Spring Meeting
15 - 19 April 1996
Regional Advisory Process (RAP)
of the Maritimes Region

6th Floor Boardroom
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Quote of the Meeting: "That's the crumbs after the party is over" - P. Shelton

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Abstract

These Proceedings record the discussions held during the spring 1996 Regional Advisory Process (RAP) meeting held at BIO during 15 - 19 April 1996. It outlines the main points of discussion, problem areas in the analyses and recommendations for further work. Stock Status Reports for the species considered were produced and subsequently submitted to DFO Ottawa for approval.

Résumé

Le présent document rend compte des discussions ayant eu lieu durant les réunions tenues du 15 au 19 avril 1996 dans le cadre du Processus de consultation régional du printemps 1996. Il fait état des grands sujets débattus, des problèmes survenus dans les analyses et de recommandations pour les travaux futurs. Des rapports sur l'état des stocks des espèces considérées ont été produits et ultérieurement soumis â l'approbation des instances du MPO à Ottawa.

Introduction

Since the disbandment of the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) in the fall of 1992, stock assessments have been peer reviewed in regionally-established bodies in a process termed the Regional Advisory Process (RAP). In 1995, the RAP in the DFO Scotia-Fundy Region consisted of:

- Working Groups on Ecosystem Issues, Management Issues and Stock Assessments
- Plenary Session
- Public Session

It was intended that the stock assessment working groups would replace the peer review that CAFSAC used to provide. However, not all sites followed this model and peer review was uneven in quality. In a post-mortem of the process, there was a general consensus that peer review needs to be held above the working group level. Therefore the 1996 process consisted of the following:

- Working Groups on Ecosystem and Management Issues as before. The results of these groups would be peer reviewed at Zonal Committees such as Fisheries Oceanography and Sampling, Surveys and Statistics.
- Creation of Stock Assessment Teams to Compile the assessment documents. These would provide a means to foster multidisciplinary teamwork on the assessments, but not provide peer review per se.
- Creation of three Subcommittees to provide peer review of the results of the assessment teams. These subcommittees were site based with the majority of reviews being conducted within a specific area of the ocean. The three subcommittees were 1) Gulf of Maine based at the St. Andrew's Biological Station (SABS), 2) Scotian Shelf based at the Bedford Institute of Oceanography (BIO), and 3) the Gulf of St. Lawrence, based at the Gulf Fisheries Center (GFC).
- Creation of a RAP Steering Committee to provide coordination and editorial functions.

Appendix 1 provides a schedule of the stock assessments to be conducted by the Scotian Shelf Subcommittee in 1996. This document summarizes the discussions held during 15 - 19 April at the spring meeting of the Scotian Shelf Subcommittee. In comparing the schedule with the agenda (Appendix 2), it will be seen that not all stocks were tabled for peer review at the spring meeting. In the interests of time, those stocks for which the information base is limited (Appendix 3) were reviewed by one external examiner. It was the responsibility of the author to address any issues raised. It will also be noted that the Scotian Shelf Subcommittee was not scheduled to review the scallop resources. There was not enough time to do these at the Gulf of Maine Subcommittee meeting during 9 - 12 April and thus they were reviewed at BIO.

The meeting was well attended (Appendix 4) by DFO, industry and university participants. A number of participants were specifically invited to provided external peer review.

This report does not provide the details of the assessments that were reviewed. These are available in the Atlantic Fisheries Research Document Series, which were based on the working papers tabled at the meeting (Appendix 5). The draft Stock Status Reports (SSR) produced by this meeting were reviewed by the RAP Steering Committee on 25 - 26 April 1996 and submitted to DFO Ottawa for approval before being publically released. The intent of these proceedings is to record the business of the meeting, including participation, agendas, main points of discussion, and any issues raised that may need further analyses.

The meeting was chaired by R. O'Boyle, who opened the meeting with welcoming comments, and an overview of the RAP process, the objectives of the meeting and an outline of the agenda. It was pointed out that the presentations given in the Overviews on the first morning were of issues which had already received peer review in other fora, such as the Statistics, Sampling and Surveys Committee. As such, they were being made as background for the assessments. Assessment team minutes for cod/haddock, flatfish and silver hake are attached as Appendix 6.

Overviews

Ocean Climate Trends (Rapporteur: K. Drinkwater)

K. Drinkwater made a presentation on the state of the physical oceanographic environment during 1995. Meteorological, sea ice and hydrological conditions were discussed for the Scotian Shelf and Gulf of Maine. After a description of the general temperature and salinity distributions in the regions, the long-term temperature trends for different areas of the Shelf and Gulf were reviewed. This was followed by a description of the 1995 conditions. Of particular note was the continuation of the relatively cold waters on the northeastern Scotian Shelf which have persisted for the past decade. The source of this water is believed to be primarily advected from the Gulf of St. Lawrence or southern Newfoundland. In contrast, warmer-than-normal waters occupied the deep basins of the Gulf of Maine and in Emerald Basin on the Scotian Shelf. This warm water has occupied these deep areas the past several years and originates from offshore slope waters.

A question arose as to why the waters in the deep basins do not cool down given that once they enter the basins they would mix with the cooler shelf waters. The mixing processes are slow, especially near bottom, which would tend to act to maintain the warm temperatures. Also, there may be a frequent or regular influx of warm slope waters into the basins to maintain the warm temperatures. Another question was why the slope waters were warmer-than-normal. The cause of this is unclear but may be related to either reduced Labrador Current flow (cold water) into the Slope water region or to the more northward position of the Gulf Stream or both. Several people wished to know when the waters in the northeastern Scotian Shelf could be expected to warm up. Based upon the variability in the temperature records, it is expected that conditions should begin to moderate over the next few years. Exact timing of significant warming will dependent upon atmospheric conditions in the Gulf of St. Lawrence and the strength of flows from the Gulf and the southern Newfoundland shelf.

Phyto and Zooplankton Trends (Rapporteur: R. O'Boyle)

D. Sameoto summarized the most recent analysis of phyto and zooplankton trends for the Canadian Atlantic Coast. The information was of particular interest this year, as there is a proposal submitted to DFO to initiate a 1,000 t harvest of krill in the Emerald Basin and Gully areas. During the question period after the presentation, questions were raised on the potential by-catch in this small mesh krill fishery. It was replied that there are krill fisheries in Europe which could be useful in determining the most appropriate gear. Also, the krill fisheries in the Pacific Ocean have been profitable and have not generally experienced by-catch problems. It was mentioned that there is estimated to be about 10 - 40,000 t of krill in the proposed fishing area.

Questions were raised as to the link between fish recruitment and zooplankton. There is a connection, but it is hard to describe due to the many factors that influence fish growth and survival. At the very least, these linkages should be investigated taking the appropriate time lags into account. During this discussion, it was mentioned that a substantial amount of data on larval sand lance abundance exists for the Sable Island area. This could be of use to other researchers of the Scotian Shelf ecosystem.

- The discussion ended with a general acknowledgement of the value of this work and a **recommendation** that next year's meeting allow more time for this work.

Finfish Community Trends (Rapporteur: R. O'Boyle)

Over the past few years, DFO scientists have been endeavouring to understand some of the larger changes in the Atlantic ecosystems. Kees Zwanenburg provided a summary of the work to date for the Gulf of St. Lawrence and Scotian Shelf. This included observations on both the original and catchability-corrected survey data.

This presentation raised much interest and many questions. The latter mostly had to do with the need to correct the survey data for both size and species - specific catchability differences. Until this was done, many of the conclusions would be suspect. However, given this, it was acknowledged that this work was important and that it should be extended to include biomass estimates from the survey, corrected for catchability as well as biomass estimates for

those resources which have VPAs or equivalent. It was noted that some of the previous work by Dickie on size spectra may be useful.

- The session ended with a **recommendation** that the Fisheries Oceanography Committee (FOC) to provide a forum for further examination and extension of this work.

Effort Trends (Rapporteur: R. O'Boyle)

R. O'Boyle gave a presentation of the results of the Effort Trends Working Group, which was chaired by Stratis Gavaris. During the question period, few comments were made on the trends, which generally showed that recent fishery closures have substantially reduced effort.

- **It was recommended** that the data used to describe the trends should be made available to the individual stock assessments to facilitate comparision with the fishing mortality trends.

Groundfish

4X Haddock (Rapporteur: K. Zwanenburg)

P. Hurley presented the results of the Cod/Haddock working group on 4X haddock. After this was completed, questions were entertained on each section of the report.

The Fishery

Questions were raised about the incidence of dumping and discarding in the recent fishery. Some industry participants noted that there may be some problems with the small, unobserved, boats. The catch and sampling information from the larger unobserved and observed vessels was similar, tending to indicate that dumping and discarding was not a large problem. It was noted that evidence of discarding could be sought in a systematic analysis of the sampling data.

- It was **recommended** that an analysis of discarding/dumping practices in the 4X fishery be undertaken using port techician, observer, and boarding length frequency information.

Despite the lack of an objective analysis, it was felt by some in DFO that discarding in 1995 was less than in previous years due to the closure of the fisheries. This was echoed by some in industry who mentioned that the larger trawl mesh sizes and high observer coverage have reduced illegal activity. There were anecdotal observations of cod, not haddock, floating around which may indicate a problem for this species. This was confirmed as a problem later in the year by the port technicians, who noted difficulties in collecting samples due to discarding and high-grading of cod. The need for the systematic study of these activities was again noted.

- It was **recommended** that next year, each assessment report should include a section on the management measures employed, and what activities were undertaken to evaluate how effective these measures have been.

In the discussion on commerical size composition, it was noted that there has been no winter and late fall fishery in recent years, when large haddock were traditionally caught, outside of the Bay of Fundy. The differences between the average size of haddock caught in the OT and LL fisheries may be due to areal differences, although the LL fleet has started to use the No. 10 hook during 1990 - 94. It was noted that 1995 was the first year that the No. 12 hook was used.

There was a lot of discussion on the re-aging project with acknowledgement of the significant progress that had been made.

- It was **recommended** that all steps of the aging re-creation process be carefully documented in the Research Document.

It was noted that the aging of the commercial otoliths for the catch at age was not yet complete and that this was an interim step. This should be noted in the research document. It was also reported that the WG tried a number of ways of combining the Age/Length keys and documented the impact of these on the final analysis. This should also be documented to provide a measure of uncertainty in the catch-at-age. In general, the Subcommittee was impressed with the degree of investigative analyses undertaken by the WG to meet shortfalls in the commercial aging. The re-aging of the survey data was completed for the assessment.

- It was **recommended** that in the Res Doc the average length-at-age from last fall's assessment be compared to that used in this assessment.

- This discussion lead the Subcommittee to **recommend** that in cases where there are no trends in growth rate, the use of pooled age/length keys may provide superior estimates of the tails of the distributions.

Resource Status

It was asked whether or not the ITQ survey would use the same vessels in the 1996 survey, to which it was replied that this would be attempted.

It was asked whether or not commercial catch rates were calculated for this stock. The answer was no. It was suggested that future assessments should at least show these trends, along with comments on the management measures.

There was comment that while condition factor was declining, recruitment appeared to be increasing, contrary to expectations. This discrepency could not be resolved.

There was considerable discussion on the size of the 1992 and 1993 year classes, as measured by the DFO summer survey. From the ADAPT model fit, it appeared that these year-classes were being over-estimated (high positive residuals), although this was countered with the observation that the residuals were negative in 1994 and positive in 1995. This raised the issue of the retrospective pattern which was shown to exist in the presented model. There was a suggestion to remove the pre-1982 survey data from the calibration, although this was not generally supported. It was considered that while the retrospective pattern was present, it had become significantly reduced as compared to previous years.

- It was **recommended** that future calibration models investigate the incorporation of correlated (between age groups) errors.

There was a suggestion that the 1984 - 86 reduction in fishing mortality could be the result of still having old, biased, aging in this part of the catch at age matrix and was thus not real. This will require further investigation upon receipt of the new aging for these years. On a related issue, it was questioned whether or not the PR was asymptotic at age seven. After further examination, it was concluded that it was.

Overall, the assessment model was accepted as presented.

Outlook

The projection to 1997 is critically dependent on the sizes of the 1993 and 1994 year-classes, which according to the 1995 summer survey are strong, particularly that of 1993. The ADAPT calibration gave a 1993 abundance estimate of about 80 million but this is based on only one observation in the calibration block. Also, the retrospective analysis suggested that year-class strength at age one subsequently drops by at least 50 percent. For this reason, the abundance estimate of the 1993 and 1994 year-classes at age one was set at 40 million for the purposes of the projection. It was noted that the 1996 DFO and ITQ summer surveys will be important in providing additional estimates on the abundance of this year-class.

It was noted that if these year-classes are as big as they now seem, there could be significant small fish by-catch problems in the fishery. Successful management will have to include provisions for dealing with this. This was added to the SSR.

4TVW Haddock (Rapporteur: P. Hurley)

Kees Zwanenburg presented the analysis on 4TVW haddock which was prepared by the cod/haddock working group. It was noted that the re-aging project is still on-going for this resource and thus the assessment was predominantly based on an examination of the length-based survey observations. It is planned that an age-based analysis will be available in spring, 1997. The subsequent discussion then addressed the sections of the report.

- It was **recommended** that the re-ageing protocol be finalized and production ageing of 4TVW haddock be initiated.

The Fishery

As the fishery is closed, discussion focused on the by-catch of haddock in other fisheries. Of special interest was the silver hake fishery. It was noted that this fishery now uses the Nordmore grate, which has resulted in significant reductions in the by-catch of haddock and other species. It was asked if the grate had reduced the catch of less than 20 cm haddock as well. Perhaps, but the likely main reason for the reduction in the catch of these fish is the change in the geographic extent of the Small Mesh Gear (SMG) box as well as the change in the season. It was noted that the Silver Hake group at BIO had conducted an extensive analysis of the by-catch reductions caused by changes to the SMG. This should be referred to in the Research Document.

There was comment on the extent of illegal fishing (i.e. gillnetting, on-board filleting) that was and perhaps is still occuring in 4VW. These could not be confirmed.

To complete the historical analysis of this fishery, it was suggested that the Research Document include the effort trends, particularly the post - 1990 otter trawler shift from 4X to 4W and the activity of the longliners in 4VW.

Resource Status

There was some discussion on the analysis of the trends in condition factor. There was a sense that the trend was significant, although there was not a consensus on this. Certainly, any trend would call into question the use of one historical length/weight relationship as was done. It was commented that any trend in condition could also be due to a seasonal effect.

- It was **recommended** that a further analysis of trends in condition factor should include both an age and year effect. It should also examine, if possible, the potential impact of any seasonal shifts in condition. This would be similar to analyses already conducted on 4X haddock.

From the maturity ogive that was presented, it appeared that 4VW haddock were maturing at a younger age. There was no further discussion on this.

There was a lot of discussion on the potential mapping analysis. This showed the changes in the areal extent of the resource since 1970. It also provided a means to quantify the relationship between age class size and distribution. It was felt that this was a promising approach but needs further examination as a technique in SSSC.

- It was **recommended** that the potential mapping technique to describe trends in geographic distribution be examined and compared to other like procedures in SSSC.

Accepting the analysis as presented, it is evident that the amount of haddock habitat in 4VW has been relatively low and restricted to 4W since the late 1980s. This is corroborated by the earlier work of Stephen Smith. There were differences noted between the results of the DFO summer survey and the industry sentinel survey as regards to the link between environment and haddock distribution. However, these could be due to size-specific responses (sentinel survey only caught commercial sized fish) and differences of coverage. Also, the sentinel survey may be affected by hook saturation, while the trawl survey isn't.

With the absence of a fishery, and a decline in the available habitat of haddock, one would expect some increase in the survey catch rates, particularly for the 50cm + individuals. These sizes should fill in quickly. This raised

comments on the growth of 4TVW haddock. There was the sense that if these haddock were growing at a reasonable rate, then there are two explanations for a lack of increase in survey catch rates in 4VW - 1) they have high natural mortality or 2) they are leaving the area.

Regarding the first hypothesis, it was noted that predatory mortality by seals was a possibility but not a significant one, given the seal diet composition work to date. The latter has indicated that haddock are not a large component of the seal's diet. An alternative hypothesis that was discussed is that large 4VW haddock year-classes spread into 4X. This has already been suggested as occurring for juvenile haddock. This is particularly relevant now given the appearance of two large year-classes (1993 and 1994) in 4X. An examination of the trend in the total mortality of age one/age two individuals was suggestive. There was an indication of an increase in Z in recent years although the high variability in the data did not allow a definitive statement on this. The group could come to no consensus on this and saw the need for further work.

- It was **recommended** that size-based methods be employed to examine trends in the total mortality of juveniles in the survey dataset. This analysis should be conducted on both the 4VW and 4X haddock datasets.

These observations would still not explain why there was no increase in the abundance of older individuals. It was sugggested that perhaps old 4VW haddock may be moving into adjacent areas (3Ps, 3NO, 4X) as well. Comment was made that the tagging that was conducted on 4VW and 4X haddock in the 1980s suggested very limited movement between the areas, confirming historical work. This, however, does nor rule out movement now, given the cold water conditions in 4V. The yield and texture of 4VW and 4X haddock are known in the industry to be quite different. Industry participants have not noticed any trends in 4X recently. However, the trend in declining condition in 4X would be consistent with 4VW haddock moving into 4X. Also, there was a small increase in 40 - 55cm fish in the 4X survey length frequencies.

These observations were countered with the tabling of a growth model based on the preliminary new age information. This indicated slow growth of the adults and suggested that a shift in the size frequency in the survey data in one year would not be expected. Also, the survey catch rates of fish 50cm + long are too low to see big changes. It was evident from this discussion that the new age data will be critical to resolving some of the above mentioned hypotheses.

- It was **recommended** that work be pursued to resolve whether 4VW haddock are moving into 4X or undergoing a reduction in growth.

Outlook

There was discussion on the analysis of the relationship between year-class size and areal extent. While interesting, as indicated above, it required further review in SSSC. Therefore, an analysis of the length-based survey data was conducted which indicated strong 1993 and 1994 year-classes. This was used in the SSR. Otherwise, the status of the resource was accepted as presented.

4Vn Cod (Rapporteur: J. Fennell)

The assessment was presented by S. Campana, the chair of the Cod/Haddock WG. For this resource, there was not much information other than that of the surveys, and thus the focus of discussion at the Subcommittee should be the SSR. This was accepted.

The Fishery

The catch in 1995 was 40 t, this due to by-catch and the sentinel survey. There were no other comments on the fishery.

Resource Status

This stock mixes with the adjacent 4T resource, especially in winter. The extent of this mixing is difficult to determine and is currently the focus of a multi-year study by DFO Science. It was pointed out that last year, a 4Vn Cod Working Group examined the available information of the stock structure of 4Vn Cod and concluded that no VPA on this resource could be conducted until the extent of mixing among 4T, 4Vn and 4T could be quantified. Until such time, the assessement would have to rely on an examination of survey trends.

Questions were raised on the status of the 4T resource and its linkage with 4Vn. The Gulf September survey in 1995 indicated small signs of improved recruitment , including large quantities of 0 - group. Sentinel fisheries in the Gulf have indicated cod migration timing by showing a decline in numbers on the western side of the Gulf in mid-October 1995, followed by an increase in numbers of fish on the east side of the Gulf by late October, with a peak on 11 November 1995. The DFO January survey was extended into 4Vn in 1996 to better understand the winter distribution of the cod. It observed good concentrations off Cape Smokey, with less around St. Pauls Island. Relatively good concentrations were found extending back into 4T. It was noted that the spring migration back into the Gulf has been delayed by two to three weeks in recent years, probably due to late ice migration. Fishing has been attempted around ice with little success. In 1991 - 1993, the boats were out later around the ice. Indications were that fish had come out later with no great concentrations near the 4Vsb line. This was particularly true in 1996.

The remaining discussion focused on the 4Vn resident population. The results of the DFO Summer survey indicate low abundance and poor recruitment. This is corroborated by the September Gulf survey which was extended into 4Vn in recent years. However, it was noted that the state of the resource is not as low as it is in 4VsW. The spring 4VsW survey for instance, has indicated no sign of cod south of 4Vn in the last two years. Overall, there appear to be higher densities of cod in 4Vn than 4VsW.

Some of these observations were confirmed by the 4Vn fall sentinel surveys. These show no change in abundance between 1994 and 1995. There were concerns raised on the coverage of the sentinel survey in relation to the DFO surveys.

- It was **recommended** that the DFO and Sentinel Survey coverage be compared and where necessary changes made to ensure that the stock area is sampled.

Outlook

Other than minor editorals, the outlook was accepted as presented.

4VsW Cod (Rapporteur: G. Chouinard)

The results of the Cod/Haddock Working Group were presented by P. Fanning.

The Fishery

Historically, this has been predominantly an otter trawl fishery. Catches in the last two years have been less than 400 t, all of this by-catch in other fisheries. While there were adjustments made to account for the migration of Gulf cod into 4Vs during 1986 to 1992, these have not been necessary since 1992. There was discussion on anecdotal reports of large unreported catches during the late 1980s - early 1990s. Also, there were catches of other adjacent areas reported as 4VsW.

- It was **recommended** that an attempt be made at quantifying the misreporting of catches in late 1980s and early 1990s to determine its impact on the view of the resource.

Resource Status

It was noted that due to vessel problems, there was no 1996 March survey. However, recent March surveys have indicated very low numbers with no indication of incoming recruitment. Interestingly, the 1995 fall Sentinel Survey, which covered the inshore areas, found concentrations of cod outside of the DFO summer survey area. The results of the 1996 survey will be very interesting in confirming whether or not this pattern persists.

The ADAPT formulation was the same as in previous years. The retrospective pattern was still apparent, although less so than in past years. The analysis indicated very high fishing mortality in 1993, with the closure of the fishery since 1993 resulting in a large decrease in fishing mortality since. The long-term view (since 1958) shows a progressive and almost continuous decline in stock abundance. While this view of stock status was largely accepted, there were some details that needed further explanation. For instance, the 1993 age nine fishing mortality from the VPA was high, although the fishery was closed. It was replied that this could be an artifact of which ages were used in the calculation of the annual average F. Sampling has been low in recent years due to the fishery closure and greater care needs to be excerised in choosing the ages of the VPA considered as fully exploited. An analysis of the age 5 - 7 fishing mortalities was conducted and compared favourably with the total mortality estimates for these age groups dervied from the survey data. This gave some confidence that the fishing mortality trends in the VPA were real.

This discussion raised that related on trends in Total Mortality. The VPA assumes a Natural Mortality of 0.2 and thus any residual trend in total mortalty was due to fishing. Given the trends in retrospective analysis exhibited in the VPA, there was a concern that strict reliance on the VPA model will not allow differentiation of trends in total, fishing and natural mortality, particularly for the younger age groups. It was suggested that techniques that examine the commercial and survey data directly would be useful, and that these should be examined in SSSC. These analyses would aid in determining the relative contribution of fishing and natural mortality to the stock decline.

- It was **recommended** that given the retrospective patterns in the assessment, other methods of calculating F and/or Z should be attempted (e.g. Zs from RV data, relative Fs)

There was a discussion on the general decline in cod condition. A graph of condition vs biomass showed a strong negative relationship until early eighties (suggesting density-dependence), but this relationship has broken down since. It is quite clear that this, along with a number of other presented biological factors, indicate that the resource has been under significant ecological stress. The apparent disappearance of the spring spawning component was raised in this regard. It was queried whether or not this could explain the decline in condition.

- It was **recommended** that the potential causes for the disappearance of the spring spawning component be investigated.

Outlook

The resource outlook, which continues to be bleak, was accepted as presented.

4VW Flatfish (Rapporteur: K. Frank)

C. Annand presented the results of the analysis which had been compiled under the auspices of the Flatfish Working. It was mentioned that the Research Document needed streamlining because there is much duplication of figures, data, etc. making for difficult reading and review. This will be addressed by the author.

The Fishery

There was considerable discussion on the problems in obtaining reliable estimates of landings broken down by species. In terms of value, the species can be rated, in terms of decreasing value, from witch to yellowtail to plaice. However, only the witch are generally separated out by species. Some of this resistance from industry may be due to a fear of closing a fishery because of low levels of the individual stocks. This was not considered a justifiable reason for not separating landings by species.

- It was **recommended** that the license condition specify identification of catch by species.

While this was a useful for the future, it doesn't address the past. It was considered that there was enough expertise in DFO Science and industry to allow development of an area/season/fleet key to split the historical catches of unspecified flounder among species.

- It was **recommended** that a key be developed for the post-1990 period to breakdown the unspecified catch until the condition of license recommendation becomes implemented. This key could be used to provide an historical distribution of landings by species.

It was pointed out that species identification is a major component of industry proposal for a flatfish survey.

There was a discussion on the catch and effort trends and what they meant. The opinion was expressed by industry participants that catchability should be increasing because of gear changes, even though nominal effort has not. Also, the landings data are not reflecting the increase in mesh size in the commercial fishery made two years ago. The change in modes in size composition of commercial fisheries in relation to changes in mesh size is a cause for concern. This needs further examination.

Resource Status

There is no aging information for any of the Scotian Shelf flatfish stocks. This has hindered the assessment of these resources. It was suggested that some flatfish be aged periodically. It was further suggested that year effects in the growth of other stocks of plaice from 4T or Nfld be investigated and if great, then periodic aging would be required. Otherwise, then it would be useful to develop a growth model in cooperation with other labs for application in the Scotian Shelf assessments.

It was noted that the workload of all these stocks makes progress on any one slow. It was suggested that for the next round of assessments, focused work on one or two resources be conducted. The year after, work on another stock would proceed. This in effect puts flatfish on an assessment rotational schedule.

- It was **recommended** that focused assessment work on 4V plaice and 4VW witch be conducted for the spring 1997 assessment. Part of this would involve interaction with other regional labs to define growth models for use in the assessments.

The discussion then focused on the analysis of the survey length frequencies that was presented. These data may be amenable to calculation of total mortalities based on comparisons of commercial and survey information.

- It was **recommended** that length-based assessment procedures be applied to the 4V plaice and 4VW witch data to generate estimates of total mortality and peer reviewed in SSSC.

Other than these comments, the analysis was accepted as presented.

Outlook

It was realized that the catch against the 1996 TAC of 3500t (aggregate quota) will be dependent upon the catch of the fleet allocations. It was suggested that reference in the SSR be made to last year's advice and the projected benefits of reduced effort. It was also recommended that the advice be focused on the special need to protect recruits of witch, given the potential for bycatch of undersized fish resulting from incoming recruitment.

4X Flatfish (Rapporteur: K. Frank)

C. Annand gave the presentation of the results of the Flatfish Working Group.

The Fishery

While the quantities of unspecified flounder landed in 4X are higher than in 4VW, the discussion and recommendations made on 4VW are also relevant here. They will not be repeated here. It was considered that the increase in total landings from 1989 to 1990 did not reflect true flatfish catch but was catch from other non-flatfish species as well.

It was noted that the declining effort since 1992 (total effort) has been due to restrictions in association with area closures and fewer boats in the fishery. This does not apply to witch, where effort has been relatively constant, suggesting targeting for this species. The Subcommittee noted that the text in the draft SSR associated with the fishery needed re-drafting to reflect the details associated with the changing nature of the fishery.

Resource Status

As with 4VW flatfish, there is a need for focused assessment work on the 4X flatfish stocks on a rotational bases.

- It was **recommended** that focused work on 4T winter flounder and witch be conducted for the spring 1997 RAP meetings. This work should involve development of a growth model and examination of size-based methods to generate estimates of total mortality.

It was noted that the 1995 ITQ survey in 4X had flounder catches but there had not been enough time to analyse the data. This will be done in future assessements.

Other than these comments, the analysis was accepted as presented.

Outlook

The bottom line for witch was to maintain 1994 level, however there was a lot of discussion on the witch flounder allocation and how to control exploitation of witch. Industry participants mentioned that there was already a closure by gentlemen's agreement. It would be useful to suggest no directed trips for witch.

It was suggested that a phrase be added to the SSR which stated that catches on the order of 300-400t have resulted in declines, and thus future catches at this level will likely result in a continued decline.

3NOPs4VWX Atlantic Halibut (Rapporteur: Stobo)

C. Annand presented the results of the Flatfish WG. Since there was no analytical assessment available for Scotian shelf and Grand Banks halibut, and the essential elements of stock evaluation were included in the SSR, it was agreed to proceed directly to consideration of the SSR.

The Fishery

In discusssion related to the fishery, it was noted that the Nfld data on halibut catches had not been provided by that region and hence were not included in the evaluation.

- It was **recommended** that the Newfoundland data be consolidatd with the rest of the Maritimes data for the next round of evaluations.

Some discusssion also centered on the use of "J" versus circle hook, the latter being the most commonly used now. The opinion of the fishermen present was that survivorship of fish taken on, then released from, circle hooks would be lower than "J" hooks due to the greater difficulty in getting them off the hooks. Questions arose pertaining to the hooks used in the study conducted by Neilson, Waiwood and Smith (1989) on survivorship - it was subsequently confirmed that circle hooks were used - thus the survivorship estimates derived in that paper would be valid.

Resource Status

It was noted that catch, catch rates (CPUE) and effort have been the main sources for examining stock status. In 1995 however, the myriad of management measures in place had a substantial impact on the value of those indices relative to previous years. It was also mentioned that in 1994 and 1995, a lot of new, inexperienced effort was re-directed to halibut due to other fishery closures, effort which would reduce the CPUE relative to previous years. Those comments were moderated by the fact that few of the new fishers would have filled out the log records so that their effort may have had only a small effect on total recorded effort and the CPUE. Concern was also expressed that only 5 percent of the commercial catch (from length frequencies) was of mature animals, a situation that has existed throughout the 1990s.

Discussion on use of the research vessel survey (RV) data related to its usefulness given the very low catch rates. It was pointed out however that similar small numbers were being used in other fisheries. There was consistency in the trends shown and the declines observed were consistent with the CPUE in the fishery.

Outlook

Concern was expressed that keeping the TAC at 850t would cause the stock to continue to decline (no recruitment, declining CPUE, declining RV trend), and felt that more restrictive measures may be in order. It was generally felt that further reductions in TAC were not realistically manageable and any modification to the fishing level could only be achieved by restricting halibut catches to a by-catch only regulation. Opinions were expressed that due to the severe state of the stock, there was an urgent need to define efficient management measures to reduce the fishing effort to the lowest possible level. The SSR was modified to reflect these discussions.

Invertebrates

Northern Shrimp (Rapporteur: M. Covey)

Peter Koeller presented a paper entitled 'Aspects of the biology of northern shrimp *Pandalus borealis* on the Scotian Shelf'. The Stock Status Report was not presented here but was sent to the original review committee, who met in November 1996, for approval.

Ovigerous females have been found both inshore and offshore in areas containing LaHave clay. The offshore TAC was based on the original biomass estimates for the offshore only. The inshore was not assessed for biomass at that time. There are two hypotheses on the relationship between the offshore and inshore resources. The inshore could be either a separate resource from the offshore or it could be a spillover from the offshore resource. The Subcommittee was asked to review the analysis conducted by P. Koeller that examined these two hypotheses.

A number of detailed comments were made on the analysis. For instance, survey tows should be plotted by no.shrimp/pound/degrees latitude as has been done for the commercial fishery. There needs to be consideration of other methods (e.g. acoustics) to verify stock distribution. However, the consensus of the Subcommittee was that under either hypothesis, an inshore trap fishery could be managed independently of the offshore. It was added however, that the inshore fishery may not be sustainable, keeing in mind the habitat, low temperature and potential for predator increase.

It will be important to ensure that there are special license conditions for the inshore trap fishery that will minimize potential interaction with the offshore fishery, such as no disputing of the inshore/offshore line and non-renewal of licences. Also, there should be a distinction between the fisheries. Inshore/offshore does not make an accurate distinction. Trap/trawl or fixed/mobile were both suggested. The Subcommittee recommended that attention be paid to what we are we going to measure from this experimental fishery and what we are going to learn. Related to this is a need to define the level of trap effort required to monitor the fishery.

The comments on the analysis will be incorporated into a special section of the Northern Shrimp SSR.

Arctic Surf Clam (Rapporteur: M. Lundy)

D. Roddick presented an analysis of the Banquereau Bank Arctic Surf Clam population to the Subcommittee.

The Fishery

It was reported that three boats can harvest 720 sq. Km. per year. The area of Banquereau Bank is about 2,400 sq. Km. Which means that the fleet could harvest the whole area in three years. Currently the fishery is market driven. The preferred size is for clams corresponding between 10-15 years. Thus the issues are: how big an area should be harvested? What areas should be not fished? What should be the rotation cycle of fishing among areas?

Resource Status

The previous estimate of clam biomass appears to be too high, with the 30,000t TAC not considered to be sustainable. Recruitment appears to be episodic, but more work is needed on this. The joint industry/ Science survey proposed this June will give more information on recruitment, growth and the distribution of the resource. Recruitment to this resource is low, and fishing is analagous to forest clear-cutting. The Subcommittee spent considerable time discussing the relative merits of a management system based on a mixture of permanently closed brood stock areas and fishing areas which would be harvested on a rotational basis. There appear to be large amounts of this resource that are not at harvestable densities, which could function as a reproductive reserve. This summer survey will hope to address some of the questions related to this management approach.

There were questions raised on the impact of dredging on the bottom. There is a large literature on hydraulic dredges and their impact in the North Sea. The DFO Habitat group is doing some preliminary work which will be useful. Groundfish are a predator of clams but the impact is unknown. Concerns have been raised by the long line industry about the impact of removal of potential groundfish food source.

- It was **recommended** that a literature review of studies in the North Sea and elsewhere on the possible impact of dredging on groundfish predation be conducted and documented.

Management has been using a conversion factor of 5.5. A program was set up to determine if this one factor was appropriate or if two factors - one per product form - was more appropriate. The use of individual factors versus two changes the round weight by roughly 18 percent. The proposal tabled at this meeting was to use 6.67 for blanched and 5.38 for raw. Industry in the fall of 1995 tabled values of 6.51 and 5.27, which are comparable to those presented in this study. Therefore DFO Statistics Branch will use the industry values of 6.51and 5.27 in 1996.

- It was **recommended** that work on seasonal variation in conversion factors be conducted.

Outlook

The current TAC was brought in as a preemptive measure and is not interfering with the current fishery. The current plan expires at the end of 1997; therefore it would be useful to develop a new approach based on closed areas and not a TAC for the next plan.

- It was **recommended** that a harvest plan be developed with two types of areas: permanently closed reproductive reserves and rotational harvesting areas. The areal extent and rotational schedule needs to be developed.

It was suggested that the definition of this new approach would benefit from a coordinated interregional effort in time for next year's RAP. It was pointed out that some Pacific fisheries have used this approach and could be used as an example to start the discussion.

Eastern Scotian Shelf Scallop (Rapporteur: M. Chadwick)

The presentation of the assessment was given by G. Robert.

The Fishery

The current TAC of 150t was for Middle (15t), Western and Sable (135t) banks and is based on the average catches for 1990-1994. The precautionary approach was taken for the small TAC at Middle Ground because this area was considered to be self-sustaining and that there was little chance of recruitment from other areas.

The description of the fishery should indicate that effort has declined and that catch rates have increased.

Resource Status

The DFO surveys did not track the cohorts very well. These surveys have been stratified by catch rates in the commercial fishery. It may be better to stratify by bottom-type. There was a general consensus that an examination of scallop survey design was needed.

- It was **recommended** that a workshop on scallops surveys be held in 1996.

When comparing the scallop size distribution from 1994 to 1995, years when the distribution of the survey has remained the same, it appears that the RV catch rates have increased for commercial-sized scallop.

- It was **recommended** that annual shell-height frequencies be produced.

It was suggested that the size composition from the commercial fishery be examined in relation to size data in the survey. Also, while the percent of clappers is very low, they should be provided in the Research Document.

The 1994 versus 1995 size composition in the survey should be put into the SSR.

Outlook

The recent catch levels appear appropriate. It was questioned whether or not a stable size composition could be defined and used as a target.

- It was **recommended** that a meat-size approach for setting management targets be examined for scallops.

Brier Island Lurcher Shoal Scallop (Rapporteur: M. Chadwick)

The presentation of the assessment was made by E. Kenchington.

The Fishery

It was noted that compliance rate for logbooks declined from 1994 to 1995. These data were used to apportion catches into the stock areas. Landings were down in both beds in 1995, and fishing covers the entire area. The two beds are no longer separated by an area of no fishing. Yield is higher in the nearshore areas, yet the fishery is moving into the offshore areas, where yield is lower. It was suggested that the trend in effective effort over time be added to the SSR.

Resource Status

The survey areas are comparable from 1994 to 1995. The lowest number of pre-recruits in recent years was observed in 1995. It is apparent that the large year-class was fished out before optimal yield was attained. Based on catch rates at all sizes from 1994 and 1995, Z was 0.7 for Lurcher and 1.58 for Brier.

Commercial sampling was poor in 1995 and cannot be used to estimate catch rates at size.

- It was **recommended** that a comparison of the catch-at-age from the shell height-age relationship to that from the cohort slicing technique be undertaken.

Outlook

The commercial catch rate for this area is four to five fold higher than current levels. It should be stated in the SSR that this is an unmanaged fishery. Fishing mortalities are very high. The loss of yield calculations would be useful to put in the SSR. The percent clappers could have increased as a result of the greater fishing effort.

While we cannot precisely estimate recruitment overfishing, we could calculate its probablity.

- It was **recommended** that the probability of recruitment overfishing be calculated for this resource.

There is no effective effort control in this fishery and the industry does not appear interested in quota management. Effort has increased dramatically. There is also less flexibility for fishers to switch to groundfish and other species. Some management options were discussed. A closed-area approach may be better. This could include permanently closed brood stock areas and other areas to be fished by rotation. This type of approach needs to be explored further.

- It was **recommended** that a management plan based on closed areas be investigated for this resource.

German Bank Scallop (Rapporteur: M. Chadwick)

The presentation of the assessement was made by E. Kenchington. Many of the comments made on the Brier/Lurcher resources were applicable here. Catches around 300-400t were not sustainable in the past and therefore present levels are also unsustainable. This is the first year that a large pulse of recruitment was seen but we are unable to compare surveys because they have expanded in areal coverage from 1994 to 1995.

It was recommended that estimates of total mortality be calculated for 1994/95 from the surveys using the same area.

SFA 29 (Rapporteur: M. Chadwick)

The presentation was made by E. Kenchington. A series of questions were posed as to the interaction between German Bank and SFA 29:

- Do scallops on German Bank influence recruitment on Lurcher and Brier Island? Yes, because the scallop size frequencies and local oceanography suggest common linkages.
- Is stock reproduction and recruitment stable? Yes
- Is this a good broodstock protection area? Yes. Until we do a more expanded survey, this area should not be opened. We already have a closed area in SFA29 that could be extended across the top of German Bank. The area has been closed since 1986.

It was noted that the survey does not cover the distributional range of the resource. It was suggested that the survey be expanded to cover the area.

There is no evidence that the Brier Island, Lurcher and German Bank fishing grounds are biologically separate units. It was suggested that the SSR be broken into 2 parts: north of 43:40 and south of 43:40.

The RAP Steering Committee will develop an overview section to include the management considerations and the suggestion to keep SFA 29 closed as a broodstock protection area as it has the appropriate properties and is already closed.

Pelagics

Porbeagle Shark (Rapporteur: P. Hurley)

The presentation of the Elasmobranch Working Group's analysis was made by its chair, R. O'Boyle.

The Fishery

It was noted at the beginning of the discussion that the stock boundaries of this resource are uncertain. It could be a North or Northwest Atlantic resource. It was seen that examination of whatever information (tagging and/or genetics) is available to assist in resolving this uncertainty be analysed on a priority basis. This raised the related issue of where to conduct the assessment and thus obtain the best peer review. It was pointed out that ICCAT and ICES already have formed shark groups, so why not take advantage of these. Some from industry noted that the ICCAT forum may not be appropriate. This is not a major issue currently so RAP will continue to be the assessment venue in the short term.

The comment was made that the difference between the Canadian and Faroese average length in the catch may be due to sampling. Further analyses of these data are planned which will take account of areal and seasonal effects.

Resource Status

The only indicator of stock trends was a very preliminary analysis of catch rates in the old Faroe Islands and new Canadian fisheries. It was pointed out by some industry participants that the fishers' learning curve will bias that analysis of catch rates from the logbooks. Vessel changes over the period of the fishery could account for the decline observed. While this was recognized, it was noted that all exploratory analyses conducted , including one with vessel as a treatment, indicated a decline in CPUE. Notwithstanding this, the analysis was preliminary and requires further work. This should be taken to SSSC for review.

It was pointed out that inshore vessels set fewer hooks but set twice a day and therefore would have same effective effort as offshore vessels. It was queried if any catch rate data was available from Europe. This will be investigated. As well, the effort in the fishery should be documented.

There was comment from industry that the timing in the reproduction figure was wrong. When asked if industry were aware of any observations on bite marks on female sharks (indicating recent mating), there was no reply. Cooperative work with industry is needed to more completely explain the probeagle life cycle in Canadian waters.

Outlook

The SSR was accepted as presented with one addition. It would appear that there is benefit for Canada to take unilateral management action for porbeagle given its reproductive strategy.

Concluding Remarks

This report documents the discussions of the spring 1996 Regional Advisory Process. It is the third such meeting that has been conducted. The discussions were very penetrating and resulted in the production of superior Research Documents and Stock Status Reports for the resources that were reviewed.

Appendix 1. Schedule of Stock Assessment Review of Scotian Shelf Subcommittee

	Groundfish	Pelagics	Invertebrates	Plants	Marine Mammals
Spring	4Vn Cod 4VsW Cod 4TVW Haddock 4X Haddock 4VW Flatfish 4X Flatfish Atlantic Halibut Wolffish Sandlance Turbot White Hake Cusk	4VW Capelin SA2-6 Spiny Dogfish Blue Shark Porbeagle Shark Shortfin Mako Shark	SS Mussel (2 Species) SS North. Prop. Clam SS North.Shrimp SS Ocean Quahaug SS Sea Urchin SS Stimpson's Surf Clam SS Toad Crab		
Fall	4VsW Skate 4X Cod Unit 3 Redfish Monkfish		SS Atl. Jacknife Clam SS Atl. Surf Clam SS Iceland Scallops SS Jonah Crab Lobster, LFA 27-33 SS Moon Snails SS North. Quahaug SS Orange Footed Cucumber SS Oyster SS Rock Crab SS Soft Shell Clam SS Striped Pink Shrimp SS Welks (3 Species)		Harbour Porpoise SS Grey Seal SS Harbour Seal

Appendix 2. Agenda for Spring 1996 RAP Meeting of Scotian Shelf Subcommittee

	15 April Monday	16 April Tuesday	17 April Wednesday	18 April Thursday	19 April Friday
0900-0930		4TVW Haddock	4VW Flatfish	Surf Clam	Reruns and SSRs
0930-1000		4TVW Haddock	4VW Flatfish	Surf Clam	Reruns and SSRs
1000-1030	Introduction	**Coffee**	**Coffee**	**Coffee**	**Coffee**
1030-1100	Ocean Climate Trends	4TVW Haddock	4VW Flatfish	Surf Clam	Reruns and SSRs
1100-1130	Plankton Trends	4TVW Haddock	4VW Flatfish	East Sh Scallop	Reruns and SSRs
1130-1200	Finfish Trends	4TVW Haddock	4VW Flatfish	East Sh Scallop	Reruns and SSRs
1200-1300	**Lunch**	**Lunch**	**Lunch**	**Lunch**	**Lunch**
1300-1330	Effort Trends	4VsW Cod	4X Flatfish	Brier/Lurch Scallop	Reruns and SSRs
1330-1400	4X Haddock	4VsW Cod	4X Flatfish	Brier/Lurch Scallop	Reruns and SSRs
1400-1430	4X Haddock	4VsW Cod	4X Flatfish	German Scallop	Porbeagle
1430-1500	4X Haddock	4VsW Cod	Halibut	German Scallop	Porbeagle
1500-1530	**Coffee**	**Coffee**	**Coffee**	**Coffee**	Porbeagle
1530-1600	4X Haddock	4VsW Cod	Halibut	German Scallop	Porbeagle
1600-1630	4X Haddock	4Vn Cod	Shrimp	SFA 29 Scallop	Reruns and SSRs
1630-1700	4X Haddock	4Vn Cod	Shrimp	SFA 29 Scallop	Reruns and SSRs
1700-1730	4X Haddock	4Vn Cod	Shrimp	SFA 29 Scallop	
1730-1800	4X Haddock	4Vn Cod	Shrimp		

Appendix 3. List of Stocks Done by External Reviewer

Groundfish	Pelagics	Invertebrates
Wolffish	4VW Capelin	SS Mussel (2 Species)
Sandlance	SA2-6 Spiny Dogfish	SS North. Propellor Clam
Turbot	Shortfin Mako Shark	SS Ocean Quahaug
White Hake	Blue Shark	SS Toad Crab
Cusk		SS Sea Urchin

Appendices

Appendix 4. List of Participants

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Appendix 5. List of documents distributed at meeting.

Annand, C., and D. Beanlands. A Review of the 4VWX3NOPs Halibut Stock

Annand, C., and D. Beanlands. An Update of the Status of 4VW Flatfish Stocks

Annand, C., and D. Beanlands. An Update of the Status of 4X Flatfish Stocks

Annand, C., and J. Hanson. Management Activities for 1995 and Early 1996 Scotia-Fundy Region

Fanning, P., R. Mohn, and W. MacEachern. Assessment of 4VsW Cod in 1995 with Consideration of Ecological Indicators of Stock Status

Hurley, P., G. Black, R. Mohn, and P. Comeau. Assessment of 4X Haddock in 1995

Kenchington, E., and M. Lundy 1995 Bay of Fundy Scallop Stock Assessment: Brier Island and Lurcher Shoal

Kenchington, E., and M. Lundy. 1995 Bay of Fundy Scallop Stock Assessments: SFA29 and Northern German Bank and an Assessment of these Areas for Broodstock Protection and Sustainable Fishing

Koeller, P. Aspects of the Biology of Northern Shrimp Pandalus Borealis on the Scotian Shelf

Koeller, P. Results from the Experimental Shrimp Trap Fishery 1995

Koeller, P. The Scotian Shelf Shrimp (Pandalus borealis) Fishery in 1995

Lambert, T., and S. Wilson. Update of the Status of 4Vn Cod: 1995

O'Boyle, R. Effort Trends

Robert, G., and M. Butler. Scallop Stock Status for 1995: Eastern Scotian Shelf and German Bank

Roddick, D. A Preliminary Look at Conversion Factors for the Offshore Clam Fishery

Roddick, D. The Arctic Surfclam Fishery on Banquereau Bank

Sameoto, D. State of the Ocean: Scotian Shelf, Bay of Fundy, and Gulf of Maine

Sameoto, D. Zooplankton Changes Along the Newfoundland-Gulf of Maine 1994 CPR Line and 1995 Halifax Line

Zwanenburg, K. Biological Update for Haddock in Division 4TVW in 1995

Zwanenburg, K. Finfish Community Trends

Appendix 6. Assessment Team Minutes

PROCEEDINGS OF THE COD AND HADDOCK ASSESSMENT WORKING GROUP

Chair: S. Campana

Members:

G. Black	P. Hurley
D. Bowen	T. Lambert
R. Branton	R. Mohn
G. Bugden	S. Smith
K. Drinkwater	K. Zwanenburg
P. Fanning	
K. Frank	

The *Cod and Haddock Assessment Working Group* met 8 times between January and April 1996 to develop, evaluate and review the 1996 stock assessments for 4Vn cod, 4VsW cod, 4VW haddock and 4X haddock. The following represents a brief summary of the issues considered, major findings, and recommendations for further research.

The Fishery

There was no directed fishery for cod or haddock in 4VW during 1995. As a result, the small amount of reported catch was due to bycatch or to catch from sentinel surveys. While samples of commercially-caught 4VsW cod were collected and aged, the small sample sizes involved and their bycatch origin suggest that 1995 estimates of catch and weight at age should be interpreted with caution. None of the commercial 4Vn cod otoliths were aged.

Length frequencies of 4VW haddock collected with small-mesh commercial gear (mainly Cuban) clearly showed the same length modes associated with the 1993 and 1994 yearclasses in the summer RV survey. Frequency histograms of catch rate at length in the small mesh fisheries suggested that the 1993 yearclass was somewhat smaller than the long-term average, but slightly larger than the average through the 1990's. The size of the 1994 yearclass appeared to be smaller again. However, the relative magnitude of these modes was difficult to assess given the introduction of the Nordmore grate in 1993 and the shift in the location of the landward line of the small mesh gear box in 1994. The WG **recommends** that the small mesh gear catch rates at length be pursued as a measure of 4VW haddock recruitment.

Industry representatives confirmed that landing statistics for 4X haddock were reasonably accurate in 1995, as has been the case in recent years. Discarding and highgrading were acknowledged as being present in the 1995 fishery, but the amount could not be quantified. There did not appear to have been a major change in discarding practices since 1994. Haddock and cod were the major species being discarded on the offshore banks and at the entrance to the Bay of Fundy, respectively, apparently due to high catch rates of both species.

An inter-year comparison of commercial 4X haddock catch at length showed a clear and unexplained decline between 1994 and 1995, although the 1995 mode was similar to that of the long-term mean. Length frequencies by OT gear have increased steadily since 1990, perhaps in part due to shifts in fishing location and mesh size, while those of LL declined between 1990 and 1992, remaining stable thereafter. FG representatives suggested that the decline was associated with the cessation of the winter fishery, which generally caught larger haddock. In 1995, OT length frequencies were larger than those of LL, particularly in 4Xmnop. OT haddock caught in 4Xqr tended to be slightly smaller than those caught by the same gear in 4Xmnop.

All 4X haddock summer RV surveys since 1987 have been re-aged by J. Simon and P. Comeau. Comparisons between these two agers showed no bias and high (CV=3.0%) precision. Comparisons of RV numbers at age based on the new ages and those of the previous St. Andrews ager showed large differences, with the new ages resulting in a much higher proportion of older fish in the population. A year by year comparison of the new and old ages using age bias plots showed high and relatively constant levels of bias for age 4+ fish between 1988 and 1991; the degree of bias was considerably less in 1992, due to re-ageing by J. Hunt. Since there was insufficient time to age more than a small proportion of the historic commercial 4X haddock otoliths before the assessment was required, emphasis was given to completing one half of the both the 1993 and 1995 otoliths, after setting a sub-sampling rate of one sample per 300 t per key.

Sentinel Surveys

The geographic distribution of longline catch rates in the July 1995 sentinel survey of 4Vn corresponded with that of the October 1994 sentinel survey, but the catch rates of the former were only 1/3 of the latter, presumeably due to seasonal differences. A comparison of the July 1995 4Vn sentinel survey and July 1995 summer survey demonstrated that cod were caught in the same areas, but none of the areas identified as being of low abundance by the sentinel survey were sampled by the Needler. Therefore, the degree of correspondence between the sentinel and summer surveys could not be properly assessed. Length frequencies in the July sentinel survey were significantly larger than those in the July RV, but no explanation for the discrepancy was apparent.

The spatial distribution of cod in the Oct 1995 sentinel survey was very similar to that of both the Fall 1994 sentinel survey and the September RV by the Gulf region, suggesting that the same group of fish was being sampled in both survey types. Stratified catch rates in the Fall 1994 and 1995 sentinel surveys were virtually identical, suggesting no change in relative abundance between 1994 and 1995. However, 1995 catch rates in the Gulf RV survey were only 1/3 those of the 1994 Gulf survey. Modal length frequencies in the 1994 RV and sentinel surveys were comparable, while those in the 1995 surveys were not; the larger modal size in the 1995 sentinel survey may have been due to sentinel survey coverage of areas of high cod density not sampled by the Gulf survey. A secondary mode at 29 cm in the 1995 Gulf survey was probably also present in the 1994 survey, but masked by the higher catch rates in that year.

The spatial distribution of cod as reflected by the October 1995 sentinel survey of 4VsW appeared to be relatively consistent with that of the summer survey. However, the region of highest cod abundance identified by the sentinel survey was inshore of the 50 fm line, and was not sampled by the Needler. The W.G. was not able to determine if such inshore concentrations of cod would have been present during the summer survey or in other years. Such a determination would bear on the significance of the untrawled region of 4VsW to the abundance estimate for 4VsW cod.

The length frequency distribution of the 4VsW cod sentinel survey was unimodal, with a mode approximately 6 cm larger than that of the summer or spring RV surveys.

The distribution of haddock catches in the 4X ITQ survey was widespread throughout the inshore region, at levels comparable to those of the offshore banks. Stratum by stratum comparisons of length frequencies between the summer RV and the ITQ survey were generally comparable, although catch rates were variable. The pooled length frequency of ITQ survey catches in regions surveyed by the summer RV survey was very similar to that of the RV survey of the same area. However, the pooled length frequency of ITQ survey catches in regions unsurveyed by the summer RV survey displayed different modal proportions. The implication of this finding is that the untrawlable inshore region may contain more haddock in the 30-45 cm range than is indicated by the RV survey. The W.G. **recommends** that the implications of dissimilar length frequencies between trawlable and untrawlable regions on the 4X haddock RV abundance index be examined. In general, it appeared as if the ITQ survey might provide a useful measure of haddock distribution and abundance in regions or seasons which are untrawled by research vessels.

High catch rates in the fall 4VW haddock sentinel survey were mainly distributed in the warmer waters of the offshore banks in both 4W and 4Vs. With some exceptions, catch rates were not high in inshore waters. The highest catch rates were associated with water in the 5-8^0 range, despite the fact that environmental temperatures were relatively evenly distributed across the 1-9^0 range. Catches in the summer RV were most often highest in the 3-7^0 range, consistent with the hypothesis that longline catches are made at higher temperatures than are otter trawl catches. In general, haddock were caught at warmer temperatures than were cod from the same sentinel survey.

Stock Status

Cod abundance as indicated by the 1995 summer research survey in 4Vn and 4VsW showed no apparent increase in abundance from the near record-low levels recorded last year. A recruitment index for 4VsW cod based on the abundance of age 2 and 3 fish showed that the number of recruits has declined since the poor 1990 year-class. This index appears to provide a useful measure of incoming recruitment, and the W.G. **recommends** that it be maintained after q-correcting the Age 2 numbers. Both the March and July surveys provided reasonably consistent estimates of 1995 abundance, and both showed reduced numbers of older (9+) fish in the population.

A July inshore survey of 4Vn caught many more Age 1 cod in 1994 and 1995 than in 1991-93, but it is too soon to determine if those recruits will increase the numbers of Age 3 4Vn cod captured in the Needler summer survey. The W.G. **recommends** that the correspondence between Age 1 inshore cod abundance and Age 3 offshore abundance by year-class be reviewed in the coming years.

ADAPT runs of 4VsW cod continued to show near record-low levels of abundance for the stock. The significance of a modest upturn in biomass since 1994 could not be determined, but ADAPT estimates of abundance become more heavily dependent upon assumptions about natural mortality rates in the absence of significant fishing mortality. The F on older fish (6+) through the 1990's was extremely high, in keeping with RV observations of reduced numbers of older fish. Recent estimates of both biomass and fishing mortality from ADAPT do not appear to be influenced by the retrospective problem.

ADAPT runs of 4VsW cod using RV data corrected for environmental year effects were planned, but could not be implemented due to lack of time. The W.G. **recommends** that these be implemented for next year's assessment.

A stock-recruitment diagram for 4VsW cod continues to show a clustering of post 1990 estimates near the origin, and substantially below that of other years. A phase diagram of surplus production on biomass showed consistent clockwise cycles from 1958 to 1988, at which point the cycle appeared to be disrupted. The W.G. considered the possible causes of such a phase disruption (in terms of ecological and environmental shifts), but was not able to identify a clear cause. Age-specific phase plots were more cyclic for age 6+ fish than for age 3-4 fish. However, given the influence of the length-weight regression parameters on estimated weight at age (see discussion of condition factor below), the W.G. could not be certain that the age-specific phase plots were meaningful.

The summer 1995 RV abundance index for 4VW haddock was similar to that of both the previous 3 years and the long-term mean. The abundance in 4W continued to be 4-5 times higher than that in 4Vs, although large numbers of both the 1993 yearclass and 50-64 cm fish were captured in 4Vs in 1995. The abundance of the 1993 and 1994 yearclasses was above average in 4W and well above average in 4Vs, suggesting some potential for incoming recruitment. Further examination of these length modes indicated that the 1993 yearclass mode was larger than the long-term mean in both the 1994 and 1995 RV surveys. The 1995 distribution of the abundant 1993 yearclass in 4Vs was throughout the Gully region and along the shelf edge; it was not restricted to a small number of sets. The same length modes were also apparent in the small mesh Cuban catch. An analysis of the area occupied by each yearclass at high densities suggested that the 1993 and 1994 yearclasses were of above average abundance.

Further progress in assessing the stock status of 4VW haddock is limited by the absence of routine ageing for this stock. Given the relative difficulty in ageing 4VW haddock and the time that has been required to re-age just the 1987-94 4X haddock RV otoliths (2 person months), high priority will have to be given to the 4VW re-ageing if the historic otolith collection (1985-present) for RV and commercial samples is to be re-aged in time for the Spring 1997 assessment. Therefore, the WG **recommends** that routine re-ageing be initiated on a high priority basis for this stock after appropriate training of haddock agers and reexamination against the otolith reference collection.
Summer RV surveys of 4X haddock were dominated by large numbers of age 0 and 1 fish, corresponding to the 1994 and 1995 year-classes. The spatial distribution of these fish was comparable to that of previous years, being centred on the offshore banks and the eastern side of the mouth of Bay of Fundy. The numbers of larger fish were similar to the long-term mean.

ADAPT runs for 4X haddock using RV age-length keys blended with commercial length frequencies produced acceptable model fits, suggesting low overall spawning stock biomass but with above average recruitment. Estimates of abundance for the most current year are heavily dependent upon the RV ages used in calibration; 1995 RV catches of age 1 and 2 haddock were very high. One assumption of the blended model is that RV age-length keys are a suitable proxy for commercial keys. However, a comparison of 1993 lengths at age (weighted by length frequency) suggested that age 2 and 3 fish caught by RV are smaller than those caught by commercial gear. A comparison of the 1993 catch at age using either RV or commercial keys revealed few consistent differences at ages > 2. Therefore, an ADAPT using ages 2-7 in the calibration block was considered justifiable, recognizing that the resulting estimate for age 2 was likely to be inflated by the poor correspondence of length at age between RV and commercial keys.

Subsequent comparisons of 4X haddock RV mean length at age across years showed variability, sometimes substantial, for age 5+. To test the sensitivity of the blended ADAPT to the use of these keys in ageing the commercial length frequency, the RV keys were pooled into a single, more stable key, assuming no trends in growth rate across years. The resulting fit of the ADAPT was better than that associated with individual keys, although the effect on the current year's population estimate was minimal. Since sampling variability and low sample sizes associated with the yearly RV keys was substantial, the pooled key model was adopted as the most reliable.

VPA biomass estimates were consistent with those of the last age-structured assessment (in 1988) until 1979, after which they diverged. The reasons for the divergence are unknown, but could have been complicated by the high misreporting which was present in the mid- to late 1980s. Incorporation of underreporting estimates of 50-100% derived for 4X cod for the 1986-90 period produced a 10% increase in terminal biomass and a corresponding decrease in terminal F. However, there was little evidence on which to base underreporting estimates for 4X haddock. An additional potential source for the divergence in historic and current VPA estimates was that the 1988 assessment used age data which we now know to be incorrect. The divergence was not due to different VPA formulations, since ADAPT results based on the data which were available in 1988 resulted in biomass estimates which were very similar to those produced in 1988. A search for local minima associated with vessel conversion in 1982 did not reveal any significant discontinuities, as had been found for 4VsW cod in the 1994 assessment. However, use of a vessel conversion factor of 1.65 identified in a search for local minima, rather than the currently-accepted value of 1.2, reduced the magnitude of retrospective model discrepancies in the 1980's. There was only a slight effect on current population estimates. Since the accepted conversion factor of 1.2 was very close to that expected on the basis of wingspread ratios (1.15), no further attempt was made to incorporate a vessel effect into the ADAPT formulation. Retrospective patterns continue to be present in the current assessment, but at much more acceptable levels than were present in the 1980s.

The low 1995 biomass suggested by ADAPT was not entirely consistent with the comments of fishermen, since the latter complain of difficulty avoiding all size classes, not just abundant recruits. However, the comments may stem more from fishing in unfamilar areas while attempting to avoid haddock, than in above average abundance.

Catch projections based on the accepted ADAPT formulation are heavily dependent upon the assumed recruitment. Use of the long-term geometric mean recruitment was discussed and rejected by the WG. The three accepted alternatives were: a) Getz-Schwarzmann model b) q-scaled RV c) Pierre Gagnon's Bayesian model. A modification of Gagnon's model demonstrated that recruitment was not correlated with biomass, but that there were substantial time trends. Therefore, bootstrapped recruitment estimates were derived from the model, both with and without the problematic 1993 population estimate. Projected yields were not heavily influenced by the recruitment value that was used, so both projections were tabled.

Ecosystem Considerations

The condition factor (as measured by predicted mean weight at a given length) declined for both 40-cm and 60-cm 4VsW cod after 1980 and has remained at low levels since. Similar declines were noted for 4Vn cod and 4VW haddock, with or without a 1995 increase. While condition factor appears to have stabilized at low levels for the above stocks, it has continued to decline among 4X haddock on both Browns Bank and the Bay of Fundy over the past 6 years. Plots of Fulton's K (weight/length^3) and observed weight at a given length across years both showed similar trends, indicating that the trends were not just an artifact of the length-weight regression. The spatial distribution of the upper and lower 15 percentiles of condition factor was random, indicating that no particular area of the eastern Scotian Shelf was associated with either high or low condition factors. Although the cause and significance of a low condition factor is debatable, there is no indication of a pending return to the plumper cod and haddock which were observed in the late 1970s.

Consumption of 4VsW cod by grey seals increased slightly in 1994 and 1995, with no apparent decline associated with reduced stock abundance. The long-term proportion of cod in the diet remained stable at about 13%, with no evidence of a seasonal pattern. Use of the more recent seal diet data (to Oct '94) in the model of grey seal consumption increased total consumption by 3% over last year's estimates. Consumption of haddock has increased in recent years, but remains at low levels (about 1% of the diet, corresponding to 1400 t in 1995). Since a large proportion of the small gadoid otoliths recovered from seal stomachs or scats are unidentified, it is possible that the true diet composition is somewhat higher for haddock and lower for cod.

The re-establishment of a capelin population in 4VW in the mid-1980s, associated with the onset of cold water conditions, persisted into 1994 and 1995.

Environmental Issues

A review of ocean temperature conditions indicated that 4VW bottom waters remained cold in 1995, with no suggestion of warming over the past few years. Maps of cod distribution in relation to both temperature and salinity showed no obvious differences from 1994 distributions. The extent of ice coverage onto the Scotian Shelf was about average in comparison to the long term mean.

Cumulative environmental and cod-weighted temperature frequency distributions in the Oct '95 4VsW cod sentinel survey demonstrated that about 80% of the longline-caught cod were captured between 3-6^0 C, while the survey area was relatively evenly distributed across the temperature range of 1-10^0 C. A comparison of the entire sentinel survey and July RV survey environments showed close correspondence in cumulative frequency up to a temperature of 6^0, and only modest deviation thereafter. A comparison excluding the inshore regions not sampled by the RV survey demonstrated that the sentinel environment was somewhat skewed to warmer temperatures (in keeping with a fall survey date). The cod-weighted temperature frequency distribution of the July RV survey showed that most of the RV cod were caught between 2.5^0 and 3^0, although this pattern was largely based on 2 large sets. The tendency for RV cod to be caught in colder waters than those captured with LL gear supports the hypothesis that temperature influences the relative catchability of OT and/or LL gear. A possible mechanism is that of decreased swimming speed by cod attempting to avoid trawl capture in cold water, or increased metabolic and feeding rate by cod caught on LL gear in warm water. One or both mechanisms could be operative. If the catchability of cod by OT gear in cold water is higher than that in warm water, there are significant implications for RV population estimate time series. Therefore, the W.G. **recommends** that this issue be addressed further, perhaps through comparison of LL vs OT temperature-weighted cumulative catch frequencies in other areas carrying out sentinel surveys (such as 4Vn).

MINUTES OF THE FLATFISH, REDFISH, SILVER HAKE, AND MONKFISH WORKING GROUP SPRING (1996) MEETINGS

The FRS Working Group met on 6 February to discuss the availability of data and analyses to be performed for the 1996 RAP. For 1996 the team, and its responsibilities, was modified. The species now to be considered includes 4VW and 4X American plaice, 4VW and 4X winter flounder, 4VW and 4X witch, 4VW and 4X yellowtail, 4VWX3NOPs halibut, silver hake, redfish and monkfish. Yellowtail in 5Z will be handled in the St. Andrews RAP process. Consideration of flatfish and halibut only will occur during the spring RAP. Silver hake will be reviewed just prior to the NAFO meetings in June. Monkfish will be dealt with during the fall RAP; redfish will be reviewed for the fall Rap but in advance of the zonal deliberations. Attendees to the first meeting were Annand, Beanlands, Branton, Fanning, Smith, Stobo (chairperson). A. Herman and B. Petrie were not asked to participate this year since we did not expect to be dealing with any environmental interactions. On 21 March two fishermen (J. Decker and G. Rennehan) participated in the discussions.

I. Flatfish and Halibut Discussions

the working group met on 21 March and again on 9 April to discuss stock status and the Stock Status Reports of flatfish/halibut . At the first meeting, Annand, Beanlands, Branton, Fanning and Stobo were present; and at the second meeting, Annand, Beanlands, Fanning and Stobo.

1. Eastern Shelf and Southwest Nova Flatfish

On the Scotian Shelf, all species of flatfish (excluding halibut) are fished in combined fisheries in NAFO Divisions 4VW and 4X. Unidentified flatfish continue to make up a substantial proportion of the catch, and it was noted that there have been limited improvements in data collection in the context of species identification (ie. catch reporting by Dockside Monitoring (DSM)). The lack of species breakdown makes it difficult to view catch as a potential indication of stock trends. Associated with this problem is the loss of effort data on a species basis because of the 'unidentified' classification. Obtaining accurate catch and effort data by species continues to be paramount to better understanding the dynamics of these stocks.

It was noted that the RV indices of abundance for some species/stocks have increased substantially due to the increased numbers of young fish, but no causative factors were evident. For 4VW witch, it appeared that several cohorts might be involved, for all species, the lack of aging data (i.e. some otoliths are being collected, but not aged) prevented any attempts at age associated analyses, thus we could not determine of the new recruitment is based on single, or multiple, cohorts. Until resources can be found to commence aging fishery and RV samples this situation will not change. Even though the RV length data (1970-1975 summer and 1986-1995 spring surveys) for each species/stock was partitioned into 5cm length intervals to give some indication of size groups, we could not determine if one or more 'pseudo-cohorts' were recruiting in several of the stocks.

It was noted that the fishing vessel buy-back program will result in some 70t of 4VW flounder quota being available to the ITQ committee. Industry has indicated a willingness to use this quota to do a cooperative science-industry survey in the area. Discussions with Industry have been initiated and will be completed after the RAP process. One goal of the proposed survey may address the problem of species composition and catch rate by species.

The increase in small fish (ie. assuming new cohorts) in many species poses the question of possible environmental change improving the survival of new cohorts. It was thought that some type of correlation analysis with other stocks exhibiting change might be worthwhile.

It was noted that the initiative of joint science-industry tagging of flatfish (including halibut) was continuing, but the inability to provide science resources to allow a large scale tagging project will ensure that small numbers only are tagged annually.

It was noted that yellowtail are highly restricted to shallow depths and/or type of bottom, thus the RV index of abundance for this species is probably highly correlated with the proportion of sets in the shallow portions of the strata. An analysis should be conducted to examine the extent to which the number of shallow vs deeper sets could

account for the noise in the abundance trend data; the examination should consider the affect by size groups and consider 4Vs and 4W separately because of the different trends in abundance and size in the two areas.

Since plotting of RV distributions indicates substantial numbers of yellowtail, a portion of which are within the closed area in 4VsW, it was felt that the possible influence of the closed area on yellowtail, winter flounder and halibut abundance should be examined.

2. Halibut

Generally for halibut the low quota and the change in management actions to accommodate this lower quota makes it difficult to evaluate the stock status since most of the normal fishery indices (catch, catch rates, etc) are compromised.

The IOP data were examined as a potential abundance indicator but the use of catch rates from the IOP were deemed not useful in indicating abundance trends because catch rates are less than 10kg/hour and catch rates and catch track each other. They were not examined to see if the by-catch of small halibut might be a useful indicator of recruitment however, and that possibility should be examined. It was also noted that commercial catch rates have been compromised by the 1995 management plans which resulted in a bycatch fishery only for many of the participating groups, the mix of halibut gear and fine (groundfish longline) gear being used with a reduction in the latter, and allocation levels which may have caused an adjustment in fishing activity to reduce halibut catches in mixed fisheries. Half year catch rates were investigated in order to examine more directly the directed portion of the fishery.

It was noted that the Newfoundland data on halibut catches has still not been forthcoming despite attempts to obtain it by Chris. It was suggested that such data may be available on the SPANS database, and Chris will contact Jeff Howell to see if it can be obtained.

In 1996 effort will be made to get industry to collect data on round versus gutted weight in order to review the existing conversion factors used which appear to be at odds with those used in British Columbia and Alaska. Such observations would require the industry to get halibut landed in the round state, an arrangement which may not be possible. A request will also be made to the Observer Program to collect comprehensive data on all halibut caught (length, round weight, otoliths) to address this issue as well as to allow development of a body length to otolith length conversion factor. Such a regression may allow reconstruction of fish lengths by collecting only otoliths or fish heads. A request is also being made to industry to try and get them to collect otoliths for science.

3. General Comment on flatfish/halibut.

It was agreed that expecting one researcher to conduct evaluations of 9 species/stock groups as well as expecting advances in evaluation ability and research knowledge was unrealistic. The need to resolve this situation was universally recognized and it was agreed that advances would be few unless the situation was addressed.

4. Comments from Marine Fish Division RAP review session (17 April).

The MFD field technician in Cape Breton noted that in 4V only witch and plaice are caught; since the more valuable witch catch is specified at dockside, one can assume that any unspecified catch is plaice.

It was suggested that one could use the RV data to estimate Zs for length groups in plaice, and possibly witch (would need to follow the modes in partitioning the number/tow in order to get the data to calculate the Zs).

II. Silver hake Discussions

The working group met on 28 May and again on 3 June to review the status of silver hake preparatory to the NAFO meetings. As agreed, the purpose of the meetings was to discuss the data analyses and suggest additional avenues for presentation to NAFO. It was not intended to produce finalized assessments, nor the associated outputs of the normal RAP; through the NAFO process, the biological advice on stock status would be generated.

In attendance at the meeting on the 28 May was B. Branton, R. Halliday, R. Mohn, M. Showell, S. Smith and W. Stobo and on 3 June, B. Branton, R. Mohn, M. Showell, S. Smith and W. Stobo.

Two prime issues were addressed, standardizing catch rates and the recurrence of a retrospective pattern in the assessments.

In the research recommendations, NAFO had requested that interaction effects in the catch rate series be examined. For the first meeting of the working group, Mark had conducted the STANDAR analysis on the total data, as well as on a reduced set using only the Cuban catch-effort series in 4W in May. The STANDAR method for standardizing catch rates uses an factorial/ANOVA type of linear model applied to log transformed data. The log transformation is used to ensure that the residuals exhibit a normal distribution. As a factorial model, the statistical significance of any factor in the model may be simply due to only one level (one of the months, years, etc.) being significantly different from all other levels of that factor. Statistical significance may also be obtained because of design problems such as imbalance in the combinations each level of each factor with those of the other factors. A balanced design for the silver hake data would have all countries fishing all areas each month of each year in the series. However, not all combinations exist in practice and significant interaction effects could be due to only one COUNTRY fishing only one AREA in any one YEAR. In this case the COUNTRY/AREA/YEAR main effects are aliased because there is no information on determining whether or not the significance of the effect is due to a only a COUNTRY effect, AREA effect or YEAR effect and not the combination of all three. Examination of the diagnostics from the STANDAR analysis indicated that aliasing probably existed and in addition, the normality assumption for the residuals was violated. Steve agreed to look into the diagnostics further and attempt an alternate analysis using a generalized linear modeling (GLM) approach.

At the second meeting, Smith and Showell tabled a draft NAFO SCR document of the re-analysis. Application of the GLM approach to the silver hake data showed that a multiplicative model using gamma errors fit the data quite well. Analysis of each of the factors (COUNTRY, AREA, etc.) accounting for possible aliasing showed that only YEAR was significant. Accepting that the simplest model (ie. YEAR only) was the appropriate way to use the data also meant that potential interaction effects became irrelevant to subsequent analysis. There was some concern expressed that there should be a 'MONTH' effect as well; it was agreed that the lack of that effect could be due to an inadequate quantity of data. Since 'YEAR' appeared to be the most appropriate model, discussion proceeded to the acceptability of using only the raw catch rate data instead of the GLM generated catch rates. The differences noted between the annual catch rates from the GLM model and just using the raw data where due to the method of calculation. For modeling purposes, catch rate for the GLM model was calculated as total catch divided by total effort within each COUNTRY, AREA, MONTH AND YEAR combination while, the raw series was calculated as the total catch divided by the total effort for each year. It was agreed that the raw catch rate series should be presented to the NAFO forum with the Smith and Showell paper providing the rationale for that approach. In brief, the gamma-GLM and the STANDAR results 1) differ very little in parameter estimates - thus could go with either one, 2) using either procedure for catch rate analysis results in differences of less than 1%, 3) the gamma-GLM procedure however provides some statistical structure that allows one to examine the effect of various factors, with no apparent disadvantages.

The retrospective problem in fishing mortality continues to exist with the silver hake analysis, and at a similar level to that observed in previous years. At the first meeting, Bob Mohn's analyses indicate that the problem is largely due to changes in catchability. Analysis of the CPUE suggest that catchability by age changed more dramatically from 1980 to 1985 than since (hence the retrospective problem was more severe pre-1980). Analysis of the RV data indicates a unique pattern of catchability - increasing till 1983/84 then declining through 1988, then increasing again. The analysis indicates that there is not a simple explanation for the problem, nor is there a simple fix. His analysis suggests that prior to the mid-80s, both the CPUE and RV data contributed to the retrospective problem, but in later years it was largely caused by the RV data.

Bob's modified version of ADAPT suggests a precipitous drop to, and persistence of low Fs in the last few years. Mark Showell's analysis of the fishery and Stratis's recent version of ADAPT agreed with that conclusion.

At the second meeting. Bob presented the results of using a dome shaped recruitment pattern and extending the number of age classes in the fishery. He found that a dome shaped recruitment pattern with the truncated age groups increased the severity of the retrospective problem; dome shaped recruitment with increased number of age groups

resulted in a somewhat less severe retrospective problem. Since the evaluation of stock status changes with an increase in age classes, the conclusion that was drawn was that THE DATA ARE NOT STABLE. But it was noted at both meetings that the catchability trend is not very important in the ages that make up the fishery (ie. ages 2-5).

The analyses resulted in some additional conclusions: 1) retrospective analysis shows a linear relationship between current and historical estimates of recruitment; 2) the conversion factor used between the A.T. Cameron and Alfred Needler (2.3) seems appropriate; and 3) there is nothing structurally or systematically wrong in the analyses - the data just don't track the cohorts well.

Although the retrospective problem still exists, and the reason for it has not been resolved, it was agreed that the analyses done and software tools developed should provide an improved ability to quantify the extent of the retrospective problem in future assessments.

It was also felt that there could be some value in examining: 1) the RV data in terms of potential environmental effects to determine if some of the variance in the trend series can be explained; 2) comparison plots of the US Gulf of Maine RV survey and the Cdn 4WX RV survey, to see if the stocks are tracking each other, since the Gulf of Maine stock could be influencing that on the Scotian Shelf; and 3) a regression of the juvenile survey (0 group) data on the RV (age 1) data to see if a significant predictive relationship results, since there is currently no good indicator of recruiting year class size.

Appendix 7. Shark/Skate Assessment Team.

Shark/Skate Assessment Team
Maritimes RAP
Minutes of 9 January 1996 Meeting

Participants: R. O'Boyle (Chair), M. Fowler, M. Showell, P. Hurley, W. Stobo, C. Jones, J. McRuer, T. Hurlbut, J. Simon, P. Comeau

The chairman welcomed the participants to the team. He noted that in 1995, the work in Scotia-Fundy Region on sharks (blue, mako and porbeagle), dogfish, and 4VsW skate had been undertaken by the Community Trends WG. The logic of separating these species out into a separate team was their similar life histories which require a common approach to analysis and management.

The chairman tabled a draft workplan and issues to be discussed. The first issue was that of membership. It had been proposed to involve industry participants. After discussion, it was considered that they should be brought in on issues as and when required. The suggestion to invite Bob Crawford from the NS DOF was endorsed. R. O'Boyle will invite Bob to attend the next meeting. The suggested foreign members will be contacted as and when required. Mike Bailey was recommended by Peter Hurley as the NMFS contact.

Blue, Mako and Probeagle Sharks

Stock Definition

It was noted that there has been a fair amount of tagging work that forms the basis of the current stock units. Wayne Stobo offered to prepare text for the working paper that summarizes this information.

It is important that we document our international commitments re sharks. Julie Porter will summarize the current ICCAT position. Peter Hurley will provide a summary of the work being undertaken by the ICES Elasmobranch WG, while Bob O'Boyle will contact Jim Beckett to obtain information on CITES.

The Fishery

Chris Jones gave an overview of the 5 January Atlantic Large Pelagics Advisory Committee (ALPAC) WG meeting in Montreal. It was very informative and outlined many of the licensing and management challenges of this fishery. He stated that he will strike a separate team, composed of mostly managers but also scientists, to draft management options for this fishery. This discussion paper will be presented to this team for comment and further development. Chris offered to draft a section of the working paper on the management of the fishery.

Bob O'Boyle will follow-up on the discussion on non-tariff trade barriers to Canadian shark products.

Resource Status

The IOP contains data on the blue shark bycatch to the Japanese tuna, and Canadian swordfish fisheries, as well as the directed porbeagle fishery. Mark Showell and Peter Hurley will undertake the analysis of this data, to the extent possible and excluding the Newfoundland information, if the latter is unavailable. Mark Fowler will assist in this analysis.

Canadian logbook data exists for 1991-94. The state of this information is in some doubt. Some of it may be keypunched, some not. The extent of the recording of the raw data is also in question. Mark Fowler and Peter Comeau will undertake an investigation of the state of this dataset.

There are a number of studies on the growth, fecundity and maturity of these shark species. Bob O'Boyle, with the assistance of Peter Hurley, will summarize this information.

Outlook

It is presumed that, due to low fecundity and slow growth, sharks are vulnerable to over-exploitation. This hypothesis will be put to the test by Bob O'Boyle using recent work by Keith Brander. Peter suggested consideration of the dogfish yield model presented at the US 19th SAW as well as the model by the Australian, Terry Walker.

Dogfish

At the beginning of the discussion, it was pointed out that the US 19th SAW had produced a very comprehensive report on SA 2 - 6 spiny dogfish. It was agreed that Jeff McRuer and Tom Hurlbut collaborate to summarize this document and add a Canadian 'spin', particularly information on discarding and survey data. This document is available in the MFD Division Manager's office.

4VsW Skate

It was noted that there were two Science/industry surveys in 1995 that require consideration. Workload of Jim Simon is a constraint, given the haddock aging. It was proposed to defer the main part of the work on this stock until the fall. Notwithstanding this, a stock update is required for the spring RAP. The content of this will discussed at the next team meeting.

Next Meeting

The proposed dates of 1-2 February at BIO conflict with some member's schedule. Therefore, the 7 - 8 February at BIO, starting at 10:30 on the 7th, is suggested.

Shark/Skate Assessment Team
Maritimes RAP
Minutes for 8 February 1996 Meeting

Participants: R. O'Boyle (Chair), M. Fowler, M. Showell, P. Hurley, W. Stobo, J. McRuer, J. Simon, R. Crawford

The chairman welcomed Bob Crawford from the N.S. Department of Fisheries to the team. Chris Jones, Tom Hurlbut, Peter Comeau, and Julie Porter could not attend.

Blue, Mako and Probeagle Sharks

Stock Definition

Wayne provided a summary of the tagging information. The US has had an active program since the early 1960s and has tagged over 120,000 sharks. It was noted that there did not appear to be many publications summarizing this dataset, at least not in the readily available literature. There is a great deal of analysis that could be done with this dataset.

- It was **recommended** that in the summer of 1996, a subset of the team approach the NMFS staff in Naragansett to investigate joint analysis possibilities.

- It was **recommended** that support be obtained to assist in the analysis of this dataset.

While there was some European tagging information, it was relatively limited. For Canada, there is an historical (1961-84) dataset in St. Andrew's.

- It was **recommended** that a computerized copy of these data be obtained by P. Hurley and maintained at BIO.

Peter Hurley provided an overview of the recent tagging he has done in cooperation with industry. While limited, it has the potential, particularly for Porbeagle's, in filling some important knowledge gaps. There was some discussion on the type of tags used. Some suggested adopting the US tag, while others suggested putting shrink tubing on the floy tags. This needs further investigation.

From the presentation, while the situation was not clear, there was support for a North Atlantic Blue shark stock unit, a North West Atlantic Porbeagle stock unit, and North West Atlantic Mako stock unit. Also, there was a clear seasonal movement for all three species - into shoaler waters on the continental shelf in the summer and into deeper waters near the Gulf Stream during the winter.

These movements in Canadian waters were corroborated by monthly distribution maps produced by Mark Showell and Peter Hurley, and displayed on a display system developed by Gerry Black. Hardcopies of these maps will be produced for the Research Document.

Wayne agreed to synthesize the tagging and mapping information into a section on Stock Definition and Movements for the Research Document.

Management

Chris Jones is working on a section for the Research Document and will table this at the next meeting.

Julie Porter provided the chairman with some information from ICCAT on that organization's involvement with sharks. Due to time constraints, this was not circulated or discussed. However, Julie noted that there is meeting of the Shark Working Group (reports to the ICCAT Subcommittee on By-Catches) in Miami on 26-28 February. She will write a section for the Research Document when the report of this meeting is produced.

Bob O'Boyle obtained information from Jim Beckett on activities within CITES. He will provide this to the group at the next meeting. Bob will write a section on this for the Research Document.

The Fishery

Peter Hurley tabled a manuscript that he has produced for the Proceedings of a meeting on sharks that he went to last year. This summarized the activities in the various directed and by-catch fisheries. It was agreed that this will serve as a good starting point for the section in the Research Document on the fishery.

During the discussion, it was noted that the catch data could be presented in a more systematic way to show where the gaps in the information exist. For instance, for each stock unit, a table summarizing the catch by year and country would be a good. This would focus attention on the lack of consolidated statistics for the stock in question. The next table would present the catch of the stock unit in the Canadian Zone, split by year and fishery (commercial versus recreational). This will highlight the problems in obtaining statistics locally. Re the recreational fishery, Bob Crawford offered to obtain whatever information he could with the assistance of Ken Rodman. He will provide these data to Mark Fowler before the next meeting.

The next set of tables would split the commercial catches more finely - into directed (by fleet) and by-catch (by directed species), again by year. With the recreational fishery, a split by anglers, derbies and charter boats would be useful. It was realized that much of the information will not exist. However, adopting this table format will facilitate documentation of the data collection problems of these fisheries.

Mark Fowler presented a first analysis of the 1994 and 1995 landings statistics. He has encountered a number of problems with the regional and ZIF data for 1995 which required follow-up with Jim McMillan. He will do this prior to the next meeting. During the discussion, there were a number of comments about data collection and processing problems in the various fisheries. Mark will systematically investigate and record these problems using the table format outlined above as a guide. It was clear that the data processing systems need to be improved.

- It was **recommended** that, based on a review of current data processing systems, the team document a list of detailed improvements for consideration by line management.

Mark and Peter will produce the section on the fishery for the Research Document at the next meeting.

Resource Status

Mark Showell presented a multiplicative analysis of Porbeagle catch rates in the Faroese directed fishery and of blue shark in the Japanese tuna fishery, based on the observer data. Re the porbeagle analysis, this showed much potential for further analysis. It was recommended that the next analysis combine some of the area and month cells to reduce the model's number of parameters. Also,

- It was **recommended** that the logbook data be used to conduct an analysis using all possible sets.

- It was **recommended** that work be conducted to include size, sex, and the Newfoundland in the model.

The blue shark analysis may be confounded by finning practices over time by the Japanese fleet. Mark Showell agreed to meet with the observers to obtain more information on these practices. Dependent on this, the analysis may or may not be put into the Research Document. If the analysis looks promising, Mark will write a draft section on this analysis for the Research Document for the next meeting.

Bob O'Boyle and Peter Hurley have not gotten together yet on the growth, maturity and fecundity information. They will do this before the next meeting and write a section for the Research Document.

Outlook

Bob O'Boyle presented information on the yield model for elasmobranchs developed by Keith Brander. It was noted that the existing formulation was specific for rays in the North Sea. It will be modified for sharks and skates and tabled as a draft section of the Research Document at the next meeting.

Dogfish

Jeff McRuer provided an update of the work that he and Tom have done. This focused primarily on updating the Research Document produced by Tom for 4T last year. A number of suggestions for enhancement to their document were made, including,

- inclusion of a table of reported landings by country, NAFO Subarea, and year for the whole stock area (2-6). This would highlight the fact that it is one large stock unit.

- documentation of the life stages (recruit, immature male and female, mature male and female) caught in the various areas. This may be a big job for the whole area. The focus should be Canadian waters.

- presentation of the stock area distribution maps from ECNASAP by two or three year time blocks. This will allow identifying any large scale distribution changes.

- compilation of one series of survey minimum biomass for the stock area, with separate series for each of 4T, 4VWX and 5-6. Future analyses could highlight the fact that the survey samples immature females and mature males.

The team agreed that there is no need at this RAP to provide specific harvest advice. The fishery is still developmental and abundance appears high. This will be re-visited at the next meeting.

Next Meeting

While considerable progress has been made, more needs to be done. The next meeting is tentatively planned for all day 7 March at BIO. It is important that team members bring to this meeting relatively complete and finished sections for the Research Document. Bob will compile the shark sections into one report with draft Stock Status Report to be reviewed later in March.

Elasmabranch Assessment Team
Maritimes RAP
Minutes for 13 March 1996 Meeting

Participants: R. O'Boyle (Chair), M. Fowler, P. Hurley, W. Stobo, J. McRuer, K. Frank, R. Crawford, T. Hurlbut, K. Rodman

The chairman welcomed Ken Rodman from DFO Management. Chris Jones could not attend.

Blue Shark

Management

Chris Jones is still committed to producing a section on fisheries management for the Research Document. This will focus on the commercial rather than the recreational fishery.

Ken Rodman gave an overview of the recreational fishery, summarizing the results of discussions with the main industry representatives the day before. It was noted that there will be three types of license in 1996: 1) derby, 2) charter, and 3) personal. The conditions of license of each are still being worked out but will involve training in hook and release, monitoring and data reporting requirements. A section on the recreational fishery management will be prepared by Ken Rodman with the help of Bob Crawford.

The Fishery

Bob OBoyle noted that he had the FAO world statistics on fish catches. He will prepare a section on the catch of blue shark (as well as porbeagle and mako) in the North Atlantic to put the Canadian situation into perspective.

Mark Fowler tabled an analysis of the catch statistics. It underlined problems in blue statistics in both the Canadian (logbook system) and foreign fisheries (IOP observed). After considerable discussion, the team agreed that these problems should be systematically documented and attached as an appendix to the Research Document. A way suggested to do this for the Canadian fishery is to document the fate of the information by each section of the logbook. A number of issues were also noted with the IOP data set.

> **It is recommended that the IOP data for sharks in the Zone be brought together into one, common dataset.**

> **It is recommended that every effort be made to record the extent of finning through the IOP.**

> **It is recommended that the status of the finning observations in the Statistics be reviewed and that conversion factors be used to generate round weight estimates.**

It was pointed out that ICCAT is attempting to document shark bycatch and problems in the Statistics systems here and elsewhere are preventing this.

Mark Fowler will document the number of unique CFVs involved in the fishery for as many years as possible.

Questions were raised about the level of recreational fishery activity in 1995. Peter Hurley noted that were six derbies in 1995, four of which were sampled by MFD. He will prepare a table of the catch information by derby for 1995 (and if possible for 1994) and will give to Mark Fowler for inclusion in the section on the Fishery, which Mark is preparing. Also, what information we have for 1996 should also be included.

> **It is recommended that the historical records by each derby be obtained to develop a time series of catches for these events. Ken Rodman offered to do this.**

It was noted that there were about 20-30 active charter boats in 1995. Information on the number of personal anglers is lacking but could be in the order of 200+. These observations are to be included in the Fishery part of the Research Document.

Comments were made on the recreational logbook that Peter Hurley had prepared last year. It was planned to review this at this meeting. This didn't occur. It will therefore be tabled at a later meeting.

Stock Definition

Wayne tabled his section of the report. The team is to review this and provide Wayne with comments. Peter Hurley tabled monthly distribution maps of blue shark in the Porbeagle fisheries. These will be incorporated into Wayne's section. These maps need to include location of fishing. This will be investigated with Jerry Black. If this cannot be done easily,

> **It is recommended that monthly distribution maps of shark catch be produced that include location of fishing.**

Resource Status

Bob O'Boyle tabled a document that included sections on Reproduction, Growth and Mortality, and Outlook. It was also a template for the Research Document. One of the most important unresolved issues in blue shark, as with the other sharks, is whether or not the reproductive cycle is one or two years.

> **It is recommended that studies be conducted that aid in resolution of the reproductive cycle question.**

Bob noted that he had used the most recent growth model for the Northwest Atlantic. There are a number of others that exist around the world.

> **It is recommended that efforts be made to consolidate these data to facilitate examination of growth dynamics.**

Mark Fowler tabled trends in blue shark catch rates collected by IOP as bycatch to the Faeroes porbeagle fishery. There may be market influences as well as IOP recording practices (this needs to be confirmed with Mark Showell) that make the series unreflective of abundance. If possible, the size composition of these data should be examined. For the Reassert Document, Mark Fowler will report that this analysis was conducted but was not considered to represent abundance trends for the stated reasons. Mark also tabled an analysis of the Japanese Tuna fishery bycatch trends. While a long time series, it too suffers problems - incidence of finning and observer recording.

> **It is recommended that these data sets be more fully investigated to answer the above raised concerns. Consideration should be given to examining ocean climate trends of the shelf to see if these could have affected catch rates.**

Outlook

Bob O'Boyle presented a steady state model for elasmobranchs developed by Keith Brander. It inferred that blue sharks could be more resilient to exploitation than other shark species. A key assumption of the model is the assumed natural mortality on the first age group. Bob will modify the model to investigate this,

particularly in regards to observations of high natural mortality (3.2) for the age. It was noted that the mortality on the older ages may be lower than estimated, similar to the situation in seals.

> **It is recommended that demographic models, such as Leslie Matices, be used to investigate mortality assumptions by age.**

Bob will modify last year's Stock Status Report to reflect the meeting's discussion. In relation to the Outlook section, it will be modified to point out that blue sharks have high growth and fecundity rates, relative to other sharks, and thus may be relatively more resilient to fishing. As well, the utility of the 250t quota was discussed. This is a precautionary level that is not based on biological assessment. The team felt that it needed to be emphasized that regulation of the fishery and its monitoring is more important at this time than the 250t quota. Therefore, it is very important to implement the management plan formulated in 1994 as soon as possible.

Dogfish

Tom Hurlbut and Jeff McRuer tabled two documents on dogfish. These will be presented at the Gulf of St. Lawrence Subcommittee meeting of 18 - 22 March. It was considered that every effort should be made to integrate the Scotian Shelf and Gulf of St. Lawrence information into one document by 23 April. It is planned to have this document and the associated SSR externally reviewed by the 23rd, in time for the Steering Committee meeting of 25 - 26 April. Tom mentioned some possible external reviewers in the US.

There were problems noted with the NAFO data, particularly the lack of recent information. Also, the table on discards needs to be redone to develop estimates of dogfish bycatch in the main, traditional groundfish fishery (cod, haddock, pollock, flatfish).

The status of the sampling in the Canadian Zone is very poor.

> **It is recommended that efforts be made to collect representative samples of dogfish catch. There are some very interesting size and sex specific differences among catches in the Gulf and the Shelf that are indicative of more wide ranging migration by the larger individuals. This needs further investigation.**

There was considerable discussion on the distribution of dogfish in the Zone. The spread of dogfish into the Gulf since 1985 was particularly. The maps generated by the ECNASAP project should be incorporated into the assessment. Concern was raised about the reducing level of US survey sampling. This didn't seem correct and needs to be confirmed.

> **It is recommended that the US and Canadian survey data be combined into one dataset on dogfish.**

This resource has a lot of potential re analyze of population trends. The team will meet later in the summer to discuss some of these possibilities.

Porbeagle and Mako Shark

Bob O'Boyle circulated draft, and incomplete, Research Documents. These could not be reviewed due to time constraints.

Next Meeting

The team will meet at 1300 on 4 April in the Hayes Boardroom at BIO to review the porbeagle documents. Between now and then, all authors are requested to provide Bob with Word 6.0 compatible text for the relevant sections of the Blue shark report.