MSC ASSESSMENT REPORT 2006
PATAGONIAN SCALLOP FISHERY

Assessed against the Principles and Criteria of the MSC

PUBLIC CERTIFICATION REPORT

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CONDITIONS AND RECOMMENDATIONS

CONDITIONS

The continuity of the certification of the Patagonian scallop fishery will depend on the following conditions being achieved within the times specified.

- **Condition 1**

Performance Indicator 1.1.1.3

The population dynamics of the species (including age at maturity, natural mortality, growth, and fecundity) are understood.

Required Action: Within a maximum of 4 years, starting from the certification of the fishery it will be necessary to commence study of the variability of the natural mortality rate for each bed, within each management unit.

Comment: The estimation of natural mortality is the most difficult task in marine resources studies, and any approach is imbued with uncertainty. But this parameter defines population dynamics and the harvesting strategy. An estimate of mortality has been made of the Patagonian scallop derived from an integrated model for the Reclutas bed (Valero, 2002), in addition to a study done by Lasta et al. (2001). The Assessment Team recommends estimating mortality from size structure and age structure of populations within the protected areas of each bed so that by the end of the certification period there is a good understanding of the spatial variation of mortality. Improved estimates of these population parameters will provide more comprehensive data for simulation modelling of the fishery and its management. Given the time span and the possibility of not having new cohorts to follow, it is important to realize that this comparison may not be fully possible or fully comparable within 4 years. Improved estimates of these population parameters will provide more comprehensive data for simulation modelling of the fishery and its management.

- **Condition 2**

Performance Indicator 1.1.3

Appropriate reference levels have been developed for biomass and fishing mortality rate.

Performance Indicator 1.1.6.1

The overall population is at appropriate reference levels.

Required Action: In a maximum period of 1 year from the fishery certification, biological reference limits must be established based on the resource biology, regarding biomass and fishing mortality rate. Limit reference levels for each bed in each management unit (to be considered in management decisions) will need to be initiated within the current certification period.

Comment: The use of a rotational management strategy overcomes many of the difficulties associated with a traditional fishery. Rotational fishing strategies in scallop fisheries have been modelled (see Breen and Kendrick, 1997; Hart, 2003).

- **Condition 3**

Performance Indicator 1.1.5.3

The assessment, including any assumptions, has been appropriately tested by simulation or other methods and considers uncertainties which are reflected in management advice.

Performance Indicator 1.1.5.4

The assessment evaluates the consequences of harvest strategies and evaluates the status of the fishery relevant to reference levels.

Performance Indicator 1.1.6.1

The overall population is at appropriate reference levels.

Required Action: Within a maximum period of 4 years from the fishery certification, the precision of the estimates in the stock evaluation must be improved, taking into account the uncertainty of the initial data and testing of the sensitivity of the results. Development of the possible changes in exploitable biomass, relative to the catch strategy currently applied, under different fishing scenarios will be analyzed within the current certification period. For example; simulation modelling of rotational fishing with existing growth mortality and recruitment parameters (see Breen and Kendrick, 1997) and the long term sustainability of the fishery evaluated (see Hart, 2003).

Comment: Although biomass estimates are precise, the estimate of catch from landed meat weight by a single estimate of meat weight-green weight conversion coefficient, is very imprecise and has no estimate of variability. Precision of catch estimation should be investigated and improved methodology developed. The consequence of the present harvest strategy can be evaluated from only 6 years catch data, so simulation studies must be initiated to evaluate their effects over long

periods with different scenarios to test sensitivity to assumptions made and imprecision of parameter estimates.

- **Condition 4**

Performance Indicator 1.3.1

There is adequate information on the population structure and reproductive capacity of the resource.

Performance Indicator 1.3.2

The age/sex/genetic structure of the resource is monitored to detect significant impairment of reproductive capacity.

Required Action: Within a maximum period of 1 year from the fishery certification, the relative fecundity per size or weight must be established for each bed, and within a maximum period of 2 years from the fishery certification, a study on the oceanographic variables involved in relation to recruitment must commence. Additionally, within a maximum period of 3 years after the certification of the fishery correlation over time with the changes in size, age and sex structures of each bed, must commence in order to evaluate the impact of the fishery on the reproductive capacity of the stock.

Comment: No relationship has yet been established between local stocks and recruitment in populations of Z. patagonica, and little relationship has been found between parental stock and recruitment in scallops in general. Hence “conventional wisdom” tends to dismiss the importance of a stock-recruitment relationship in scallops with most variation in recruitment being attributed to effects of environmental variation on larval mortality and settlement. Nevertheless, McGarvey et al. (1993), found egg production was correlated with recruitment in two Georges Bank populations of Placopecten magellanicus and this correlation was stronger and held more widely among other populations when egg production of older (larger) scallops alone was considered. They concluded that the two scallop populations may be reproductively self sustaining stocks. Furthermore, recent modelling of larval

dispersal in the Caribbean concluded that marine populations must rely on mechanisms enhancing self-recruitment rather than depend on distant 'source' populations (Cowen et al. 2002). There is sufficient doubt about the relationship between stock and recruitment in scallops to make investigation of fecundity of Z. patagonica a sensible precautionary approach to management of this new fishery. The fecundity data will provide input to simulation models of the fishery and its management.

RECOMMENDATIONS

The Assessment Team considers it necessary to make some recommendations that are not obligatory requirements but which could improve the performance of the fishery against the MSC Principles and Criteria. The ways to achieve these recommendations and the times required remain the judgement of Glaciar Pesquera S.A., and INIDEP the research organization involved in the development of this fishery.

Performance Indicator 1.1.1.2

The life history of the species is understood.

Performance Indicator 1.1.1.6

Information on the relationship of recruitment to parental stock is understood.

Recommendation 1.

To continue with studies on the requirements for settlement and commence studies on morphology and larval development. To study the rate of settlement, for example by means of measurement of the prodisoconchas and the environmental factors that govern the recruitment of the species. These studies will contribute to knowledge on the factors affecting larval settlement and, therefore recruitment intensity, which is important for prediction of production from the different beds. It is difficult to firmly establish the stock-recruitment relationship for this species. There are a number of factors involved, but it is necessary to identify these. The uncertainty of reproductive

success mediated by environmental variability may also make the relationship between fecundity and recruitment more difficult to unravel but other scientific investigations suggest it is likely to prove important (see notes on Appendix IV, Assessment Team rational for points raised by the Peer Reviewers, Performance Indicator 1.1.1.6).

These data will provide input in simulation modelling of the fishery and its management.

Performance Indicator 1.1.2.1

Fishery removals are recorded/estimated (including landings, discards and incidental mortality).

Recommendation 2.

Carry out estimations and keep registers of incidental mortality during the different fishing activities as a consequence of recapture and discard of juveniles or the process of cooking juveniles fixed on the shells of commercial size scallops that are processed.

This will permit understanding of the fishing activities which cause significant mortality of juveniles that currently are not taken into account for evaluation of the impact of fishing on the stock at population level, nor for the estimation of allowable catches. These data will provide input in simulation modelling of the fishery and its management.

Performance Indicator 1.1.2.6

Selectivity is known for the fishery (including incidental catches).

Performance Indicator 3.2.2.1

The fishing gears, methods and practices suitable for harvest of the target species have been examined with regard to their adverse impacts on habitat (especially in critical or sensitive zones), their rates of capture of non-target animals and incidental

impacts on target animals. The gears with least impacts and non-target catches are used and/or prevented by other management measures.

Performance Indicator 3.2.7.2

The operations of the fishery are conducted so as to minimize (to the degree practical) the mortality of discarded non-target catch. Fishermen and others in the industry take reasonable measures, beyond the formal management requirements, to minimize such mortality.

Recommendation 3.

The selectivity of the fishing gear (otter net) could possibly be improved using large square mesh to evaluate whether the by-catch of other invertebrates, juvenile scallops and non living material could be reduced.

Performance Indicator 1.1.5.1

There is a scientifically-rigorous stock assessment methodology that is relevant to the biology of the target species and the nature of the fishery. The assessment uses all available relevant data.

Recommendation 4.

Initiate studies on the application of analytical models and elaborate conceptual and quantitative models that permit demonstration that the management methods applied to the fishery are appropriate (without substantial changes in the biomass and capture), integrating survey evaluations with the commercial fleet data on an appropriate map. Periodically evaluate the F value stipulated. This recommendation aims to predict yields in different fishing scenarios in order to apply management actions which contribute to the sustainability of the fishery. The use of a rotational management strategy overcomes many of the difficulties associated with a traditional fishery. Rotational fishing strategies in scallop fisheries have been modelled (see Breen and Kendrick, 1997; Hart, 2003). Similarly, the use of predictive models for rotational fishing as it was applied to the P. magellanicus fishery (See Hart, 2003) should be investigated.

Performance Indicator 1.3.2

The age/sex/genetic structure of the resource is monitored to detect significant impairment of reproductive capacity.

Recommendation 5.

Study the genetic structure for each bed with the objective to determine the source-sink relationship and its correlation with the fishing activity. This will allow application of protection measures or creation of no-take zones, with the aim to maintain the genetic diversity of the stock and improve the settlement of larvae in the different beds.

Performance Indicator 2.1.1.2

The habitat requirements of the target species, in particular the settlement habitat of juveniles, are known.

Recommendation 6.

Initiate studies to establish if the primary settlement occurs on the shells of the adults or if the presence of juveniles is the result of secondary settlement from another substrate.

Although bushy bryozoa and hydroids have not been recorded in fishery-trawl or survey-dredge bycatch, many of the echinoid groups present in the bycatch feed on bryozoa in other areas hence bryozoa and hydroids may be more important in the benthos than their representation in the bycatch suggests. Fishing is likely to destroy emergent bushy bryozoa or hydroids more rapidly than other benthos (see Collie et al., 1997; 2000). If primary settlement of scallops is on such filamentous substrates in Argentina as it is elsewhere, then fishing by reducing this substrate will have an effect on recruitment. If primary settlement is on the shells of adult scallops alone, the removal of adult scallops by fishing will likewise affect recruitment and fishing mortality will operate equally on cohorts of small juveniles as well as adults.

If primary settlement is on filamentous substrates, fishing gear could be modified to reduce its impact on the seafloor and damage to filamentous benthos and help sustain recruitment. If primary settlement is on adult scallops recruitment will probably be best sustained by rotational fishing that maintains high adult populations locally.

Performance Indicator 2.1.1.3

Information is available on the position and importance of the target species within the food web.

Recommendation 7.

Quantitatively study the ecological relations in the benthic community. Scallops dominate biomass and production in the benthos. Gut contents show they ingest mainly diatoms and some dinoflagellates. Investigation of gut contents of other suspension feeders could identify whether they are competing for the same resource and investigation of the isotope signal of carbon in scallops (adults and juveniles) and the other suspension feeders could show the proportion of benthic and plankton algal production and plankton.

These data can be modelled to develop an understanding of how present fishing is likely to indirectly alter benthic energy flow and dynamics and how management can minimise the effects on the food web and productivity.

Performance Indicator 2.1.1.5

There is information available on the recovery rate of the ecosystem from fishery related impacts.

Recommendation 8.

Annually tabulate the quantitative data from the by-catch collected for each bed, by the On Board Observer Programme and the research surveys, comparing these with the 1995 data base. Compare the quantitative by-catch data obtained from the

trawls in fished areas with those obtained from trawls in non-fished zones within the same bed, which are collected in the annual research surveys.

The testing of these data will show whether benthic habitat regenerates in the absence of disturbance by fishing. Regeneration of benthic habitat on fishing-disturbed-seafloor is linked to increasing productivity of fisheries on this habitat (Cranfield et al., 2001).

Such habitat regeneration is likely to follow a succession that is partly determined by distance from sources of propagules and partly by period without disturbance hence habitat recovery can be facilitated by rotational fishing (Cranfield et al., 2004). If benthic habitat does recover here, analysis of the data will be useful in determining length of rotation cycle and sizes of areas and usefulness of MPA's in a rotational fishery management plan.

Performance Indicator 2.1.3.1

Information is available on the nature and extent of the non target species caught, or otherwise killed, by the fishery. This includes all non target species – invertebrates, fish, mammals, reptiles, birds etc.

Performance Indicator 2.1.3.2

Information is available on the extent and survivability of the discarded by-catch.

Performance Indicator 3.2.1.3

Catch levels are set to prevent significant capture of non-target species.

Performance Indicator 3.2.7.2

The operations of the fishery are conducted so as to minimize (to the degree practical) the mortality of discarded non-target catch. Fishermen and others in the industry take reasonable measures, beyond the formal management requirements, to minimize such mortality.

Recommendation 9.

Estimate the biomass of the non-target species for each systematic group and for each bed, each year, and evaluate the annual changes. Experimentally estimate the

discard mortality for the principle species in the by-catch and consider it in the management system.

One aim of the fishery should be to reduce mortality and bycatch of non-target speciesso benthic habitat is less modified, trophic webs preserved and the productivity of the fishery maintained (see Cranfield et al., 2001). Discarded bycatch is a major problem in fisheries world-wide but this figure could be reduced by 25 to 64% by modifying fishing gear (Hall and Mainprize 2005; Harrington et al., 2005).

The components of bycatch, mechanisms of their capture and their subsequent mortality need to be measured so improvements can be measured in investigations of methods of reducing bycatch and bycatch mortality.

Performance Indicator 2.1.4

Strategies have been developed and implemented within the fisheries management system to address and restrain any significant negative impacts of the fishery on the ecosystem.

Recommendation 10.

In addition to tabulation of the biomasses of by-catch for each group, each year (Performance Indicator 2.1.1.5, and 2.1.3.1), it is necessary to evaluate the usefulness of the fragile, long-lived species, which could suffer damage from the fishing gear and classification methods, as indicators of the impact of the fishery on the marine habitat.

The echinoids are long-lived species (Bremec and Echeverria 2005) and are frequently found in the by-catch of the fishery (Bremec et al., 2003). Because of their fragility they are very sensitive to all fishing activity around the world.

By focussing study of the effects of fishing on especially fragile benthic species, deleterious changes in the benthic habitat can be more rapidly identified and improvements can be more rapidly identified and enumerated in investigations ofmethods of mitigating these effects.

Performance Indicator 2.1.5.2

The impacts on ecosystem structure and function from removal of target stock(s) are known.

Recommendation 11.

Study the consequence of removal of target species on ecosystem structure by modelling the energy flow. This recommendation is linked to recommendation 11.

Performance Indicator 2.1.5.3

The impacts on ecosystem structure and function from removal of non-target stocks are known.

Recommendation 12.

Compare the benthic by-catch from reserve areas within each bed with those from fished areas and analyze systematic changes; and in particular, study how the recruitment of the species dependent on scallop shells for settlement have been affected.

Modelling energy flow through the benthic ecosystem will indicate the relative importance of each species and how the trophic web is likely to be affected by fishery removals of different species. These studies should be used in mitigation studies of the effects of gear modification and use of rotational fishing to let benthic habitat recover and maintain productivity of the fishery.

Performance Indicator 2.1.5.4

Fishery impacts on habitat structure are known.

Recommendation 13.

Consider a more extensive use of video cameras to investigate the role of the scallops within the structure of the benthic habitat.

Remote underwater video allows direct observations of the effect of fishing on the benthic habitat in addition to the indirect studies analysing changes in bycatch. Observations of trawls in operation have shown that visibility on the seafloor allows

capture of good images and use of a high resolution camera should enable specific identification of benthos. More extensive use of this system could allow direct comparison of fished seafloor, seafloor in reserve areas that has been fished and unfished reserve areas so giving direct evidence of fishery impacts on habitat structure.

These observations can be applied in modifying fishing gear to reduce its impact on the seafloor as well as directly testing the effect of rotational fishing on seafloor habitat.

Performance Indicator 3.1.7.1

Adequate funding is provided for management.

Performance Indicator 3.1.7.2

Adequate funding is provided for research.

Recommendation 14.

Study the need for increased budgets for management, control (authorities) and scientific research for regular presentation to the relevant authorities.

Communication of results in this fishery is good but one of the issues identified by the team was the lack of opportunity and lack of budget for scientists to brief management, control authorities and fishers in plain language the results and implications of their research. Facilitation of this communication will result in more cohesive management and greater understanding of its importance.

Performance Indicator 3.2.5

The management system has considered no-take zones as a means to control exploitation.

Recommendation 15.

Analyze the usefulness of the current reproductive and experimental reserve areas, the necessity for relocation and/or establishment of new ones. No-take zones already exist in this fishery. Their effectiveness in excluding fishing, providing unmodified

areas of seafloor for benthic comparisons with fished areas, and effectiveness in providing local sources of scallop larvae and propagules of other benthos, and the optimum size should be evaluated. These data can then be utilised in establishing new closed areas within the rotational fishing management regime to optimise production of the fishery.

Performance Indicator 3.2.7.1

The operations of the fishery are conducted so as to minimize (to the degree practical) the capture of non-target animals, particularly those which cannot be released alive.

Recommendation 16.

The fishery undertake systematic trials measuring the effects of fishing operations on catch of scallops, size range of scallops and quantities and composition of bycatch and use this information to agree on long term gear modifications.

Performance Indicator 3.4.2.4

The management system is subject to periodic external reviews.

Performance Indicator 3.4.2.5

The management system responds to the results of assessments and reviews.

Recommendation 17.

Study the feasibility for and adoption of better external reviews of the management system and the incorporation of the results obtained in decision making.External reviews of the management system are important because they provide for regular objective overviews of how the system is performing and can more readily identify areas in which performance can be improved. In one sense the MSC certification process has provided a major external review and the next review 4 years out will do the same again.


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