: Michael Healey
Institute for Resources, Environment and Sustainability
University of British Columbia
2206 East Mall
Vancouver, BC, V6T 1Z3

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Introduction

The herring (*Clupea harengus harengus*) fishery in the southern Gulf of St. Lawrence is experiencing serious conflict and unrest. In 2003, following demonstrations and civil disobedience by inshore fishers in New Brunswick and PEI, the Hon. Robert Thibault, Minister of Fisheries and Oceans, Canada, appointed Mr. Allister Surette, vice president of Development and Partnerships, l'Universite Ste-Anne – College de l'Acadie, Church Point, NS, to investigate the causes of the unrest. In his report Mr. Surette identified 8 core issues in the conflict[1]: 1) disagreement and misunderstanding over fishery exclusion zones; 2) Insufficient and uncertain science; 3) the perception that seining damaged lobster habitat; 4) the perception that excessive herring mortality was caused by some gears; 5) uncertainty and disagreement over mixing and migratory patterns of herring; 6) ghost fishing by gear left in the water; 7) DFO leadership and credibility; and 8) generally poor quality of herring products. Although he acknowledged that many of the disagreements among stakeholders were entrenched and there were no easy solutions, Mr. Surette urged all involved to show leadership in attempting to resolve these issues so that an orderly fishery could proceed. He suggested that the Gulf Region Small Pelagics Advisory Committee might provide a forum for discussions.

Conflict in the herring fishery and some issues concerning the Gulf mackerel fishery (unrecorded catches and discarding in particular) were discussed at the Gulf Region Small Pelagics Advisory Committee meeting in December, 2004. Following this meeting, DFO decided to employ consultants to assist the Department and Industry in developing a long-term vision for the southern Gulf herring and Atlantic mackerel (*Scomber scombrus*) fisheries. Consultants have since been engaged to address three broad topic areas relevant to the fisheries: 1) Socio-economic issues with a special focus on improving quality and value of products and market diversity (Pierre-Marcel Desjardins, consultant); 2) Sustainable fisheries including gear technology and selectivity and a road map for promoting shared stewardship (Bob Johnston, consultant); and 3) Scientific aspects including a critical review of current research programs and recommendations regarding future research needs (Michael Healey, consultant). Brief biographies of the consultants and the press release announcing the review of scientific aspects of the herring fishery can be found in Appendix 1. This report addresses primarily the scientific

[1] Surette, Allister. 2004. Conflict between mobile and fixed gear herring fishers in the southern Gulf of St. Lawrence. Report submitted to the minister of fisheries and oceans, February, 2004.

issues in the fishery. Socio-economic and management issues will be addressed in separate reports by Mr. Johnston and Mr. Desjardins.

Although good science is essential to the effective management of these fisheries, good science alone will not resolve the principal conflicts in the herring fishery. Negotiation and mediation of the most pressing conflicts that are disrupting the fishery, development of trust and respect among all interests in the fishery (including between fishers and DFO), and improvement in the economic performance of the fishery are as important or more important than any improvements in scientific understanding. Nevertheless, fishers expressed concern about the scientific differentiation among herring stocks and interest in exploring more focused local management of the herring fisheries that would incorporate some aspects of the successful approach to herring management in British Columbia. Furthermore, the terms of reference for the consultants point in the direction of a long-term vision that includes integration of research and management into a fishery that is economically self-sufficient. Implementing these approaches will require new kinds of information and more detailed information as well as better understanding of the biology and ecology of both herring and mackerel. Much of this report will focus on the kind of research program that would be needed to support such new approaches to herring management. Although currently less contentious than herring, mackerel presents its own significant scientific challenges. As one of the largest fishable pelagic stocks in the western Atlantic, mackerel is deserving of careful stewardship. Current understanding of mackerel ecology and productivity appears insufficient to ensure careful stewardship or to support Canada's interests in this large trans-boundary stock. New approaches to mackerel management also appear necessary. It is important to recognize, however, that implementing any new approaches to management will take some time and most elements of the current management regimes will have to be maintained until such time as any alternative approaches prove effective. Such a transitional phase will make considerable demands on scientific and technical resources that already appear spread very thin.

Terms of Reference for the Study

The terms of reference for the study state that the consultants are to assist DFO and industry in developing a long-term vision for the Southern Gulf herring and mackerel fisheries. This is to include the identification and validation of important fishery objectives, threats and

challenges to achieving the objectives, performance indicators, and potential strategies for attaining the objectives. In developing the vision, the participants are directed to focus on sustainability and value of the resources rather than the volume of the harvest, to incorporate the precautionary approach, objectives based fisheries management (OBFM), and relevant ecosystem considerations, to engage with the industry and provinces to define their ideas, concerns and recommendations in support of the aforementioned objectives, and to identify areas of consensus and options for resolving differences.

Requirements for the study of scientific issues are described more specifically in element 1 of the Terms of Reference:

> "Element 1 will deal with the scientific aspects of the herring and mackerel fisheries including conservation and ecosystem objectives with a special focus on, but not limited to, improving the fisheries by conducting a critical review of the current research programs and providing recommendations to DFO in regards to the orientation of future research activities. The scientific portion of the long- term vision will focus primarily on conservation and achieving sustainable use of the resource, on developing a more stable and long term approach to fisheries management through shared stewardship with industry, and in setting measurable objectives and identifying strategies towards protecting the stocks and provide recommendation aimed at improving management of the fishery." (Terms of reference, p 4)

The complete terms of reference are attached as Appendix 2.

Approach and Methods

Element 1 of the terms of reference, which is the principal concern of this report, identifies 5 specific tasks for the consultant:

1. Evaluate scientific aspects of the herring and mackerel fisheries including conservation and ecosystem objectives;
2. Conduct a critical review of the current research programs and provide recommendations to DFO with regard to the orientation of future research;
3. Give particular attention to conservation and achieving sustainable use of the resource;
4. Consider ways to develop a more stable and long term approach to fisheries management through shared stewardship with industry, setting measurable objectives and identifying strategies for protecting the stocks; and
5. Provide recommendations aimed at improving management of the fishery.

These tasks were addressed through a review and analysis of published documents and discussions with members of industry and DFO Gulf Region. From April 16-24 the consultant traveled to New Brunswick and PEI to meet with scientists, managers, fishers, processors, First Nations, members of fishers associations, women for environmental sustainability and other interests to discuss scientific issues affecting the fishery. The schedule of meetings that the consultant held with various interests in the fishery is presented in Table 1. Following preparation of preliminary reports, all three consultants met with representatives of industry in Moncton on June 29-30, 2005. At this meeting the consultants presented their preliminary findings and received feedback from industry.

The workshops held on April 19, 20, and June 29, 30 provided the consultant with wide ranging commentary from a broad spectrum of individuals involved in the southern Gulf herring and mackerel fisheries. This commentary dealt with many aspects of the herring fishery in addition to scientific issues. Several representatives from First Nations attended the first part of the April workshop but had to leave before the end of the first day. First Nations representatives were contacted and the consultant offered to meet separately with them if they wished but the First Nations did not request such a meeting.

The second day of the April workshop included a presentation by Dr. Ross Claytor on acoustic assessment of local spawning populations and a presentation by a delegation from the BC roe herring fishery on co-management[2] of that fishery. The research on acoustic assessment of local spawning populations has been ongoing for some time and shows promise that management based on local spawning populations may be possible for fall herring. The presentation by the delegation from BC was particularly useful because it provided an example of a herring fishery that successfully integrates management and research into the fishery, that is economically self-sustaining, and in which gear conflicts have been largely resolved. In its concept if not in its details, the BC example provides a potential model for southern Gulf herring.

[2] In this report co-management refers to the sharing of authority and responsibility for fisheries management among users and managers. Co-management can indicate a broad range of institutional arrangements from those in which industry plays only a consultative role to those in which the majority of management decisions as well as regulation are the responsibility of industry. In recent decades, DFO has been moving increasingly toward delegating more responsibility and authority for management to industry. The BC herring fishery is one in which management decision-making is fully collaborative between industry and DFO and where industry takes responsibility for much of the day-to-day management of the fishery.

Table 1. List of meetings held by consultant, Michael Healey, to gather information on research needs for the southern Gulf herring fishery during April 17-23, 2005.

Date	Time	Meeting Description
April 17	1000-1600	Meeting with Mike Chadwick for briefing on herring and mackerel issues and driving tour of Northern Shore herring facilities
April 18	1000-1200	Meeting with Pierre-Marcel Desjardins for briefing on results of consultations on socio-economic issues
	1300-1500	Meeting with Ghislain Chouinard and Gloria Poirier for briefing on herring assessments and research being conducted in southern Gulf
	1500-1600	Meeting with Alain Hebert for briefing on management of herring and mackerel
April 19	0900-1700	Workshop with industry and other interests in the herring fishery to explore research needs for herring management
April 20	0900-1100	Continuation of workshop on research needs for herring
	1100-1200	Presentation and Q&A by Ross Claytor on acoustic assessment of local herring stocks.
	1300-1600	Presentation and Q&A by delegation from the British Columbia roe herring fishery.
	1600-1700	Final plenary session and wrap up of workshop
	1730-1900	Meeting with FRAPP
April 21	0700-0900	Travel by car to PEI
	0900-1000	Meeting with Bob Johnston for briefing on results of consultations on herring management
	1000-1130	Meeting with PEIFA and travel to Souris
	1130-1500	Meeting with fishers and other interests in Souris to discuss issues in the NE PEI herring fishery.
	1500-1900	Return to Moncton
April 22	0900-1100	Meeting with Olin Gregan, Barrie Group, NF
	1100-1300	Debriefing with DFO staff, Moncton

During April, the consultant held separate meetings with representatives of the seine and inshore fishers. These meetings allowed representatives of each gear type to express their concerns about the fishery in a candid way and provided the consultant with important insight into the nature and extent of the conflict in the fishery.

The program for the April workshop, the list of participants in the workshop and the lists of individuals with whom the consultant met at various meetings are included as Appendix 3. Throughout the visit the consultant was assisted by Alain Hebert, chief, Pelagics and Groundfish for the Gulf Region, who arranged meetings and freely shared his insights into the scientific, technical and social issues around these fisheries. M. Hebert also coordinated circulation of report drafts to obtain comments and additional input from DFO, industry and other interests in the fishery.

The consultant was not able to meet directly with Francois Gregoire, the biologist responsible for mackerel. However, M. Gregoire has provided many helpful comments on earlier drafts of this document and his assistance is gratefully acknowledged.

At the June 29-30 workshop, each consultant gave a brief summary of his main findings and conclusions and received feedback from participants. As the problems in the fisheries are well known there was little debate about these and the latter part of the workshop focused on how to take advantage of the consultants' reports to clarify and implement a long-term vision that would carry the fisheries forward in an ecologically and economically rational and sustainable way.

The major emphasis of this report is on the herring fishery and science in support of that fishery as this is the focus of the current conflicts in the fishery. Less attention was paid to mackerel but this is not a reflection of its importance to fisheries inside or outside the Gulf or its importance in the marine ecosystem. A comprehensive, ecologically based vision for the fisheries of the southern Gulf of St. Lawrence will include both herring and mackerel as well as other species.

Much of the discussion at the workshops and the various meetings the consultant held with industry addressed concerns and conflicts in the fishery that were not specifically science related. However, these concerns and conflicts provide the context in which the fisheries take place and this has considerable bearing on the ways in which management and the research program might be structured to reduce the conflict and increase the stability in the fisheries. To

provide this context, the main issues in the fisheries, as they were described to the consultant, will be presented in the summaries of consultations below. In these summaries the intent was to present the information and concerns as they were conveyed to the consultant. The reporting of statements about the fisheries or the science conducted in support of them does not imply that the consultant has validated the statements or that they will carry any particular weight in subsequent analyses. Regardless of whether they can be confirmed by objective study, these statements, some of which are controversial, reflect the strongly held and often conflicting views of fishers and other interested parties. Any long-term vision and new management regime for the fisheries will have to acknowledge these views and find ways to negotiate their resolution.

History of the Fisheries

Herring Fishery

Herring were fished in the southern Gulf long before European colonization and herring fisheries were among the first established by early colonists. From 1900 to 1960 herring catches were in the range 30 to 40 thousand tons and comprised 30 to 50% of total Canadian Atlantic fish catch, second only to cod. The fishery was conducted primarily in the spring by inshore fishers who used gillnets to capture herring on their spawning beds. The major fisheries were in Escuminac, Chaleur Bay and on the Magdalen Islands. There was a very limited fall fishery in Caraquet, around PEI and in Pictou but little appreciation among the fishers that the fall spawning stock might be as large as the spring spawning stock. Herring from this fishery was marketed fresh, frozen, smoked, canned, salted and pickled. Large numbers were also used as bait.

In 1965 a herring purse seine fishery developed in the southern Gulf. Herring captured in this fishery were processed mainly as fishmeal and oil. The seiners searched for herring throughout Canadian Atlantic waters and quickly began to target large winter concentrations of herring off southwest Newfoundland. These herring were determined to be a mixture of spring and fall spawning herring, mainly from the southern Gulf of St. Lawrence. Catches by this fishery peaked at 175,000 metric tons in 1970 (65 seiners were active at that time) and during the 1970s over 80% of herring catch was by the seine fishery. After 1970, catches declined rapidly. Fishing herring for fishmeal and oil was banned in 1975 but catches continued to decline. Herring stocks collapsed in 1981 and, following the collapse, changes in management allocated 80% of the harvest from the southern Gulf to the inshore fishers. In 1983, the combination of reduced catches and low prices put the seine fleet in economic jeopardy. Under a fleet rationalization program the number of seiners was reduced and the remaining vessels were given licenses to fish in specific regions. Eleven large (> 65 ft) seiners continue to hold licenses to fish herring in the Gulf of St. Lawrence. In recent years, five vessels have been active in the fall fishery in the southern Gulf (Area 4TVn) and two in the spring fishery.

Since the early 1980s, mature fall spawning herring have been fished on the spawning beds by the inshore gillnet fleets to sell into the roe market in Japan. The roe is frozen and shipped to Japan for final processing. Spring spawning herring produce too small a roe and the roe yield is too small to contribute to this market. As a consequence, the inshore gillnet fleet has

been fishing in the spring primarily for bait and to supply local processors. Until recently there was an unwritten agreement between inshore gillnet fishers and seine fishers that the seiners would not fish for roe herring. From 1983 to 1990 the fall fishery in Chaleurs Bay was closed to large seiners until October 1st. In 1991, a compromise with the inshore gillnet fleet allowed the large seiners to start their fishery in Chaleurs Bay in September on the condition that the seiners did not target their fishery for roe. For several years this agreement ensured a peaceful fishery but since the late 1990s the agreement has broken down[3]. In the past three years, seiners have entered the roe fishery, exacerbating the long-standing animosity that inshore fishers feel toward the seine fleet.

Since 1984, southern Gulf herring have been managed as two separate stocks, the spring and fall spawning components, with separate TACs (Total Allowable Catch) for each component. Presently, the quota for each seasonal stock component is divided between the fixed and mobile gear with 76.8% of the TAC allocated to the inshore fixed gear fishery and 23.2% to the seine fishery. There is no specific allocation for the bait fishery and bait harvests have not been monitored[4]. Bait harvests have been estimated locally in some areas by Fishery Officers.

Fall stocks appear near their known historic abundance with harvests since 1995 ranging from 41 to 66 thousand tons. The spring stock has been in decline for some time and harvests have dropped over the same period from around 18 thousand tons to just over 8 thousand tons[5]. In 1987, area 4T was divided into 7 herring management zones (HFAs) aligned with the major spawning grounds and the fall inshore quota was divided among the HFAs. The spring inshore herring quota was divided among the HFAs in 1998.

The seine quota is not divided among the HFAs but there are many parts of area 4T that are closed to seine fishing either year round or during certain seasons to protect spawning or

[3] The consultant was informed by DFO that the inshore fleet would like this agreement to remain in effect. However, the economic impact on the seine fleet, in combination with other restrictions on their fishing, has resulted in most of the private vessel operators selling their vessels and licenses to corporate interests who do not wish to continue the agreement.

[4] A logbook program to record bait harvest was introduced in 2004 but is not yet fully effective.

[5] LeBlanc, C.H., G.A. Poirier, G. Chouinard, C. MacDougall, C. Bourque. 2004. Assessment of the NAFO Division 4T southern Gulf of St. Lawrence herring stocks in 2003. Canadian Science Advisory Secretariat Research Document 2004/29. Prepared by Fisheries and Oceans Canada, Gulf Region, P.O. Box 5030, Moncton, NB.

nursery areas and reduce conflicts with gillnetters[6]. Until recently, the seine fishery took most of its quota from Chaleurs Bay (HFA 16B) in the fall and area 4Vn (north and northeast Cape Breton) in winter. Since 1996, the seine harvest of herring in Chaleurs Bay has been limited to 50% of the quota to reduce pressure on fish that spawn in Chaleurs Bay and spread the seine effort over a greater area. Since 1998, seiners have not been able to catch herring in area 4Vn and in 1999 began fishing in the fall off NE PEI (HFA 16G) arousing considerable opposition from the inshore fleet.

Mackerel Fishery

In the northwest Atlantic, mackerel are distributed from Cape Hatteras in the south to the Gulf of St. Lawrence and eastern Newfoundland in the north. Two principal spawning locations are known within this broad distribution, off the New Jersey Coast and in the southern Gulf of St. Lawrence, suggesting at least two distinct stocks. Mackerel move into the Gulf of St Lawrence for spawning and feeding in June and begin their exodus in September. Mackerel schools are highly mobile but their timing appears rather precise so that the fishery in a particular area occurs at the same time each year. Like herring, mackerel were fished by First Nations long before European colonization. Aboriginal fishers used gillnets set over night or tied between two canoes as a kind of drift net to catch mackerel near shore. Early settlers captured mackerel with gillnets, and beach seines. In the 1800s hand lines, weirs and trap nets were used in the fishery. As fishing technology improved in the 20th century, trawls and purse seines began to be used to catch mackerel. The present day fishery is prosecuted with a variety of gear types including hand lines, purse seines, gillnets and traps.

Mackerel harvests by domestic fleets in the northwest Atlantic have generally been modest, less than 50,000 tons/year. Two periods of intensive fishing by foreign fleets occurred, the first from the mid 1960s to the mid 1970s when foreign fleets fished actively on Georges Bank and the Scotian Shelf. During this period harvests peaked at around 440,000 tons. The

[6] According to DFO, most of the seine fishery closures along the southern Gulf shore were introduced at the end of the 1970s to prevent the intensive seine fishery from damaging spawn during the spawning period and were of short duration (around 1 month). The Northumberland closure was introduced in 1983 to encourage development of an inshore fishery in the area. At that time a few inshore fishers in PEI wanted to obtain small purse seine licenses to fish herring in this region.

intensive foreign fishery was terminated after the US and Canada declared their 200 mile economic zones. A second but less intensive fishery took place on Georges Bank in the 1980's under an agreement between the US and Russia. Peak catches in this fishery were less than 100,000 tons. Recorded Canadian harvests between 1990 and 2000 averaged just under 20,000 tons/year. The largest regional harvest is from the southern Gulf (9460 tons). Recorded Canadian harvests of mackerel until 2000 constitute only a small fraction of the TAC which is set at 75,000 tons, however, recent information suggests that actual harvests may be considerably higher. Estimated Canadian landings for 2004 are around 52,000 tons. Considering that there is a significant unrecorded bait harvest and recreational harvest as well as potentially large discards of small mackerel and an unknown harvest of Gulf spawning mackerel in US waters, actual catches may equal or exceed the TAC (preliminary 2004 estimates provided by DFO). The recent harvest estimates, if they are verified by further investigation, indicate the need for considerably greater emphasis on mackerel biology and assessments if the fishery is to receive proper stewardship.

Summary of Consultations with Industry

Summary of the Workshop Held on April 19 and 20

The workshop began at 0900 hr with opening remarks by Dr. Mike Chadwick, Regional Director of Oceans and Science, Gulf Region, DFO, who introduced the consultant and facilitator for the workshop, Dr. Michael Healey and opening remarks by A. Hebert who also introduced the visiting delegation from the BC herring fishery.

Dr. Healey outlined the agenda for the workshop by summarizing his task as consultant on science issues around herring and mackerel. He pointed out that the terms of reference for his task included contributing to a long-term vision for herring and mackerel in the southern Gulf. Three objectives were to guide development of this vision and its associated multi-year management plan for herring and mackerel:

1. To develop with stakeholders a vision for the future of the Southern Gulf Herring and Mackerel fisheries with a special focus on sustainability of the resources and the viability of the industry by concentrating on the value of the fishery and not the volume of harvest.
2. To develop a more stable and long term approach to fisheries management by incorporating elements which reflect:
    a. The precautionary approach,
    b. The concept of Objectives Based Fisheries Management (OBFM), and
    c. Relevant ecosystem considerations.
3. To engage the fishing industry and provinces by encouraging the parties to precisely define their ideas, concerns and issues as well as their recommendations in support of the aforementioned objectives.
4. To identify areas of consensus between the parties and to offer options that could be considered in resolving differences.

Dr. Healey noted that discussion at the workshop should be conducted with these broad objectives in mind. He then went on to lay out the agenda for the day which began with a presentation by Ghislain Chouinard, head of the Marine Fish Section at DFO, Moncton, on the

current research and stock assessment for herring in the region and followed with round table discussion of 6 questions related to science needs for herring and mackerel.

The approach to herring stock assessment used by the Gulf Region is well described in recent stock assessment documents[7]. The basic approach involves virtual population analysis (VPA) in a format termed sequential analysis. The 2003 stock assessment indicates a biomass of spring spawning herring aged 4 and older of 65,000 t whereas the draft 2005 report indicates a biomass of 47,600 t. The spring spawning stock has been declining since 1995, when it was estimated at 120,000 t, and is currently around 65,000 t. Fall spawning stock biomass has been at high abundance in relation to historic estimates since 1998. The 2003 assessment set the biomass of fall spawners aged 4 and older at 287,000 t whereas the 2005 draft assessment set the biomass at 255,000 t. In terms of stock biomass, therefore, fall stocks appear healthy whereas the relatively low biomass and continuing decline of spring stocks is a cause for concern.

Mr. Chouinard did not discuss assessments for Atlantic mackerel. Spawning biomass of this species is currently estimated from egg surveys. No analytical assessment (VPA) for this highly migratory species is possible because the current landing data are inadequate[8].

Mr. Chouinard discussed several recent research projects on herring, some of which were collaborative with industry. These included studies of otolith (ear bone) shape and chemistry, the collection of acoustic data on spawning aggregations by fishers during their fishing trips, and the collection of samples by means of gangs of variable mesh gillnets by fishers. Otolith shape and chemistry are being studied to determine if otoliths can be used to distinguish spring and fall spawning components or finer scale stock structure within each spawning component. Preliminary results indicate that both methods provide good discrimination between spring and fall spawning components. Variation among local spawning populations within seasonal spawning components is less and it is not clear whether otoliths will allow any discrimination among sub-populations within the spring and fall spawning components.

[7] LeBlanc, C.H., G.A. Poirier, G. Chouinard, C. MacDougall, and C. Bourque. 2004. Assessment of the NAFO 4T southern Gulf of St. Lawrence herring stocks in 2003. Canadian Science Advisory Secretariat Research Document 2004/29. Available from www.dfo-mpo.gc.ca/csas/. AND, 2005 Draft Stock Assessment Rep;ort on Southern Gulf of St. Lawrence (4T) Herring.

[8] F. Grégoire, DFO Mackerel biologist, Maurice Lamontagne Institute, Mont-Joli, Québec, G5H 3Z4, pers. comm)

Acoustic sampling of local spawning aggregations is conducted to determine if it is possible to estimate relative abundance of individual spawning populations that could be used in finer geographic scale assessments. Fishers are involved in this data collection. Preliminary results are not promising for spring spawning aggregations but are promising for fall. Local acoustic sampling has been discontinued for spring spawning aggregations but is continuing for fall. Data have not been analysed in full as yet but preliminary analyses indicate that acoustic biomass indices correlate with catch rate data.

Fishing with gangs of gillnets of various mesh size is conducted to provide target strength estimates for the acoustic analysis, to provide information on mesh selectivity and to determine if recruitment can be assessed from such sampling. This program is continuing with the assistance of the fishermen. Data have only received preliminary analysis.

At 10:30 the workshop broke into 7 round tables to begin discussion of 6 questions relating to the research agenda for herring (See box below for questions). Questions 1 and 2 were discussed for about 30 minutes after which each table reported its main findings. After a break for lunch, questions 3-5 were discussed and reported on. Question 6 was dealt with in an ad hoc manner after the discussion of questions 3-5.

Box 1: Questions used to guide the discussion of research issues.

Question 1: Is The Scale Of The Current Stock Assessment And Advice Sufficient To Ensure Conservation Of The Herring Resource In The Southern Gulf?

Question 2: Does Gulf DFO Science Have Adequate Capacity Both In Terms Of Resources And Expertise To Provide The Advice Expected By DFO And The Industry?

Question 3: What Are The Approaches Used In Other Parts Of The World That Would Improve The Assessment Of The Southern Gulf Of St. Lawrence Herring Stocks?

Question 4: Is Lack Of Scientific Knowledge The Main Stumbling Block In Developing A Long Term Management Plan Satisfactory To All Stakeholders For Southern Gulf Herring? Are Other Factors More Important?

Question 5: In The Context Of Refocusing Stock Assessment Announced In The Last Budget, Is It Possible To Transfer Part Of The Assessment Of This Resource To Industry?

Question 6: Are There Other Scientific Issues That Need To Be Addressed?

The main points arising from the discussion of each question were as follows:

Question 1: Is The Scale Of The Current Stock Assessment And Advice Sufficient To Ensure Conservation Of The Herring Resource In The Southern Gulf?

Point 1. The assessment is Gulf wide and recognizes only 2 stocks. Many fishers believe that there are local stocks that are put at risk by this policy.

Point 2. The lack of detailed information on stock differentiation and potential loss of local stocks is the biggest concern of fishers.

Point 3. To reduce the potential risk to local stocks there is a need to spread fishing effort across a broad geographic area so that no single area receives too much fishing effort. The inshore fishery is structured in this way. However, the seine fishery tends to fish heavily in a few areas and so poses a greater danger to local stocks.

Point 4. Fishers would like to see pilot projects to determine if it is possible to manage the fishery on a finer geographic scale with local stock assessments and local TAC.

Question 2: Does Gulf DFO Science Have Adequate Capacity Both In Terms Of Resources And Expertise To Provide The Advice Expected By DFO And The Industry?

Point 1. Expertise in DFO is good but the resources are inadequate. Industry is frustrated that the data from projects in which they participated are not analyzed and no changes in management seem to have resulted from this investment in information. This is frustrating for DFO scientists as well.

Point 2. Available information indicates that DFO will be facing even further cuts in resources for science. Industry would like to help but herring and mackerel fisheries are not high profit and may not be able to make up the difference.

Point 3. Given that resources are already scarce and likely to become scarcer, there is a need for clear vision, objectives and prioritization of resource use. At present industry feels it has no say in setting priorities and is not convinced that resources are spent in the most useful way.

Point 4. The generally low value and low quality product produced by the industry is an impediment to increased industry funding of science and management. If product quality

was increased it would lead to a higher valued industry and greater capacity for industry contribution. At present there are systemic problems in the industry that work against developing higher product quality.

Point 5. DFO needs to have a scientist dedicated to herring to provide intellectual leadership both within DFO and in potential collaborative projects with industry.

Question 3: What Are The Approaches Used In Other Parts Of The World That Would Improve The Assessment Of The Southern Gulf Of St. Lawrence Herring Stocks?

Point 1. Most participants felt they did not have enough information on what was done elsewhere to comment on viable alternatives.

Point 2. BC seems to have developed a sophisticated, workable system but their approach may not translate to the Gulf region.

Point 3. ITQ systems are not favourable to community based fisheries as they lead to corporatization of the fishery, accumulation of quota in a few hands and relocation of fishers to larger urban centres.

Point 4. The spawning area survey approach used in BC to measure spawn density and determine spawning biomass may apply to some areas in the spring but not fall spawners. In any event, surveys would be more difficult because all east coast spawning is subtidal.

Question 4: Is Lack Of Scientific Knowledge The Main Stumbling Block In Developing A Long Term Management Plan Satisfactory To All Stakeholders For Southern Gulf Herring? Are Other Factors More Important?

Point 1. Participants felt that both the science and resources available for science were insufficient for long term planning.

Point 2. The lack of scientific knowledge is not the only or even the most important obstacle to long term planning. Conflict between sectors and back room decision-making are equally important.

Point 3. There is a need for agreed reference points (e.g., minimum spawning stock biomass) and rules in management decisions. At present the decision process appears inconsistent (e.g., biomass of the spring spawning component is declining rapidly while fall is high

yet there are numerous restrictions on fishing for fall herring but few on fishing for spring herring).

Point 4. The spring spawning group is the biggest concern. There is a need for finer scale management of this stock component.

Question 5: In The Context Of Refocusing Stock Assessment Announced In The Last Budget, Is It Possible To Transfer Part Of The Assessment Of This Resource To Industry?

Point 1. Industry is already engaged in contributing to science and stock assessment in many ways. It is not clear that industry can afford to contribute more.

Point 2. There is need for better feedback and more timely use of the information that industry already provides.

Point 3. If industry is to pay the costs of management and research it must have a much greater say in decisions. At present industry feels it is asked to pay but has no real say in management decisions.

Point 4. Industry mistrust of DFO is an obstacle to greater industry contribution to management and research. Before there can be more contribution from industry there is a need to build trust and respect.

Point 5. If more responsibility is to be downloaded to industry there will be a need to explore innovative means of funding necessary research and management.

Question 6: Are There Other Scientific Issues That Need To Be Addressed?

Point 1. There is a need for better data on mackerel. At present, catch in either the commercial or recreational fishery is not fully recorded nor are data on age and size structure routinely collected.

Point 2. Product quality and marketing issues in the herring fishery need to be addressed. There may be some scientific issues related to product quality (e.g., factors controlling histamine production).

Point 3. If industry is to be expected to take on stock assessment roles, there will need to be training.

Point 4. Priority should be placed on establishing minimum spawning biomass and other critical stock values for management decision-making.

Wednesday's session began with a review of the main points of the previous day's discussion as outlined above. The session then moved to a brief discussion of some elements of the second of the Long-term Objectives. This objective is to develop a more stable and long-term approach to fisheries management by incorporating: 1) The precautionary approach; 2) Objectives based fishery management; and 3) Relevant ecosystem considerations. These represent three relatively new aspects of resource management and the consultant felt they needed to be more clearly defined if industry was to consider how they might be included in long-term planning. The terms of reference provided some guidance as to how DFO understands the first two of these elements. According to the terms of reference the precautionary approach implies that:

- Conservation, environmental, ecosystem, and socio-economic issues are all considered in management;
- Unacceptable outcomes are clearly identified;
- Strategies to achieve objectives are developed;
- Uncertainties are taken into account; and
- Caution is greater when uncertainty is high.

The precautionary approach was codified for the first time in Article 15 of the 1992 Rio Declaration as: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". Canada has debated the application of this principle for some years (see: www.ec.gc.ca/econom/pp_e.htm). The intent of Article 15 was to tilt decision-making in favour of environmental protection where the risk of harm (particularly irreversible harm) was high but information and understanding were weak. Adopting management practices that protect local spawning stocks of herring (or other species) even though the scientific basis for the existence of such stocks is weak would be an example of the application of the precautionary approach.

Also drawing from the terms of reference, Objectives Based Fishery Management means:

- Improving management by having explicit and measurable goals;
- Clarifying the roles of industry, managers, scientists, and other interests in fishery management;

- Managing the fishery in relation to clearly defined and measurable performance objectives;
- Assessing and managing risks; and
- Applying the precautionary approach and ecosystem-based management.

Objectives based management appears to be an adaptation of Management by Objectives (MBO) introduced by Peter Drucker in his 1954 book, "The Practice of Management". The key features of MBO are setting realistic objectives, breaking them down into achievable tasks and assessing progress through specific performance indicators. MBO focuses on results rather than activity. A key aspect is that everyone involved understands the objectives and their role in achieving them. In fisheries management this implies co-management arrangements that engage all interests in a meaningful way.

The terms of reference did not provide guidance as to what DFO means by ecosystem-based management. However, scientific writing on ecosystem-based management is now quite extensive and suggests that this approach incorporates the following principles into management:

- The recognition that non-human species have intrinsic value;
- The recognition that complexity, interconnectedness and uncertainty are fundamental characteristics of ecological systems;
- Management of individual species as components of the marine community;
- Protection of biodiversity and ecological integrity;
- Management decision-making based on clearly articulated goals and scientifically defensible ecological models;
- Integration of environmental, economic and social objectives for the resource; and
- Treating humans as integral to the ecosystem being managed rather than independent of it.

Ecosystem-based management has become the guiding philosophy of resource management throughout the developed world, however, operational approaches remain poorly defined. Achieving consensus on appropriate ecosystem models is one important obstacle but there are many areas of uncertainty that need to be worked out. Adaptive management (treating management initiatives as experimental) is one of the principle tools for implementing ecosystem-based management but adaptive management is itself a controversial tool.

Collaborative approaches to making decisions are needed if anything approaching ecosystem-based management is to be implemented successfully.

There is obviously considerable overlap among the definitions of these three aspects of management. In terms of practical, on-the-ground management, incorporation of these aspects into management implies that harvest rates will be set more conservatively to provide room for the species to satisfy its other roles in the marine community and to take account of uncertainty. Their incorporation also implies that harvesters and processors will be much better integrated into the management decision-making process, in the development of goals and long-term plans, and in the implementation and evaluation of management measures.

Adopting the precautionary approach, OBFM, and ecosystem-based management also has implications for the kind of science that will need to be undertaken. Traditional stock assessment tools will still be important but well articulated ecological models will play a much more important role in decision making than they have to date. Taking account of risk and uncertainty implies a greater emphasis on ecological risk assessment and a search for management models that are robust to uncertainty. The emphasis on integration of ecological, economic and social aspects of fisheries implies an emphasis on integration of ecological and economic models. The demand for new kinds of science in a time of shrinking scientific budgets in DFO also implies that ways will have to be found to generate the necessary information from the fishery itself. Adaptive management is a formal methodology for using the management process to generate new knowledge. For example, the design, implementation and evaluation of experimental fisheries to assess new management policies is one form of adaptive management. If carried through to implementation of experimental management of local spawning populations with appropriate monitoring and follow-up analysis, the experiments in acoustic estimation described below by Dr. Claytor would be another example. Formal procedures of adaptive management are thoroughly described by Walters (1986)[9]. If these new aspects are to be incorporated into fishery management a strong partnership between industry, DFO science and the academic community will have to be developed around the application of adaptive management.

[9] Walters, C. 1986. Adaptive management of renewable resources. MacMillan Publishing, New York, NY.

After the morning break the workshop continued with a presentation by Dr. Ross Claytor on the use of acoustic systems aboard fishing vessels to conduct fishery assessments of local spawning aggregations. This is work that Dr. Claytor began while with DFO in Moncton and represents one of the collaborative research projects between DFO and herring fishers. Dr. Claytor relocated to the Bedford Institute for Oceanography several years ago and since that time has had little time to spend on the analysis of data from this project. To the extent that he has been able to analyze the data, Dr. Claytor believes that this kind of acoustic sampling could be used as part of a finer scale approach to herring management. However, Dr. Claytor was careful to emphasize that the acoustic system is not yet able to provide an absolute estimate of herring abundance at the local scale. Participants were pleased to have received a thorough up-date from Dr. Claytor on the status of the acoustic program but frustrated that it seems so difficult to carry these projects through to a useable product. Some groups within the fishery are eager to participate in pilot projects to determine if more local scale management can be made to work.

After the lunch break the workshop was turned over to the delegation from British Columbia for a presentation and question and answer session on the BC herring fishery. Dennis Chalmers, the DFO manager responsible for herring in BC, began with a description of the history of the fishery and its present day management. In BC, an intensive reduction fishery for herring caused the stocks to collapse in the mid 1960's and the fishery was closed for a few years. Fortunately, the stocks rebounded quickly and by the early 1970's there was sufficient biomass to permit a fishery to be reestablished. Also fortunate was that this coincided with a demand for herring roe in Japan so the BC Herring fishery was reestablished as a directed roe fishery. Following a period of competitive chaos during which fishing effort rose rapidly in response to very high prices for roe herring, fishers and managers brought the fishery under control and established harvest rules that were designed to ensure conservation and a sustainable harvest. Nowadays the fishery is managed collaboratively by the industry and DFO. More than 250 seiners and 1200 gillnetters fish side by side in the fishery. Each year 12 to 14 seiners are bought out of the fishery to conduct test fishing. About 80% of the annual harvest of about 25.000 to 30,000 t is shared 55/45% between seiners and gillnetters. The remaining quota is shared among a spectrum of small fisheries (including bait, food, roe on kelp) and 6% is set aside to provide funds for management and research. The management and research fund is managed through the non-profit Herring Conservation and Research Society. The Board of Directors for

this society includes gillnetters, seiners, processors, first nations, DFO and public representatives but is dominated by industry members. The Society effectively pays for all research and management related to the fishery. Proposals to conduct scientific research using these funds, whether from DFO or any other organization, are vetted through a scientific review committee established by the board. To be funded a project must be seen to benefit the industry as a whole. The Society also never commits more than half its available funds in any year to ensure that it can continue to fund longer-term research.

The fishery is managed on the basis of 5 coastal areas where the main spawning concentrations of herring occur. All BC herring are spring spawners so the fishery is concentrated in the spring. Allowable catches are determined from spawning stock biomass the previous year and estimates of average recruitment. Each license is entitled to an equal share of whatever is the TAC for the gear and coastal area in which the license owner elects to fish. Redistribution of fishing effort can be made within a coastal area if it appears that too many licenses have elected to fish on a particular spawning population. Any such redistribution, however, is always made by a committee involving industry.

The BC herring fishery is an example of a fishery in which the industry makes most of the decisions about management and research. It is also a fishery in which a portion of the resource is used to pay for research and management. This approach is becoming the norm for fisheries managed under individual quota systems. However, the BC delegation was careful to emphasize that, during the early days of the roe fishery there was lots of conflict between gear types and lack of trust and respect between fishers and DFO. The current arrangement, which all agree works well, began in conflict but over the years fishers and managers found a way to work together for the benefit of the fish and the fishers. The quality of product produced is also very high and this was driven by processors who wanted to get top prices for their product in Japan. Both seines and gillnets handle their fish in such a way as to ensure there is minimum loss of quality from net to processing plant.

Following a lengthy plenary discussion between workshop participants and the BC delegation, the consultant summarized the lessons from the BC herring fishery.

- Cooperative, collaborative management among competing gear types and DFO is possible;
- Seiners and gillnetters can work together and fish side by side in a sustainable manner;

- A cooperative approach to improved product quality is possible;
- Both gillnets and seines in BC are mobile gear, traveling between fishing areas to take advantage of multiple licenses. This feature of the BC fishery may not be applicable in the southern Gulf but that does not negate the potential for productive joint fisheries;
- The Herring Conservation Research Society could be a model to consider in southern Gulf as a means to generate and administer resources from the fishery to support research and management;
- Developing trust and respect takes time;
- In BC, moving to a quota share fishery was important in reducing conflict; and
- Good science has been an important foundation of success in BC.

Following the presentation by the BC delegation and the summary of lessons the workshop adjourned.

Summary of Meeting With New Brunswick Herring Seiners (FRAPP)

The main point of discussion at this meeting was the antagonism toward the seine fishery off NE PEI. The seiners believe they have done everything to convince the inshore fishers that they are not damaging the stock. They have agreed to an "experimental" fishery to gather data on effects of the seine that has restricted their access to inshore fishing grounds and involves observers on their vessels, monitoring of their gear and whether it touches the bottom, etc., yet still the community has blocked the landing of fish for trucking to NB.

The agreement for the experimental fishery was made with local fishers but still the community was demonstrating and blocking the port. One participant in the discussion expressed the opinion that the situation was made worse by local press who will not print factual information about seiners but continually report only the negative impressions and comments of local fishers. Also, this individual believes that local politicians are using the dispute to bargain with Ottawa to obtain quota of crab and shrimp for local fishers. As a result they see no benefits to reaching agreement. In fact the payoffs all come from not reaching agreement.

Participants at this meeting stated that DFO is not doing an effective job in enforcing regulations. Fishery officers from DFO, who also live locally are cautious about enforcing fishery regulations against local people. The scientific fishery was agreed to in 2004 and should

have governed the 2004 fall fishery but protests still disrupted the fishery. Local fishers have received shrimp quota as a result of the dispute but they do not fish these quotas. Instead they lease the quota to fishers elsewhere.

Processing of herring locally might help reduce the conflict but there is no suitable local processing capacity. The fish must be trucked to NB. Even local fishers truck their fish to NB. So lack of local processing of seine fish is not the issue.

There was general agreement that the workshop was productive. It was an eye opener for inshore fishers to see that in BC seiners and gillnetters work together and have a very successful fishery.

The FRAPP also sent the consultant a copy of their report, "Long term management strategy – herring and mackerel fisheries in the southern Gulf of St. Lawrence", which provided additional information on the views of this organization concerning management and science needs for the fisheries.

Summary of Meeting with Mr. Olin Gregan, representative of the Barry Group and also representative of the NFLD large seiner fleet

In the representative's opinion, the PEI dispute is not about science but social and political issues. He hopes that the experience of the two-day workshop will have started a change of attitude among PEI people, Women for Environmentally Sustainability especially.

Mr. Gregan believes that potential for a mackerel fishery exists and seiners scouting for herring will find mackerel and this will trigger a fishery. Francois Gregoire, mackerel biologist based in Mont-Joli has been doing assessments and finds lots of mackerel.

Mr. Gregan believes the right people are in place in DFO, the Fishermen's associations and the NB Government to allow significant change in the fishery. The PEI lawsuit is an obstacle. PEIFA is a wild card that could play a positive role but could also be an obstacle.

Mr. Gregan is concerned about both spring and fall stocks of herring in the Southern Gulf. There is decreasing size of fish and changes in movement patterns and concentration areas of fall spawners and this is worrisome. He is concerned we could have the same mess in the southern Gulf as he sees in Bay of Fundy – apparent overestimation of biomass there has led to excessive exploitation. Acoustic assessments of biomass were not reliable in the Bay of Fundy

and the degree of error is shocking, as much as a four to five times overestimate. If the current Bay of Fundy stock is only 150,000 tons as is now suggested, then the total stock represents one season's catch in recent years. If there are any similar problems with assessment of the southern Gulf stocks then even the fall stock could be in trouble. He does not want to see the southern Gulf stocks go the same way as the Bay of Fundy stocks. He is concerned that a directed roe fishery could be contributing to the problem.

Roe yields are low and the quality of fish landed is generally poor in the herring fishery. There are various contributors to this situation including commission buyers who do not care about quality and the tendency for fishers, processors and buyers to tie purchase of herring to purchase of lobster so that herring quality is not important. Processors buy herring to get lobster or crab and do not care about quality. If any buyer starts to pay a premium for quality the other buyers match the price regardless of quality so that it is not possible to establish a premium price for quality.

Mr. Gregan sees potential for gillnetters and seiners to work collaboratively to produce high quality product with economic benefit for all. But this will need serious adjustments to the fishery. The move by the Maritime Fisherman's Union to organize into "communities of interest" to build an economy around particular products (e.g. roe on kelp) could help with the quality issue.

Summary of Meeting with PEI Inshore Fishers and Other Interests in Souris, PEI

Great animosity and mistrust toward DFO was expressed at this meeting. This animosity was fueled by the local fisher's assertion that DFO failed to consult over the "experimental" seine fishery that was supposed to resolve the gear conflict in the region. Local fishers see this fishery as simply another example of DFO and the minister siding with the seiners against PEI. The recently released regulations for the bait fishery, that closed the fishery during October to prevent conflict on the water between seiners and inshore fishers, was the most recent illustration of the arrogance of DFO the fishers said. These regulations were made without consultation with local fishers and simply served to confirm the opinion of local fishers that DFO does not

consider them[10]. Other examples were offered to illustrate how PEI submissions to advisory committee meetings and other fora for input on fishery issues were ignored.

The inshore fishers want seiners out of PEI. Their observation is that the summer herring fishery has disappeared since seiners arrived. They acknowledge that this could be a coincidence but they doubt it. They believe that the great catching capacity of seiners, despite their relatively low overall quota, results in local stocks being fished out. They believe this is why the seine fishery has been cut back severely in Chaleurs Bay. Local PEI fishers believe that they do (or did) have discrete local stocks and what remains is put at risk by presence of seiners fishing in shallow water. Several participants noted that when the reduction fishery was operating herring were fished out along northern PEI and it took 20 years for them to come back. Now the seine fleet is threatening to do the same again and DFO will not listen.

PEI fishers do not understand why seiners can be excluded from Chaleurs Bay for conservation reasons but not from north PEI. If there are local stock concerns in Chaleurs Bay there should be the same concern for north PEI. If it is all one stock why does it need protection in Chaleurs Bay and not PEI?

The local fishers noted that seiners have not been able to catch their quota in recent years. They believe this is because they have fished out the fish in deep water. Now the seiners want to come into the shallow water and devastate inshore stocks on which the fixed gear depend.

Inshore fishers do not accept DFO assessment of the size of the herring stock. Nor do they accept DFO's data on herring size and age because they say the dockside monitors only sample from the top of the herring load thereby getting only the largest fish[11]. They see huge problems with the data collection system that could mislead managers and result in management failures and devastation of herring stocks. Even if there are fall spawning herring migrating along NE PEI in fall that the seiners could legitimately catch, that does not mean there are not local stocks that could be vulnerable to the harvest.

Inshore fishers believe that the process set in motion by the minister (Surette report and current consultant studies) are, at best, time delaying tactics by the Minister so that he does not

[10] The decision to limit the bait fishery off northeast PEI to water less than 17 fathoms from October 1 was recently rescinded by DFO.

[11] According to DFO, sampling is done both by dockside monitors and port sampling technicians according to protocols that are designed to ensure accurate measurements. This is not to say that protocols are always scrupulously followed.

have to deal with seiner problem. At worst they are designed to validate what DFO is doing and, in this respect, the consultants are simply pawns in the Minister's game.

Participants emphasized that the north shore fishery is a multispecies fishery and maintaining all aspects of the fishery is critical to local fishers. They also believe that the food web relationships have to be sustained. For example, tuna that is fished seasonally only comes into the Gulf to get herring and if herring are depleted tuna will no longer come. They believe that quality of tuna has declined since the herring fishery picked up and believe this is because herring is being overfished[12]. Lobster also feed on herring spawn and if spawning populations locally are depleted, as they believe they have been, then lobster will also suffer.

The PEI fishers do not understand why the seine fleet is not subject to mesh size restrictions that would allow small fish to escape. They believe the small mesh seines currently in use catch too many small fish and this is bad for herring stock[13]. They are also resentful that they are subject to weekend closures and other restrictive measures whereas seiners can fish day and night seven days a week. In their view this kind of open fishery will allow even a small fleet of seiners to have a devastating effect. One load in a seiner, one night's fishing, can be equal to 10 weeks of harvest for a single gillnetter[14]. This confirms to them that seiners are too efficient. In addition, a seiner has only a small crew. The same catch, if fished by inshore gear can support a large number of fishers and their families. There need to be rules that spread the seine harvest over large area so that they cannot destroy local stocks.

The inshore fleet is also concerned that the seiner fleet is a corporate fleet and further restrictions on inshore fleet will also drive it into the corporate sector.

Several fishers argued that seiners are not able to release fish safely. As a result, if seiners have to release fish for size reasons or any other reason the majority will die. One fisher

[12] Analysis of data on condition of tuna and its relationship to herring abundance has been conducted by DFO. The analysis confirms that condition of tuna has decreased in recent years but there appears to be no relationship between tuna condition and herring abundance.

[13] According to DFO, employing larger meshes in seines results on many herring being caught in the mesh and killed. When herring are abundant, the numbers caught in the mesh can make the net so heavy it can capsize the vessel. There may be other gear modifications that would reduce the catch of small fish, however.

[14] In one night of fishing off northeast PEI, however, both seiners and gillnetters land about the same amount of fish, about 800 tons.

noted that attempts by seiners to release fish in Cape Breton simply resulted in millions of dead herring. These fell to the bottom but showed up as rotting fish in scallop dredges[15].

Local fishers do not agree with the design of the "experimental" fishery because the straight lines delineating the 17-20 fathom region include much shallower bottom. This is just a ploy by seiners in collusion with DFO to get the fish in shallow water. They believe that it would be easy with modern navigational gear for the seiners to be kept outside the 17 fathom line so having straight lines to delineate fishing zones cannot be anything but a ploy to let seiners into shallower water.

The consultant questioned the participants about having greater responsibility for the fishery to fund research. Fishers were very skeptical. They saw it as merely another ploy by DFO to rob the fishery and they would get nothing back. They did not believe that a co-management system in which fishers controlled the decision-making could be set up. Politicians and politics would always undermine anything the fishers worked to put together.

[15] According to DFO the timing and location of the scallop fishery in Cape Breton makes it unlikely that this occurred. DFO has not been able to verify this observation with Cape Breton fishers.

Analysis

This section presents the consultant's analysis of information from the reports and consultations organized in relation to the five tasks identified for element 1 in the terms of reference. Recommendations are offered at the end of each section. There is duplication of recommendations between sections because similar issues were dealt with under the different headings. Recommendations are provided primarily to highlight important issues as these fisheries are entering a stage of transition and it is important that the diverse interests in the fisheries negotiate their own workable solutions to the issues raised.

Task 1. Evaluate scientific aspects of the herring and mackerel fisheries including conservation and ecosystem objectives

Southern Gulf herring are managed as two separate stocks, spring and fall spawning components. Separate TACs are estimated for each stock and catch and fishing rates are tracked separately. The policy of managing herring as two stocks is consistent with what is known about the biology of southern Gulf herring. Both stock components overwinter north and northeast of Cape Breton on the edge of the Laurentian Channel (including possibly south west Newfoundland) and migrate into the southern Gulf in spring. Spring spawners move onto their spawning grounds in April and May and spawn while fall spawners remain in deeper water. After spawning the spring spawners move to deeper water where they mix (although perhaps not completely) with the fall spawning component in large feeding aggregations. In late summer, the fall spawning component moves onto its spawning grounds to spawn. After spawning the fall spawners move back into deeper water to mix with the spring spawning component. In the late fall both stock components migrate out of the southern Gulf to their wintering area. The inshore fishers typically harvest each stock when the herring are aggregated for spawning in traditional fishing areas not far from the fisher's home port. The mobile gear fishery generally targets mixed feeding or migrating aggregations of spring and fall spawners in the southern Gulf or winter aggregations in the 4Vn area northeast of Cape Breton and a portion of the Laurentian Channel north of Cape Breton. The scientific data on which spring and fall stocks and migratory and spawning patterns are defined were collected some time ago. So far as the consultant is aware there have been no recent studies of stock differentiation, migration patterns, or other

aspects of the ecology of southern Gulf herring important to management. For example, it is unclear to what extent herring from the southern Gulf migrate to the south west coast of Newfoundland in recent years.

As noted earlier, stock differentiation and the possible existence of discrete local spawning populations is a significant concern of inshore fishers. DFO has initiated two research projects to investigate whether local sub-populations can be identified within the spring and fall stock components. Both are based on otoliths, one focusing on otolith chemistry and the other on otolith shape. Analysis to date indicates that both shape and chemistry of otoliths can be used to distinguish spring and fall spawning components. Analysis has not yet determined whether sub-populations of fish can be distinguished within these components.

DFO has also engaged in two studies in which fishers collaborate in collecting data, acoustic surveys of fishing areas and sampling with variable mesh gillnets. The acoustic data collection is intended to determine whether relative herring abundance can be assessed on the spawning grounds, a necessary condition for local scale management. The fishing with gangs of gillnets of various mesh size has several purposes. It provides information from which target strength is calculated for the acoustic data collection on the spawning beds. Size composition from the variable meshes provides information on mesh selection that can be used to adjust stock assessment analyses when mesh sizes used in the commercial fishery changes. Finally, the sampling can be used to determine whether fishing with small mesh nets can provide information on recruitment.

These latter research projects indicate that, within the constraints of its limited research budget, DFO is attempting to respond to the concerns of industry by exploring ways to detect finer scale differentiation within spring and fall spawning components and taking steps to develop technology for local scale management. This research also engages industry in data gathering, which contributes to integration and understanding. Unfortunately, lack of resources has slowed the analysis of data from these projects, leading to frustration on the part of fishers and DFO personnel who participated in the studies.

Research on mackerel is not the responsibility of the Gulf region and, in the time available, the consultant was not able to gather sufficient data on mackerel research to make informed comments. As a consequence, no assessment was made of mackerel research programs.

Objectives for herring management as stated in the draft Integrated Fishery Management Plan[16] are as follows:

Long Term Objectives:

1. Conserve the resource for long term sustainable utilization
2. Enhance the process of allocating quotas among inshore groups based on the status of the major spawning components
3. Develop a self-sustaining inshore and midshore fishery capable of competing world wide
4. Address the problem of overcapacity

General Management Objectives:

1. Promote and ensure the conservation and protection of herring stocks
2. Spread the inshore and midshore effort out over the spawning areas to protect the stock composition
3. Gather timely and accurate information essential to assessing the status of stocks
4. Protect the various spawning components

These objectives are typical of traditional single species management regimes. The primary focus is to maintain adequate spawning biomass and harvest the stocks sustainably using F0.1 as the rule for setting fishing mortality and establishing the TAC. Concern for the possible existence of local stocks is reflected in the objective of spreading fishing effort over the spawning areas. However, the plan does not define critical stock sizes for conservation, which are an important aspect of the new fisheries policy.[17] In addition, so far as the consultant could determine, ecosystem objectives are not an explicit aspect of herring management. Incorporating ecosystem based management into fisheries management is also a priority of the new fisheries policy.[16] The role and importance of herring in Atlantic coast ecosystems, including the southern Gulf, is part of the region wide ecosystem analysis (Comparative Dynamics of Exploited Ecosystems in the Northwest Atlantic or CDEENA, www.osl.gc.ca/cdeena). However, stock assessment analyses make no mention of the ecological role of herring in discussing allowable

[16] Fisheries and Oceans Canada, Gulf Region. Integrated fisheries management plan, herring – Area 16, 2001-2004. Draft document available from Fisheries and Oceans, Gulf Region, Box 5030, Moncton, NB.

[17] Fisheries and Oceans Canada, Ottawa. A policy framework for the management of fisheries on Canada's Atlantic coast. Ottawa, ON.

harvests and the F0.1 harvest rule is not based on ecosystem considerations. The integrated fisheries management plan for herring devotes only 2.5 lines to species interactions, simply noting that herring is an important forage species for all pelagic predators, sea birds and marine mammals and that the spawn is food for winter flounder. Ecosystem research is being conducted in the gulf and there is appreciation that the ecosystem has changed significantly in recent decades. However, as yet, this information appears not to be directly influencing management decisions about herring.

The long-term objectives for the mackerel fishery from the integrated fisheries management plan[18] are as follows:

1. Conservation of the resource for long-term sustainable utilization
2. Co-management of the mackerel resource to ensure full participation by the stakeholders, developing partnerships where applicable. Stakeholders are defined as holders of either traditional or exploratory mackerel licenses.
3. Priority access to the mackerel fishery will be provided to the inshore sector
4. Protection of traditional inshore markets will continue.

Specific management objectives for mackerel include:

1. Improve the existing index fishery program to enhance scientific data collection and increase industry/science cooperation in stock status evaluation.
2. Improve fishery statistics by implementing mandatory logbooks for most fishers including bait fishers
3. Encourage aboriginal participation and integration into the commercial fisheries
4. Allow access for recreational fishers subject to availability of mackerel and by-catch considerations in other fisheries
5. Maximize the access to mackerel by the commercial fleet and value of the product.
6. Encourage exploratory fishing as a means to increase Canadian harvest of mackerel.

The objectives for the mackerel fishery reflect a traditional single species management regime and, as with herring, critical stock sizes for conservation are not specified. It seems likely that the dynamics of the mackerel population are as yet not known well enough to establish critical stock sizes. Nevertheless, it would be advantageous to set the critical stock

[18] Fisheries and Oceans Canada. Atlantic Mackerel Integrated Fisheries Management Plan, 2002-2006. Available from Fisheries and Oceans Canada, Ottawa, ON.

sizes on an interim basis until they can be updates with better information. There are also no objectives that relate directly to the role of mackerel in the ecosystem. The most recent stock status report includes a section on the diet and prey of mackerel but this information appears not to have been explicitly incorporated in the section on management implications[19]. The inclusion of such ecological information in the stock status report represents an important first step toward a more ecosystem based approach to fishery assessment and is to be encouraged. It may be too early in the research on the Gulf ecosystem to adopt more explicitly ecosystem-based decision-making but that should be the ultimate goal.

Conservation of the stocks is a priority in the plan but more emphasis is placed on increasing harvest. Given the recent evidence that harvest rates may equal or exceed the quota, a greater emphasis on conservation would be advisable.

Recommendations:

1. *Recast conservation objectives in relation to critical stock sizes for both species. Where stocks sizes are in the "healthy" range, F0.1 provides a practical criterion for setting TAC's. At stock sizes in the range of "concern", more conservative rules for setting TAC should be adopted that emphasize conservation and rebuilding. At stock sizes below the critical level conservation should override other objectives except in the most extreme circumstances.*
2. *As part of the conservation program, all components of the harvest of both species need to be measured and these measurements integrated into the management program.*
3. *Developing ecosystem objectives for these species should be a priority. Development of these objectives should recognize that ecosystem-based management implies the integration of economic, social and ecological considerations in management institutions, not just an understanding of the role of each species in the marine ecosystem.*

[19] Gregoire, F. 2005. Atlantic mackerel in the northwest Atlantic in 2004. Canadian Scientific Advisory Secretariat, Science Advisory Report 2005/014. Available from Regional Science Advisory Bureau, Quebec Region, DFO, Maurice Lamontagne Institute, P.O. Box 1000, Mont Joli, Quebec, B5H 3Z4.

Task 2. Critically review the current research programs and make recommendations with regard to the orientation of future research

For southern Gulf herring, science is devoted primarily to gathering and analyzing the information necessary to calculate the TAC for each stock. In keeping with its strategy of managing southern Gulf herring as two stocks, DFO collects data on total catch, age structure and fishing effort for each stock from the inshore fishery. This is accomplished through a combination of dockside monitoring and sampling, sales slips, and a telephone survey to determine nets set per fishing day. Catch and effort data from the gillnet fishery provide an index of abundance. A further index of abundance is provided by an annual fall acoustic survey. These data are analyzed by sequential population analysis and yield per recruit to generate estimates of abundance, biomass and yield at F0.1. Uncertainties are taken into account and a risk analysis is performed to allow decision makers to incorporate risk of overfishing into decisions about TACs. Within the limitations of such models and the data on which they depend, the assessments appear to be performed in a professional and competent manner. The stock definitions used and the models applied are fully consistent with established practise in marine fishery management. Trends in stock size from the VPA match fishers' perceptions of changes in herring abundance. Overall, the VPA appears to provide a sufficiently accurate assessment of herring stock size for effective single species management in the context of the current management regime.

There are, however, legitimate concerns about the use of this approach. The model assumes a linear relationship between the abundance index based on catch and actual population size, which is seldom the case. For the herring fishery, total catch and the abundance index (catch per unit effort, CPUE) are confounded in the data. The acoustic survey provides an alternate, independent index of abundance but this index does not agree with the CPUE index. Both indices are used in the assessment of the spring spawning component but, due to internal inconsistencies in the acoustic data for the fall spawning component, only the gillnet CPUE is used in the assessment of the fall component. These and other well known weaknesses with sequential population analysis argue for a conservative approach to setting TACs even if the long-term vision involves a decision to continue managing herring as two large seasonal stocks. The scientists and technicians who conduct the sequential analysis appear fully aware of its

weaknesses and their judgments about allowable harvests are sound. Under the current management regime the fall spawning component appears very healthy. The spring component has declined significantly but managers are keeping close watch on this component. One shortcoming of the present management regime is that critical stock sizes have not been established for either stock component. Establishing minimum spawning stock sizes and rules for minimum condition of local spawning populations that are agreed between DFO and industry would establish the conditions for taking decisive management action to conserve stocks or local populations.

Under the current management regime, local spawning populations of herring are not recognized as ecologically or genetically distinct. If one accepts the assumption that there are only two herring stocks in the southern Gulf, there is no need to protect local spawning populations. Tagging indicates that exchange occurs between geographically separate spawning populations within each stock and this will ensure their recovery if local exploitation rates exceed local productivity. In practice, the management system acknowledges the need to distribute fishing effort among the local spawning populations. This is achieved for the fixed gear fishery by allocating both the spring and fall TACs among 7 herring fishery areas (HFA). This distribution of the fixed gear TACs among HFAs also ensures that the localized fixed gear fisheries all have access to a reasonable share of the TAC. The fishers appear to accept that dividing the TACs among the HFAs is a good idea but expressed some confusion about how the allocation was decided and concern that there was insufficient consultation with inshore fishers about these allocations. A clear set of rules for distributing the TAC among HFAs would help reduce this confusion. To the extent that distribution of fishing effort has a conservation objective, the objective and the scientific support for a particular distribution of effort need to be described. At present, the scientific basis for distributing fishing effort seems to be a precautionary one, to reduce any risk associated with fishing too heavily on, as yet, unidentified local gene pools. However, fishers expressed concern that political objectives and recent fishing success also played a role in determining how the quota was distributed among the HFAs.

The mobile gear TAC is not distributed among the HFAs but there are many areas closed to mobile gear fishing and recently a cap of 50% of mobile gear TAC was placed on Chaleurs Bay. Area closures and the cap on harvest in Chaleurs Bay are intended both to reduce conflict among gear types and to force a wider distribution of mobile gear effort. The cap for Chaleurs

Bay coupled with the inability of seiners to catch herring in 4Vn has led seine fishers to fish off northeast PEI, which has precipitated the fishery conflict there. From DFO's perspective, however, having the seine fleet harvest of northeast PEI accomplishes the objective of distributing seine effort across many local spawning populations as the fall herring migrating along the north coast of PEI come from a large number of spawning populations. If a wider distribution of seine fishing effort in the southern Gulf is intended as a conservation measure, DFO needs to articulate a scientifically defensible plan for how seine effort should be distributed. Such a plan would at least legitimize the policy even if it was still unpalatable to inshore fishers. The plan and its scientific basis would also provide a framework for negotiating access for the seine fishers. Better information on the composition of the herring migrating along the north coast of PEI would also strengthen the case for having the seiners fish there. Obtaining such stock composition data would be an expensive and long term undertaking, however. In the short term, synthesizing whatever evidence is available about areas of aggregation and composition of migrating stocks would help.

Although the management regime based on two stock components does not recognize any known or suspected differentiation within spring and fall spawning components, as we have seen, DFO has implemented a number of measures to distribute fishing effort among spawning populations. These measures constitute an acknowledgement that local spawning populations could be overexploited even if genetic stock differentiation is weak. It is well demonstrated that failure to manage for distinct sub-populations in stocks that appear weakly differentiated genetically can lead to loss of local sub-populations and an apparent reduction of population diversity[20]. The presence of sub-populations within a widely distributed stock argues for finer scale, more local management. Although such management may be desirable from an ecological and biodiversity perspective, it requires detailed data on local stocks that are not currently available and assessment technology that has not yet been fully developed for the southern Gulf herring.

The potential that local spawning populations are unique and could be destroyed by excessive local fishing is clearly a dominant concern of inshore fishers. Gulf region science has responded to this with research projects intended to determine if there is any measurable

[20] E.g., Smedbol, R.K., and R. Stephenson. 2001. The importance of managing within-species diversity in cod and herring fisheries of the north-western Atlantic. J. Fish. Biol 59:109-128.

phenotypic differentiation among spawning populations. Both projects focus on otoliths. In one the chemical composition of otoliths from various populations of spring and fall herring is being compared and in the other details of otolith shape are being compared. Preliminary analyses confirm that both kinds of variables will distinguish spring and fall spawners. Analysis has not proceeded far enough to show whether there is any distinction between sub-populations within a stock. Limitations on resources for research are hindering more thorough analysis of these data. Resource limitations have precluded employing other approaches to evaluating stock differentiation and spawning ground fidelity such as tagging and genetic fingerprinting. Tagging projects in collaboration with industry have proceeded elsewhere (e.g., Scotia-Fundy, British Columbia) and opportunities for such collaboration could be explored in the southern Gulf.

Other research projects are exploring the potential for acoustic assessment of the relative abundance of local sub-populations and use of variable mesh gillnets to gather information on recruitment and mesh selection. These projects have been undertaken in collaboration with inshore fishers and illustrate the potential for joint research within the herring fishery. Unfortunately, limitations on staff and resources have precluded thorough analysis of the data collected in these projects. This has been a source of frustration for both DFO staff involved and fishers who have not seen any benefits from the projects.

During consultations a number of additional research needs for herring were identified. These are summarized in Table 2.

The list of research topics in Table 2 reflects the immediate concerns of fishers and managers within the current management regime. All are topics worthy of investigation and it would be easy to add other important topics to the list. For example, in keeping with the policy of DFO to implement ecosystem based management, I would add research to understand better the role of herring in the Gulf of St. Lawrence ecosystem and research on the development of ecological models to assist with management decision making. This research is being pursued under the project, “Comparative Dynamics of Exploited Ecosystems in the Northwest Atlantic (CDEENA, www.osl.gc.ca/cdeena) but has yet to be fully integrated into the management program for either herring or mackerel. Progress in incorporating ecosystem-based management into fisheries has been slow in Canada. One of the stumbling blocks may be the perceived need for a fully-functioning model of the ecosystem. Yet, ecosystem models are only one component

of ecosystem-based management and a great deal can be accomplished with incomplete models employed in an adaptive framework.[21]

Table 2. List of research questions identified in consultations on herring research and management

Research Topic	Projects
Uncertainties in Stock Assessments	1. Assess potential biases in CPUE 2. Determine shape of relationship between CPUE and population size 3. Determine causes of retrospective changes in cohort size estimates 4. Resolve differences between acoustic survey and catch data
Fine Scale Management	1. Initiate pilot projects on fine scale management with fishers by further developing and analyzing the acoustic assessments of local sub-populations and implementing local co-management.
Effects of Fishing	1. Investigate effects of fishing practices on near shore habitats 2. Evaluate the conservation benefits of distributing fishing effort 3. Investigate the causes of herring decline in Escuminac
Herring Ecology	1. Determine conservation reference points for spring and fall stocks 2. Investigate causes of apparent changes in migratory and overwintering behaviour

While some or all of these ideas could form the basis of a future research agenda, it is my view that the research agenda should emerge from the long-term vision for the fishery. This is because the research agenda should be primarily designed to support and facilitate the long-term vision. Until the industry and regulators have come together to agree on the vision, any proposed research agenda must be regarded as preliminary. Furthermore, under the current management

[21] See for example: Christensen, N. 1997. Implementing ecosystem management: Where do we go from here? Chapter 16 in: M. Boyce and A. Haney (ed.) Ecosystem Management. Yale University Press, New Haven, CT. and, Read, A.J. and C.R. Brownstein. 2003. Considering other consumers: fisheries, predators, and Atlantic herring in the Gulf of Maine. Conservation Ecology 7:2 [online] www.consecol.org/vol1/iss1/art2.

regime, budget and personnel limitations severely constrain the number and kind of research projects that can be undertaken. DFO personnel and resources that can be devoted to research on southern Gulf herring have been scaled down to the point that available staff must devote most of their time to maintaining the existing stock assessment program. Until new methods of funding research are identified, little research beyond that which is essential for stock assessment will be undertaken.

In the time available for this review the consultant was not able to gather enough information on mackerel research to provide a detailed review. It appears from the long-term management plan that mackerel research is also directed primarily at providing a credible assessment of stock size and TAC and the Quebec region has even fewer resources to spend on mackerel research than the Gulf region has for herring. The stock size estimate is currently based on egg surveys as insufficient information is gathered from the fishery to calculate a VPA. The long-term plan is to improve data gathering from the fishery but there does not appear to be a specific time table for this. At present, a strong year class has entered the fishery, catches have increased dramatically in the past few years and may now equal or exceed the TAC. There is some urgency to get better information on mackerel. Mackerel is a highly migratory species fished in both Canada and the US. Ultimately, Canada and the US will have to agree on how to share this resource. Canada will need much better data on catch and effort in this fishery to have any leverage in bargaining for a substantial share in the harvest of this transboundary resource. Future catch statistics should include bait and recreational harvests. From the perspective of ecosystem-based management, mackerel represent even greater uncertainties than herring. The mackerel is a highly migratory, fast moving, fast growing species that is transient in the Gulf but also uses the Gulf as a spawning and nursery environment. The role of mackerel in the Gulf ecosystem and how more intensive fisheries for this species might impact on the ecosystem should be priority topics for investigation. Research into the role of mackerel in the Gulf ecosystem is under way but how aggressively it is being pursued and how it will be integrated into management planning is not clear. As with herring, severe limitations in budgets and personnel make it impossible for DFO to carry the full responsibility for such an expanded research agenda on mackerel.

Although it is appropriate to leave the research agenda for these two species open until guidance on priorities can be determined from the long-term vision for the fisheries, certain

measurements should be implemented without delay. For the herring fishery monitoring of the bait fishery should be a priority. A logbook program is being initiated to gather data on the bait fishery and emphasis should be placed on making this program effective as quickly as possible. Herring bait should also become a specific allocation under the TAC but information on the size of the harvest will be needed before an appropriate portion of the TAC can be allocated. For the mackerel fishery, monitoring of both bait and recreational harvests also needs to be initiated. As with herring, efforts are underway to implement a log book program for mackerel bait fisheries. Monitoring the recreational catch is not yet on the agenda. Monitoring recreational harvests is problematic but programs elsewhere to monitor recreational harvests (e.g., recreational mackerel harvests are estimated in the US) could be examined to determine what might work in Canada. A recreational license might have to be implemented as a precursor to making estimates of this harvest. There should be a firm timetable for implementing bait and recreational harvest monitoring and, as with the herring fishery, monitoring of these harvests should be a prelude to making specific quota allocations to bait and recreational harvests.

Recommendations:

1. *Until any new management regime for herring and mackerel is decided, the research agenda should be kept open and tentative so that it can be adapted to fit the needs of the management regime in the most effective and efficient way.*
2. *Recommendation 1 notwithstanding, it appears likely that traditional stock assessments for spring and fall spawning components of herring and for Atlantic mackerel will form the basis of management decision-making for some time to come. With this in mind, high priority should be placed on enhancing the database for herring and mackerel so that all components of harvest are adequately monitored and so that sequential analysis or other VPA methods can be used in mackerel stock assessment.*
3. *Together with enhancing the database for stock assessment, DFO and industry need to determine critical stocks sizes for conservation. Two decision points are needed at a minimum, the stock size below which decision-makers should begin reducing TACs below the F0.1 level as a conservation measure and the stock size below which no fishery should occur except in exceptional circumstances.*

4. *A number of collaborative projects have been undertaken with herring fishers yet resource limitations have delayed the analysis of results and their incorporation into management. It seems unlikely that substantial additional federal resources will be available for research on southern Gulf herring in the foreseeable future. The consultant recommends that DFO explore with fishers and other interests innovative ways to complete the analysis of these results and to fund and implement additional research, of the sorts listed in Table 2, or other high priority research questions that emerge from any new management initiatives. Given the concern within industry about the existence of unique local spawning stocks, emphasis should be placed on ways to address this question.*
5. *Industry supports the need to distribute the herring TACs among fishing areas (HFAs) both as an allocation tool and to distribute fishing effort, but expressed concern that the process for making this distribution was not transparent and did not engage all interests. Decision-makers should ensure a transparent, objective, science based, and mutually agreed process for allocating the spawning stock TACs among the HFAs.*
6. *The legitimacy of the seine fishery appears to be the single most divisive issue effecting southern Gulf herring fisheries. Industry participants together with DFO need to establish transparent, objective and mutually agreed criteria for distributing seine harvest effort across spawning populations. Although this is not specifically a research issue, objections to the seine fishery are typically couched in terms of science issues (e.g., habitat destruction, mortality of small fish, destruction of local stocks). These concerns could become part of the research agenda if that would facilitate agreement on the seine fishery.*
7. *Industry has expressed considerable interest in participating in experiments in local sub-population management and several collaborative projects have been directed at assessing the feasibility of such local scale management. The consultant recommends that DFO and industry take the next step in implementing pilot local scale management so that the techniques of local scale management can be worked out and the capacity for co-management can be established.*
8. *Implementing ecosystem-based management commands high priority in federal fisheries policy yet operational progress in this area has been slow. The consultant encourages*

DFO to place additional priority on developing models for incorporating ecosystem considerations into herring and mackerel management. Given resource limitations within DFO, creative ways of funding this research, including collaboration with industry and universities, will need to be explored.

Task 3. Give particular consideration to conservation and achieving sustainable use of the resource

Species conservation is high priority with southern Gulf managers and neither of the species appears in immediate danger of overfishing. Fall herring appear to be at an all time high abundance. Spring herring have declined in recent years but abundance appears to be stabilizing. More aggressive measures could be adopted to promote recovery of this stock. Mackerel are also at high abundance and a strong year class appears to be recruiting. If, as recent data suggest, catches of mackerel are near or above the TAC, more aggressive management and conservation measures may be required for this species. Additional research and better catch statistics will be needed to support a more aggressive conservation program.

For both species, significant components of catch are not recorded. Herring caught for bait are not recorded and both bait and recreational catch of mackerel are not recorded. Plans are in place to record bait catch for both species through logbook programs. These plans should be implemented without delay so that bait catches can be incorporated into management planning. The bait fishery should also have a specific quota allocation so that it can be incorporated into conservation planning. Methods should also be developed to record recreational harvest of mackerel and this harvest component should also have its quota allocation. Monitoring harvest in a widely dispersed recreational fishery is problematic but it is possible. Implementing a recreational license together with a punch card system and intermittent dock-side monitoring is one possible approach. License fees could be used to develop co-management regimes with recreational fishers and to help support research and management.

A primary concern of inshore herring fishers is the possible loss of local, discrete herring populations to intensive fishing. Current management addresses this concern through

measures to distribute fishing effort in the inshore fishery among the 7 HFAs. The only measure currently in place to distribute seine fishing effort is the 50% cap on harvest in Chaleur Bay. Although the seine fishery nominally targets mixed aggregations of spring and fall herring, inshore fishers are concerned that local spawning populations could be overexploited particularly when the seine fishery operates in shallow water. An acceptable and scientifically defensible regime to distribute seine fishing effort needs to be worked out and this might help reduce tensions in the fishery. In the short term, synthesizing whatever evidence is available about areas of aggregation and composition of migrating stocks would help legitimize various options. A precautionary approach based on first principles could also be delineated. Better information on the composition of the herring migrating along the north coast of PEI might help legitimize the current seine fishery harvest there. Finding ways to ensure that the seine fishery fishes in a number of geographic locations would help defuse the argument that intensive seining is being imposed on a few local areas.

Although there is little evidence of the existence of local populations in the southern Gulf, there has also been little research to identify such populations. There is considerable evidence from elsewhere that sub-populations can exist within widely distributed and apparently weakly differentiated stocks and that these sub-populations can be damaged by excessive fishing regardless of the fishing gear. This evidence argues for prudence in the management of southern Gulf herring to ensure that important sub-populations are not put at risk by intensive fishing by either the inshore or the seine fleet. Population specific harvest planning coupled with well-defined critical population sizes is one way to address this conservation concern. Such fine scale management will inevitably mean finding ways to limit fishing effort on particular spawning populations or sub-populations. At present neither the kind of intensive local information nor the technology of stock assessment that would be needed to implement such a regime exists for the southern Gulf. In the absense of such information and techniques, a system that relies on local knowledge of local herring populations could be implemented to distribute fishing effort away from populations that seem to be in serious decline. The management regime could then incorporate both stock and local sub-population specific rules for curtailing fishing effort in the event of regional or local sub-population declines.

The possibility of any sub-population structure within Atlantic mackerel has received even less research than herring. As exploitation rates for mackerel increase, the need for information on stock structure will become more critical. At present, Canada and the US disagree over even large scale stock structure, Canada recognizing two stocks and the US only one. Agreement at this level will be critical in negotiations over shared harvesting and management of the species as mackerel that spawn in the Gulf of St. Lawrence winter in US waters. Any finer scale stock structure will also have implications for Canadian management of this species.

Although species and stock conservation are management priorities, conservation of ecosystem structure and function has not yet been integrated into management decision-making. There is considerable evidence that the ecosystem of the Gulf of St. Lawrence has changed dramatically in recent decades (collapse of cod and hake, increase in small pelagics, increase in shrimp and crab) yet the implications of these changes for the health of the system and for sustainability of fisheries have only recently become subjects of research. Evidence is accumulating that fisheries can have profound effects on the structure and function of marine ecosystems[22]. Mass balance models of food web interactions in the ecosystems of the western Atlantic are currently being worked out. If the policy of ecosystem based management is to be implemented, greater attention will have to be paid to integrating the results of this research into management. However, ecosystem-based management is much more than developing models of the marine ecosystem and using them in management. It also refers to the integration of ecosystem science with economics and social concerns in a system of sustainable fishery management. The components of ecosystem-based management are well articulated in the recent policy for management of Atlantic fisheries and this document should serve as a guide to implementing ecosystem-based management. Not specifically identified in the policy document, however, is the importance of adaptive management as a tool for addressing uncertainty and facilitating the complex process of

[22] See for example, Jackson, J.B.C. and 18 coauthors. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293:629-638 and, Myers, R. and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. Nature, London, 423:280-283.

integrating ecosystem thinking into management. Numerous publications provide guidance in the use of adaptive management as a tool for ecosystem-based management.[23]

Recommendations:

1. *DFO, in consultation with industry and other affected interests should move quickly to establish critical stock sizes for conservation for both herring and mackerel. At least two trigger points are needed for both species, the stock size below which decision-makers should begin reducing the TAC below the F0.1 level as a precautionary measure to prevent overfishing and the stock size below which no fishing should occur except under exceptional circumstances.*
2. *DFO, in collaboration with industry should ensure that all components of the harvest are recorded and properly sampled so that reliable stock assessments can be conducted. This includes the recreational catch of mackerel.*
3. *Accommodating the seine fleet appears to be the most divisive issue in the herring fishery. DFO in consultation with industry needs to develop a rational plan for distributing seine fishing effort geographically and among stock components.*
4. *The concern among inshore fishers that local stocks could be damaged by intensive fishing is legitimate but this concern applies to all types of fishing not just to seining. Effective and collaborative measures need to be developed that will protect local sub-populations but not unreasonably constrain either the inshore fishery or the seine fleet.*
5. *The structure and dynamics of the southern Gulf ecosystem appear to have changed in recent years increasing the need for research on the ecosystem and for incorporating ecosystem understanding into management decisions. DFO and industry are encouraged to increase the pace at which ecosystem-based management is implemented and to employ adaptive management as a tool for addressing uncertainty.*

[23] See e.g., Walters, C. 1986. Adaptive management of renewable resources. Macmillan Publishers, New York; Johnson, B.L. 1999. The role of adaptive management as an operational approach for resource management agencies. Conservation Ecology 3(2) [online] www.consecol.org/vol3/iss2/art8; Lee, K.N. 1999. Appraising adaptive management. Conservation Ecology 3(2) [online] www.consecol.org/vol3/iss2/art3.

Task 4. Consider ways to develop a more stable and long-term approach to fisheries management through shared stewardship with industry, setting measurable objectives and identifying strategies for protecting the stocks

Defining sustainable management regimes is not the responsibility of this report. However, the research agenda will depend strongly on the kind of management regime that is adopted in the southern Gulf. It appears that there are three primary alternative management regimes that might be considered. The first is simply to continue with the status quo. The recent open conflicts between gillnet and seine fishers in PEI notwithstanding, this regime has functioned reasonably well from a stock conservation perspective. Presumably through negotiation or other means some accommodation could be made for the seiners within the southern Gulf herring fishery that would relieve the recent disruption of the fishery. None of the systemic problems in the fishery is likely to be resolved under the status quo, however, and the simmering resentments would remain likely to boil over at any time. The objective of establishing a sustainable, economically self-sufficient fishery in the modern context would not be achieved by continuing with the current management regime.

The second option is an elaboration of the status quo in which DFO and industry engage in one or more experiments in co-management of local sub-populations. This could be done in collaboration with the MFU community of interest program or negotiated directly with the fishing communities that have been participating in local acoustic surveys of spawning populations. This option would not address the systemic problems with the fishery in any comprehensive way but would allow both DFO and industry to gain experience with co-management. Assuming that a successful co-management regime could be established for some local spawning populations, the participants might also address other issues such as fish quality and more economically efficient forms of quota sharing. This option would involve somewhat greater risks to stock conservation as assessment methodologies would be unproven at the beginning and DFO would have to relinquish significant decision making authority to industry. Creative ways would also have to be explored to fund the pilot co-management projects. Various options could be considered such as a specific quota allocation of herring or other species to fund the projects and cost sharing among industry and federal and provincial governments. As an administrative model for the pilot experiments, organizations along the lines of the BC Herring Conservation and Research Society could be established. This option

could be a good intermediate step toward a truly integrated and economically self-sufficient herring fishery.

The third option would be the implementation of a sustainable, economically self-sufficient regime throughout the southern Gulf. To be sustainable in a modern fishery context implies: having a long-term vision for the role of the fishery ecologically, economically and socially; achieving economic self-sufficiency within the fishery; and integrating management and research into the fishery itself. Challenges to achieving this kind of sustainability in the herring fishery include chronic mistrust and antagonism between fishers from different regions, between fixed and mobile gear types, and between fishers and managers. The challenges include insufficient emphasis on product quality and product value and a willingness among fishers and processors to trade off value against opportunities in other fisheries. And, the challenges include gaps and limitations in knowledge about the ecology of herring that impede a rational analysis of alternative approaches to management. However, these are challenges that must be overcome if the fishery is to address its systemic problems.

The BC herring fishery provides an instructive illustration of how this kind of revolutionary change in management regime can take place. Four critical events in that fishery allowed the present effective regime to emerge. The first was the development of trust and respect among fishers from different gear types and between fishers and managers. Until trust and respect are established among fishers and managers it seems unlikely that significant restructuring of the industry can occur. The second was the implementation of an effective co-management regime with industry in the driver's seat. In BC, a single organization manages the fishery throughout the coast. This may not work in the southern Gulf given the strength of the political and social disagreements in the region. A nested set of co-management institutions may be more workable in the Gulf allowing regional groups to have significant say over the fishery within their region but with a higher level institution managing Gulf wide decisions such as stock assessments, the determination of TAC and the allocation of TAC among more local management units. The third was agreement to use the fishery itself to finance management and research. The BC roe herring fishery generates about $60 million landed value a year so it was possible to finance research and management with a relatively small quota allocation of 6%. The Gulf herring fishery generates much less landed value but it should still be able to make a significant contribution to its own management. And, as product value is increased the fishery

should be in a position to support all of its research and management. Furthermore, the herring fishery is part of a regional multispecies fishery so that creative approaches to financing might include allocations of quota from other species to help support herring management. The fourth event was the agreement to divide quota among licenses. This effectively eliminated the scramble for fish and allowed individual fishers to buy or lease sufficient quota to satisfy their needs. This decision also effectively eliminated the problem of excess capacity and too many licenses. Although Gulf region inshore fishers have expressed opposition to such license based quota systems, fishers from BC who attended the Moncton workshop were of the opinion that this was the single most important change in the BC herring fishery that put them firmly on the path to the present successful system.

Designing and implementing a Gulf wide co-management system will be a contentious process with many potential obstacles along the way. In BC it took industry and government 15 years to work through the problems. However, the benefits in terms of stability and prosperity greatly outweighed the costs in BC and could do so as well in the Gulf. Fortunately, some aspects of the current fishery may ease the transition. Inshore quota is already divided among the 7 HFA's, which will allow local arrangements to be negotiated so that not all regions need to adopt new management measures at the same time. Fall herring stocks appear very healthy so that implementing management measures with somewhat greater risk in the short term will not pose a conservation problem. And the high abundance of this stock component might allow allocation of some quota to pay for experimental fisheries without too great an opposition. Hopefully, as co-management regimes in some areas show their promise, other areas will want to join in and ultimately an economically self-sustaining management regime can be extended throughout the southern Gulf.

Issues around the mackerel fishery at present appear less contentious although any increase in seine fishing activity, even for mackerel, raises concerns in the inshore fishery. The main problems appear to be limited monitoring of harvests, particularly harvests in the commercial inshore fishery, bait fishery and recreational fishery as well as inconsistent sampling for size and age. These shortcomings not only compromise Canada's ability to manage mackerel in a sustainable manner but when the need arises to negotiate shares of this straddling stock with the US, will also put Canada in a weak bargaining position. As the mackerel fishery appears to

have expanded recently it is important to put procedures in place to monitor the catch from all fishery sectors as quickly as possible.

Although the limitations in mackerel research in support of the current management regime can be relatively easily rectified if sufficient resources and personnel are available, these simple changes will only confirm a traditional command and control management system for Gulf mackerel. This may be the time to put in place a co-management system for mackerel that will give it a head start toward a self-sustaining regime.

Accomplishing self-sustaining fisheries for herring and mackerel of the sort described above will not be the final answer as these models do not obviously integrate ecosystem-based management. Self-sustaining single species fisheries are likely to perpetuate the rather narrow research agendas of the recent past. If Canada's fisheries are to retain the flexibility and capacity to adapt to changing ocean conditions and if Canada is to meet its obligations for conservation of marine biodiversity, a broader research agenda must be established. Historically, DFO took much of the responsibility for such research. In the future it may be necessary to form more broadly based collaborative institutions involving government, academia and industry to fund the necessary research. Single species fisheries may need to be nested into larger species groups that make sense ecologically to ensure the appropriate exchange of information and to inform research designs. Economically successful fisheries will have a strong role to play in such endeavors both financially and as partners in research.

Earlier the BC herring fishery was used as an illustration of a successful self-sustaining fishery. This fishery is also illustrative of the kind of relatively narrow research agenda that can accompany such a management regime. The BC herring fishery is not obviously managed in the context of the west coast marine ecosystems in which herring is a critical forage species. By incorporating a concern for ecosystem based management at the outset, southern Gulf herring and mackerel fisheries might avoid this limitation.

<u>Recommendations:</u>

1. *DFO in collaboration with those segments of the industry that wish to participate should design and implement pilot experiments in local scale herring management. These experiments should build on the collaborative research already conducted. The pilot*

projects should be designed to develop the capability for local scale management and the capacity for co-management with industry.

2. *Resource limitation is likely to be a serious impediment to undertaking any experiments with new forms of management and to undertaking the necessary supporting research. DFO, industry and other interests need to explore innovative ways of funding these projects including specific quota allocations for research and management.*
3. *The BC Herring Conservation and Research Society should be examined as one successful model for integrating research and management into the fishery and using quota allocations to cover the costs.*
4. *The long-term goal of management reform in both fisheries should be fisheries that are ecologically sustainable, economically viable and self-sufficient. Achieving this goal will require overcoming chronic mistrust, improving economic performance and delegating authority for most day-to-day management decisions to industry through co-management agreements.*
5. *The evolution of management regimes for the two species must include measures to incorporate the full spectrum of elements in ecosystem-based management. This includes research on species interactions and the ocean environment. To accomplish this, single species fisheries will need to be nested into larger species complexes that make sense in terms of marine community structure and dynamics.*

Task 5. Provide recommendations for improving management of the fishery.

Much of this task has been addressed above. Here particular recommendations will be formulated from the discussion and recommendations in the previous sections. It is worth noting that the herring and mackerel stocks harvested in the southern Gulf are among the largest in the world. They have the potential to generate high quality fishery products that support vibrant and economically prosperous communities of fishers. Yet, these fisheries and their products have to compete in highly competitive and rapidly changing international markets. Management regimes that are inflexible and community practices and traditions that perpetuate conflict and mistrust will not serve the fisheries well. To succeed all components of each fishery need to work together toward a set of commonly agreed and mutually beneficial goals. High quality information the comes from carefully planned research is essential to the success of the fisheries

but good information alone is not sufficient. Even more important are collaborative and adaptable social institutions that have the capacity to identify the kinds of information that are needed, to make good use of the information when it is available and to adjust to changing local and global circumstances. The recommendations below and those presented earlier are offered as a stimulus to developing the necessary capacity to ensure the success of these fisheries.

Recommendations:

1. *Develop the long-term vision for herring and mackerel fisheries as a collaboration among fishers, processors and DFO but with majority voting rights held by industry. Developing trust and respect among components of the industry (gillnet and seine fisheries) and between fishers and managers is an essential step toward implementing a successful co-management regime.*
2. *Establish clear, agreed and measurable goals and objectives for both fisheries and mechanisms for reviewing and updating goals and objectives at reasonable time intervals. Ensure that all components of management and industry understand and agree with the goals and objectives and that each component also understands the role it must play in achieving the goals. This is the foundation of objectives based management.*
3. *Implement catch monitoring for bait and recreational fisheries and make specific quota allocations to these fisheries.*
4. *Define critical stock sizes for conservation that are unequivocal triggers for management action. This will be particularly important in relation to any pilot projects for local co-management so that there is no uncertainty about when conservation will take precedence over continued fishing. In this case, the critical stock sizes will refer to any local sub-populations administered under the co-management regime. All affected parties need to be part of the negotiations about critical stock sizes.*
5. *Initiate radical change in the herring fishery by implementing pilot co-management experiments with industry to develop effective local scale management of herring populations. Initiate a similar process with commercial, bait and recreational fishers in the mackerel fishery.*
6. *Identify innovative ways to finance and staff the pilot projects including allocations of herring or other species quota and cost sharing between industry and federal and*

provincial governments. Creative forms of financing will have to be considered for the mackerel fishery. Resources within DFO are insufficient to carry the responsibility for financing new or even existing management and research regimes. Industry acceptance of financial responsibility will be one of the costs of co-management.

7. *As the co-management system and new approaches to local scale management gain in experience and capacity, implement practices to increase product value and economic efficiency. Increases in product value and economic efficiency will make it easier for the industry to take responsibility for the cost of fishery management.*
8. *The BC herring fishery provides a model of how a successful co-management system could be designed. Key events that led to the BC model included: development of trust and respect among components of industry and between industry and DFO; agreement on institutional design that gave significant authority to industry for decision making; financing of management and research through quota allocation; and division of quota among licenses. In BC the processing industry has also pushed hard to maximize product quality. Fishers expressed concern about implementing licensed based quotas for the southern Gulf. There are other forms of quota allocation, such as community based quotas that may be more attractive in the local context.*
9. *Although the BC herring fishery is a useful model, institutional design will have to be adjusted to take account of the unique social and political circumstances in the Gulf region. A nested set of institutions that give significant authority to local organizational units to manage local populations but with higher levels in the organization dealing with Gulf wide issues such as stock assessment and setting of TACs might work better in the southern Gulf. For herring, the HFAs already define local stock groupings that could be the basis of co-management experiments and agreements. There is no similar regionalization of the herring seiners or the mackerel fishery but this should not deter industry and managers from seeking logical co-management units for these fisheries. Fostering working relationships between herring seiners and inshore fishers will be one of the most significant challenges to revolutionizing the southern Gulf herring fishery.*
10. *The co-management regimes envisioned would take responsibility for research related to their respective species. However, the research agenda must be broader than that needed to satisfy the needs of the individual fisheries. In particular, provision must be*

made to support broad ecosystem research to ensure that fisheries can adapt to changing ocean conditions and to ensure that Canada is able to meet its obligations for conservation of marine biodiversity. In the future, this kind of research should be the responsibility of broad coalitions among government, academia and fisheries. Single species fisheries could be nested into ecologically meaningful groupings to facilitate the necessary research and exchange of information.

11. *Building capacity for resource management decision-making among communities of fishers will be an important part of developing the new management regimes. Pilot co-management experiments will provide one way of developing such capacity but decision-makers will have to develop or take advantage of other means as well. Existing community based groups that have been working with fishers may provide a helpful vehicle for capacity building.*

Fisheries and Oceans Canada

News Release

Appendix 1

Press release and biographies of consultants

NR-G-05-05E **March 17, 2005**

REGAN AND MURPHY ANNOUNCE INITIATIVE TO DEVELOP A LONG-TERM STRATEGY FOR SOUTHERN GULF HERRING AND MACKEREL FISHERIES

Charlottetown – The Honourable Geoff Regan, Minister of Fisheries and Oceans (DFO), and the Honourable Shawn Murphy, Parliamentary Secretary, today announced an initiative to develop a long-term strategy for herring and mackerel fisheries in the southern Gulf of St. Lawrence. The Gulf Small Pelagics Advisory Committee was consulted last December 2004, and supported such an approach.

"It is critical that the year-to-year management of our fisheries resources be guided by a long-term vision of the overall objectives to be set and challenges to be met," said Minister Regan and Mr. Murphy.

Université de Moncton economist Pierre-Marcel Desjardins, former Director of Aquaculture at the University of Prince Edward Island, Robert Johnston, and professor Mike Healey have been appointed to lead the discussions with fishing industry representatives and provincial governments on developing the strategic long-term framework for herring and mackerel fisheries.

Their task will focus on developing approaches aimed at improving future management of the herring and mackerel fisheries and on developing a more stable and long term approach to fisheries management through shared stewardship with industry. Mr. Desjardins will look at improving quality, market diversity, catches by fleet sectors and establishing socio-economic goals such as increasing the overall value of these fisheries.

Mr. Johnston will examine ways and means to achieve sustainable fisheries, identify potential risks to fisheries sustainability and address current issues regarding gear technology and gear selectivity in relation to fish quality. He will also design a road map for promoting shared stewardship between industry and government.

A third aspect of this initiative, to be undertaken by Professor Mike Healey in April 2005, will involve a scientific review of the fisheries and will focus on achieving conservation and sustainable use of the resource. The scientific review will also examine current research

News Release

programs and provide recommendations to DFO regarding the orientation of future research activities.

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News Release

The consultants will not examine access and allocation issues or issues involving conflicts between provinces or fleet sectors. These matters were examined in 2004 and an action plan has already been developed and is being implemented.

Both Mr. Desjardins and Mr. Johnston will begin their work immediately. The consultants will table their preliminary report in March 2005 and submit a final report by April 30, 2005.

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A related backgrounder is also available on the web site below.

For information:

Michel Thérien
Communications Branch
Fisheries and Oceans Canada
Gulf Region
Moncton, N.B.
(506) 851-7704

Internet: http://www.glf.dfo-mpo.gc.ca/comm-comm/nr-cp/index-e.html

B-G-05-05E(a)

Biographical notes - Robert Johnston, Pierre-Marcel Desjardins and Mike Healey

Robert Johnston

Since 2001, Robert Johnston has been involved in research and editorial projects related to fisheries and aquaculture. He was Director of the Canadian Aquaculture Institute from 1994 to 2001, involved in the development and delivery of continuing education programs on aquaculture medicine, fish health and management across Canada, and around the world. He conducted projects in New Zealand, Australia, Malaysia, Thailand, Iceland, Chile, Brazil, and the United States.

He started his career in 1966 as a high school teacher in Charlottetown, PEI. He holds a Bachelor of Arts degree from St. Dunstan's University in Charlottetown and a Masters of Adult Education degree from the University of Toronto.

Robert Johnston was DFO's Area Director for PEI from 1983 to 1994. Prior to joining the Department he was Senior Policy Advisor for the Federal Department of State for Economic and Regional Development in PEI. From 1975 to 1981 he worked with the Federal Department of Regional Economic Expansion. He also worked with the Federal Department of Manpower and Immigration from 1967 to 1969.

Pierre Marcel Desjardins

Pierre-Marcel Desjardins became Associate Director of the Canadian Institute for Research on Regional Development on July 1, 2003. His current research projects focus on regional and rural economic development, public policy, fiscal federalism and trade. He has been called upon by governments of Canada and New Brunswick to work on studies pertaining to economic development.

He held the *Chaire des caisses populaires acadiennes en études coopératives* from 1996 to 2001. From 1990 to 1996 and from 2001 to 2003, he was research associate at that Institute. He taught economics at the Université de Moncton from 1990 to 2003.

Pierre-Marcel Desjardins holds a Ph.D. in economics from the University of Texas. He received his Bachelor and Master's degrees in Economics from the Université de Moncton.

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Appendix 2

TERMS OF REFERENCE

LONG TERM VISION FOR THE HERRING AND MACKEREL FISHERIES IN THE SOUTHERN GULF OF ST. LAWRENCE

A. INTRODUCTION

Following a consultation with the herring and mackerel fisheries stakeholders at the Gulf Small Pelagics Advisory committee meeting of December 1-2, 2004, DFO has decided to hire consultants to assist DFO and industry in developing a long-term vision for the Southern Gulf herring and mackerel fisheries including the validation/identification of; Fishery objectives important to both industry and DFO; Key threats and challenges impacting on the objectives; Performance indicators to determine progression in relation to objectives and the Potential strategies to attain the objectives.

The purpose of this initiative is to establish an independent process that will enable the stakeholders to define their goals and objectives in relation to the southern Gulf of St. Lawrence herring and mackerel fisheries.

The establishment of objectives is considered an essential element in helping resolve issues surrounding these fisheries as well as establishing a more cohesive direction for the industry to ensure sustainable use of these resources as well as to respond to market trends.

B. BACKGROUND

The annual meeting of the Department of Fisheries and Oceans' (DFO) Gulf Small Pelagics Advisory Committee is the usual forum for discussions of herring and mackerel issues in the southern Gulf of St. Lawrence. Its main purpose is:

a) To obtain input and seek consensus on elements for the preparation and approval of a new multi-year herring management plan for the southern Gulf of St. Lawrence (4T stock) and;

b) To solicit the opinions of industry on past regional management practices and on proposed management measures for the 2005 Gulf mackerel fishery as a component of the existing Atlantic Mackerel Management Plan.

For more detailed background information and ongoing issues for the southern Gulf herring and mackerel fisheries, please refer to Annex I.

C. OBJECTIVES

1. To develop with stakeholders a vision for the future of the Southern Gulf Herring and Mackerel fisheries with a special focus on sustainability of the resources and the viability of the industry by concentrating on the value of the fishery and not the volume of the harvest.

2. To develop a more stable and long term approach to fisheries management by incorporating elements which reflect:

    a) the precautionary approach,

    b) the concept of Objectives Based Fisheries Management (OBFM), and

    c) relevant ecosystem considerations.

3. To engage the fishing industry and provinces by encouraging the parties to precisely define their ideas, concerns and issues as well as their recommendations in support of the aforementioned objectives.

4. To identify areas of consensus between the parties and to offer options that could be considered for resolving differences.

D. SCOPE

1. The consultant(s) will focus his/their activities on consulting with DFO, stakeholders and provinces to assist DFO and industry in developing a long-term vision for the Southern Gulf herring and mackerel fisheries consistent with the Precautionary Approach (PA), the concept of Objectives Based Fisheries Management (OBFM), and any relevant ecosystem considerations.

2. With respect to the southern Gulf herring fishery, the long-term vision will apply to fleets in Québec, New Brunswick, Prince Edward Island, Gulf Nova Scotia and Newfoundland with access to the southern Gulf. The assigned work is to be consistent with access/quota sharing arrangements already in place between the two Gulf large seiner fleet sectors, and with an anticipated forthcoming decision on sharing arrangements within the inshore herring fleet sectors. The long-term vision will be applicable to fleets in their authorized fishing areas (Herring: Inshore-HFA 16A-G, Large seiners-Area 13, 14, 15, 16 and 17); Mackerel: Inshore-Area 16, Large seiners-Area 12, 13, 14, 15 and 16).

3. The consultant's approach to mackerel is to move forward within the scope of the current Atlantic Mackerel Management Plan. The long-term vision for mackerel is intended to

be a separate document to guide the industry in the southern Gulf. The long-term vision is not intended to be incorporated into the current Atlantic Mackerel Management Plan. This long-term vision could, however, serve as a benchmark for any future work involving the whole mackerel industry should a decision be taken to consider broader issues.

4. Consultations with DFO, stakeholders and the provinces will include validation and identification of objectives important to industry and DFO, key threats and challenges impacting on the objectives, performance indicators to measure progress in relation to objectives, and potential strategies to attain the objectives.

5. The consultant(s) will not undertake new scientific, socio-economical or fishery related research, but will instead rely on existing research and reports.

6. The vision should be consistent with principles such as establishing more transparent rules-based decision-making, multi-year plans focused on conservation and risk management, and stable long-term sharing arrangements. Under this framework, options and recommendations regarding fleet viability and healthy fish resources must be well thought out.

7. As fish quality would benefit all in the industry, close attention should be given to the two-year pilot project undertaken by the Centre de Recherche et de Dévelopement des Produits Marins in Shippagan. Allister Surette, in his report, pointed out that attention should be given to this project for two reasons; one, the results of the research and development project regarding fish quality and optimum use of the herring, and two, the process being used to involve various parties of this industry (Round Table and Sectorial Table) and whether this structure could be used by the industry to discuss other matters of interest.

Precautionary Approach (PA)

1. The PA is a concept which requires that:

    - Stock conservation, environmental and ecosystem considerations, as well as the socio-economic performance of the fishery be given due consideration in managing the fishery;

    - Unacceptable outcomes, such as stock collapse, be identified;

    - Strategies to achieve objectives while avoiding unacceptable outcomes be duly considered at an early stage;

    - Uncertainties be taken into account and mitigated; and

    - Greater caution be exercised when knowledge is less complete or less reliable.

Objectives Based Fisheries Management (OBFM)

1. The role of Resource Management is to implement, in partnership with industry, plans, policies and programs to protect the stocks in order to assure future abundance and provide for the fair allocation and distribution of harvestable surpluses among those dependent on the resource.

2. The OBFM is a concept that has been developed to guide the development of new Integrated Fisheries Management Plans for a fishery. This concept will be introduced gradually in all fisheries of the southern Gulf of St. Lawrence.

3. The OBFM attempts to:

    a) Improve conservation, ecosystem and fisheries management with explicit measurable goal;

    b) Clarify the roles of Stakeholders, Science and Fisheries Management;

    c) Measure the management of a fishery through performances objectives;

    d) Assess or manage all risks associated with achieving the objectives; and

    e) Fully consider the Precautionary Approach and ecosystem management in the development of fisheries management plans

E. METHODOLOGY / APPROACH

1. The work in support of the long-term vision will involve three distinct elements that will be dealt with simultaneously by different consultants.

2. Element 1 will deal with the scientific aspects of the herring and mackerel fisheries including conservation and ecosystem objectives with a special focus on, but not limited to, improving the fisheries by conducting a critical review of the current research programs and providing recommendations to DFO in regards to the orientation of future research activities. The scientific portion of the long- term vision will focus primarily on conservation and achieving sustainable use of the resource, on developing a more stable and long term approach to fisheries management through shared stewardship with industry, and in setting measurable objectives and identifying strategies towards protecting the stocks and provide recommendation aimed at improving management of the fishery.

3. Element 2 will examine the socio-economic aspects of the herring and mackerel fisheries including Fisheries Management objectives with a special focus on, but not limited to, improving the quality and value of the products, market diversity, and catches by all fleet sectors for areas where their licences are valid. The socio-economical portion of the long-term vision will focus primarily on developing a more stable and long term approach to

fisheries management through shared stewardship with industry in setting measurable objectives and identifying strategies towards improving quality, markets diversity, establishing socio-economic goals (such as increasing the overall value of these fisheries) and provide recommendation aimed at improving management of the fishery,

4. Element 3 will examine ways and means to achieve a sustainable fisheries, identify potential risks to fisheries sustainability, address current issues regarding gear technology, gear selectivity and fish quality, design a road map for promoting shared stewardship between industry and government and provide recommendation aimed at improving fisheries management.

5. The consultants will be required to meet with representatives of the following primary parties (considered as "core") in carrying out their duties:

Fishers' Associations

Maritimes Fishermen's Union,

Prince Edward Island Fishermen's Association (PEIFA),

Association des Pêcheurs Propriétaires des Îles de la Madeleine (APPIM),

Regroupement des Pêcheurs Professionnels du Sud de la Gaspésie (RPPSG),

Regroupement des Pêcheurs Professionnels du Nord de la Gaspésie (RPPNG),

Gulf Nova Scotia Herring Federation (GNSHF)

Gulf Nova Scotia Fishermen's Association (GNSFA)

Gulf Nova Scotia Bonafide Fishermen's Association (GNSBFA)

Fédération Régional Acadienne des Pêcheurs Professionnels (FRAPP)

Association des senneurs du Golfe (ASG)

Newfoundland large seiners representatives

First Nations

Provincial Governments

NS Department of Agriculture, Fisheries and Aquaculture (NSDAFA)

Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ),

Newfoundland Department of Fisheries

NB Department of Agriculture, Fisheries and Aquaculture (NBDAFA), and

PEI Department of Fisheries, Aquaculture and Forestry (PEIDFAF)

Seafood Processors

Representatives groups of seafood processors in each of the provinces of Newfoundland, New Brunswick, Nova Scotia and Prince Edward Island

Association Québécoise de l'Industrie de la Pêche (AQIP)

Non-Gouvernemental Organisation

Centre de Recherche et de Développement des Produits Marins (CRDPM)

6. The consultants may consult other interests which they feel may contribute to a proper understanding of the issues and conduct of the required work.

7. The consultants will carry out interviews, obtain and examine relevant documents and information to identify and describe the views of the representatives.

8. The consultants will organize meetings with the primary parties either individually, collectively or both at their discretion and likewise, with DFO staff.

9. The consultants will have access, as required and subject to Access to Information and Privacy Acts, to DFO documentation and DFO personnel when seeking information on the southern Gulf of St. Lawrence herring and mackerel fisheries.

10. The Department's Gulf Region will provide assistance for the work, including coordination for the production of report, assigning experienced technical staff to undertake documentary research which may be required by the consultants as well as to respond to requests for information.

11. The consultants will prepare and submit a report to the Minister of Fisheries and Oceans on the long-term vision for the herring and mackerel fisheries of the southern Gulf of St. Lawrence.

12. The above written report to the Minister will also be provided to the primary parties, in both official languages.

13. The consultants may speak to the media on the process being used to scope out the long-term vision in the herring and mackerel fisheries.

F. TIMEFRAME

1. The consultants' activities will commence on February 17, 2005, and conclude by April 30, 2005. A preliminary report to the Minister must be completed by March 31, 2005, with a final report submitted no later than April 30, 2005.

G. CONSIDERATIONS

1. The need to clearly articulate the perspectives of all parties.

2. Obtaining the most readily available published information related to ideas, issues and concerns raised by all parties.

3. The need to identify possible gaps of information that would be helpful in addressing the concerns and issues of the various parties.

4. The need to articulate an overall perspective on the long-term vision.

ANNEX I

ADDITIONAL BACKGROUND INFORMATION AND ONGOING ISSUES FOR THE SOUTHERN GULF HERRING AND MACKEREL FISHERIES

Southern Gulf Herring fishery

1. The multi-year integrated fishery management plan (2000-2003) for the southern Gulf herring fishery (4T stock) ended on December 31, 2003 and was rolled over in 2004 with minor adjustment on access and allocation issues. The roll-over included:

    a) A temporary allocation of 29.82% to HFA 16D (Magdalen Islands) in the spring of which 20.28% was risk-managed within the 2004 spring TAC and;

    b) A modification of the temporary inshore fall quota transfer process by allocating equally 2,356 t to be risk-managed to requesting HFA's before the start of the fishery. HFA 16B, 16C&E, 16F and 16G received an equal amount each.

2. The management of the southern Gulf herring fishery is based on a strategy which promotes sustainability (in this case, $F_{0.1}$ level). DFO Science provides the $F_{0.1}$ level following the Regional Advisory Process (RAP) currently held at the end of March. A decision on the upcoming fishery TAC level, set at or below the $F_{0.1}$ value, is based on the results of the RAP and on consultations with industry after the RAP.

3. Over the past number of years, there have been disagreements between inshore fishers and the seiner fleet over the conduct and potential impacts on the fishery by seiner vessels. Proximity to the shoreline by the seiners is the most recent contentious issue in NB, Gaspé and PEI.

4. A facilitator, Mr. Allister Surette, was hired to meet with all parties to ascertain the facts and perceptions in the herring dispute between the seiner and inshore fleets. His report, tabled in February 2004, identified six issues as being central to the dispute: Exclusion zones as being the most divisive issue, more science and improved mechanisms for communicating and discussing science, the possible negative impact of purse seining activity on lobster habitat and possible negative impact of lost gillnets on habitat, estimation of unaccounted herring mortality by both fishing gears, lack of knowledge regarding mixing of various local herring aggregations and their migration route, lack of trust in DFO management, enforcement and science.

5. A summary of potential monitoring activities and scientific studies as well as possible transition management measures to help resolve the conflict were developed and discussed with industry and Provincial representatives in 2004. The total project cost is estimated at 700K. The parties agreed that Science work was important to address the issues raised in the Surette Report. Funding sources remain to be confirmed

6. There is an emerging concern about quality and histamine content of herring caught in the inshore (gillnet) fishery in the Southern Gulf of St. Lawrence. Histamine is produced during the decomposition process of fish and can be harmful to humans. Canadian and foreign

inspection agencies monitor the levels of histamine in herring. The roe and flesh markets of herring caught by inshore fishers may be severely affected in the short term if herring quality issues persist.

7. Historical inshore quota shares between Herring Fishing Areas (HFA) is the other major issue that has been disruptive within the inshore herring fishery over the past 6 years. This includes the contentious issue of the spring quota share for the Magdalen Islands and fall quota transfers of uncaught quota near season end. While the overall TAC is determined using scientific analysis, there is currently no objective method to determine how the TAC should be divided based on local abundance. Work in this area is on-going.

8. DFO will attempt to obtain a consensus amongst the various inshore groups on a new approach for sharing the inshore quota. In the absence of a consensus amongst the industry, DFO will provide its own recommendations to the Minister by end of February 2005.

Southern Gulf Mackerel fishery

1. The Atlantic Mackerel Integrated Fisheries Management Plan is an Atlantic plan ending in 2006 involving fishers from the Maritimes, Gulf, Québec and Newfoundland Regions. Regional management measures for the coming season's fishery are discussed during annual regional consultations on small pelagics.

2. The abundance of mackerel spawning in the Gulf of St. Lawrence is currently estimated on the basis of egg survey data. Egg surveys are carried out annually and consist in collecting egg and larvae samples at regularly distributed stations using plankton nets. The number of eggs found at each station is extrapolated for the entire area samples to obtain daily annual egg productions. The figures are converted to reproductive biomass data by taking into account the biological characteristics of the females.

3. The TAC for Atlantic mackerel was reduced from 100,000t to 75,000t in 2002 following Canada's scientific advice. Catches in the mackerel fishery are under reported. Annual recorded landings for the almost 17,000 licence holders have only been about one-fifth of the TAC since the 1990s. However, in 2003 total recorded landings by Canadian provinces were about 45,000 t. Total recorded mackerel landings from all source (American and Canadian) in 2003 was about 76,000 t. An increased incidence of small, unmarketable mackerel in catches has curtailed fishing activity for this species and those fishers who are active. Small mackerel caught by hand lines and mechanical devices in particular are discarded and raises concerns (uncertain mortality rate).

4. An increase in abundance was forecast for 2003 given the predominance of the 1999 year-class in the catches and the fact that these fish were all mature in 2003. However, a lower abundance was measured in 2003 and may be attributable to the presence of the 1999 year-class alone in the stock and/or to the very unusual oceanographic conditions encountered during the survey (very cold water was observed as a significant reduction of the spawning area). Given this uncertainty, the TAC was maintained at 75,000 t for 2004.

5. The TAC is divided between the traditional inshore fisheries (60%) and the exploratory mobile gear fishery (40%). This sharing formula has been in place for many years and was decided following consultations with stakeholders during various Atlantic Mackerel Advisory Committee meetings. Landings in the Atlantic Provinces have averaged 20,000 t in the last 10 years of which about 15,000 t (75%) was landed in the Gulf of St. Lawrence (Area 4RST). Of this amount, about 8000 t were harvested in the Southern Gulf of St. Lawrence (4T). The large seiners have had more success during the last three years in catching mackerel on the west coast of NFLD. Despite the importance of the landings in 2003, only 49% of their quota was caught.

6. The southern Gulf mackerel industry would like to see further development of the mackerel fishery (increasing landings) and improvement of markets. The international market is for large mackerel. Processors have indicated that exports are not well developed. There is potential for additional market penetration but regular supply and improvement in price is needed. Quality of mackerel has been raised as an obstacle to improvement of the mackerel fishery and increases in landings. Mackerel is more prone to oxidation because of its high fat content compared to other small pelagics. Mackerel is presently mainly sold for bait purposes and the outlook suggests that it will remain like that in the next few years unless there are concerted efforts to change this.

7. Improvement of catch statistics in the mackerel fishery has been identified as an important element towards improving the stock assessment process, determining more precisely where are landings in reference to the TAC and to ensure a fair share of the quota if international shares are renegotiated with the USA. Currently there are no self reporting of catches other than sale slips filled by fish buyers and logbooks submitted by large seiners.

8. The Atlantic mackerel observed in Canadian waters during the summer and fall migrate to the coast of Maine (USA) during the winter where it may mix with another more southerly mackerel stock and is fished extensively. The extent of mixing in the American catches is unknown. Scientists in the USA have been conducting their own stock assessment on this same stock using Canadian and American landings catch data. (In fact the American considers these two stocks as one stock in their assessment). DFO and industry have serious preoccupations with the way the USA stock assessment is carried out. This assessment may lead to unrealistic high biomass and jeopardize conservation of the species. In order to improve the stock assessment and reach an agreement between Canada and USA on what the Mackerel biomass should be, it was suggested by stakeholders that discussions be initiated between scientists from Canada and USA in an open process with industry.

Mike Healey

Mike Healey is recognized internationally as an expert in the ecology of Pacific salmon and as an expert in the design of resource management systems. He has served as a consultant to government and industry in Canada, the United States and Asia on the management of fish and fish habitat and on restoration of aquatic ecosystems. For the past eight years he has been an advisor on ecosystem restoration to the CALFED Bay-Delta program in California. He is the author of more than 200 articles and books on fisheries, ecology and resource management.

Professor Healey was a scientist with the federal government from 1970 to 1990. He worked at the Winnipeg Freshwater Institute from 1970 to 1974 where he conducted research on ecology and management of freshwater fishes in Canada's north. In 1974, he worked at the Pacific Biological Station in Nanaimo where he conducted research on the ecology and management of Pacific salmon. In 1990, he joined the University of British Columbia (UBC) as Director of the Westwater Research Centre, a multidisciplinary centre devoted to research and policy analysis of issues related to water.

Mike Healey received Bachelor of Science and Master of Science degrees from UBC in 1964 and 1966, and his Doctorate from the University of Aberdeen, Scotland in 1969.

Internet: http://www.glf.dfo-mpo.gc.ca/comm-comm/nr-cp/index-e.html

March 2005

Appendix 3
Workshop Agenda And Participants

Workshop - Long term vision for the herring and mackerel fisheries in the southern Gulf of St. Lawrence

Tuesday, 19 April 2005	**Topics**	**Lead**
09:00-09:10 AM	Welcome and introduction of Dr. Michael Healey	Mike Chadwick
09:10-09:30 AM	Purpose and format of workshop. The five questions: 1. Is the scale of the current stock assessment and advice sufficient to ensure conservation of the herring resource in the southern Gulf? 2. Does Gulf DFO Science have adequate capacity both in terms of resources and expertise to provide the advice expected by DFO and the industry? 3. What are the approaches used in other parts of the world that would improve the assessment of the southern Gulf of St. Lawrence herring stocks? 4. Is lack of scientific knowledge the main stumbling block in developing a long-term management plan satisfactory to all stakeholders for southern Gulf herring? Are other factors more important? 5. In the context of refocusing stock assessment announced in the last budget, is it possible to transfer part of the assessment of this resource to industry?	Mike Healey
09:30-10:15 AM	Uncertainties in the stock assessment and current research priorities	Ghislain Chouinard
10:15-10:30 AM	Break	
10:30-12:00 AM	Discussions of the five questions within roundtables	All
12:00-13:00 PM	Lunch	
13:00-15:00 PM	Roundtables present their responses to the five questions in plenary	Mike Healey
15:00-15:15 PM	Break	
15:15-17:00 PM	Are there other scientific issues for herring and mackerel research in the southern Gulf?	Mike Healey

Wednesday, 20 April 2005	**Topics**	**Lead**
09:00-09:30 AM	Plenary discussion of the conclusions from Day 1	Mike Healey
09:30-10:00 AM	An example of potential fine-scale assessments	Ross Claytor
10:00-10:15 AM	Break	
10:15-11:00 AM	Any changes to the research priorities for southern Gulf herring?	Mike Healey
11:00-12:00 AM	Recap, review, next steps and communications plan	Mike Healey
12:00-13:00 PM	Lunch	
13:00-13:10 PM	Opening statement and presentation of the group from BC	Alain Hébert
13:10-14:00 PM	Roe herring fishery in BC • Overview of Herring Biology and Stock assessment • Precautionary approach in the BC roe fishery • Overview of management method and strategy • Co-management inshore/seiners/processor • Communication amongst stakeholders a key element • Funding of herring research in BC • Quality in relation to gear and management measures	Dennis Chalmers
14:00-15:00 PM	Panel with seiner, gillnetter and processor from the BC roe herring fishery • Individual perspective of the BC roe fishery dynamics • Floor open for question and comments	Processor - To Be Determined, Bob Rezansoff seiner/gillnetter Don Herron gillnetter
15:00-15:15 PM	Break	
15:15-17:00 PM	Plenary session and roll-up of workshop	Mike Healey

Participants in the 2 day workshop:

Participants in the Workshop on Herring and Mackerel
Howard Johnston Hotel, Moncton, NB
19 and 20 April, 2005

Table 1	Table 2
Dennis Chalmers BC Alain Hébert P&O Ed Frenette PEIFA ShelleY Boertien WES Louis-Marie Gionet Bryce Hornbrook (Producteur NB)	Bob Rezarsoff BC Fernand Friolet ASG Mike Healey Consultant Dave Crawford GNS Dave MacEwen Province IPE Rod Morin P&O
Table 3	Table 4
Don Herm BC Romeo Cormier Producteur NB Ron Caissie PEIFA Olin Gregan Barry's Group Paul Cormier Province NB Mike Chadwick P&O Bob Johnston Consultant	Marc Lecouffe P&O Terry Carter PEIFA Ghislain Chouinard P&O Noella Richard P&O Michel Gauvin Producteur NB George Sanipass Abor
Tabel 5	Table 6
Sylvain Poirier Claire MacDonald P&O Hlx Rachel-Josée Chiasson FRAPP Jamie Ellsworth PEIFA Sara Roach-Lewis WES Doug Swan P&O	Eda Roussel ASG Jean-Maurice Coutu P&O Ott Annie Ferguson Province NB Colin MacDonald Ocean Choice Gloria Poirier P&O Paul-Aimé Mallet UPM
Table 7	
Ronnie Heighton Francois Beaudin UPM< Pierre-Marcel Desjardins Consultant Réginald Comeau UPM Daniel Landry Leon Sock Abor Tom Hulbut P&O Michel Albert P&O Rhéal Vienneau P&O Sandra Gaudet P&O	

Participants in the Meeting with Federation Regionale Acadienne des Percheurs Professionnels (FRAPP), April 20, 2005

Fernand Friolet, President
Rachel Josee Chiasson, Executive Director
Eda Roussel, Responsible for the seiners association
Daniel Landry, Councilor for the crewmembers association
Romeo Cormier, Processor

Participants in the Meeting with PEIFA and WES in Souris, PEI, April 21, 2005.

Sara Roach-Lewis: WES
Chuck White: President SKQFA
Karl Clement: SKQFA
Peter Baestien: E.K. Fish Assoc.
Shelley Boertien:
Sharon McMillon:
Jamie Bruce: President EKFA
Michael MacDonald: EKFA (Herring advisory board)
Mark Rose: EKFA
Ed Frenette: PEIFA
Fred Piegott: WSFA
Ken Drake: VP Easter Kings FA
Allen McPhee: Local businessman