Surveillance Report
South Georgia Patagonian Toothfish Longline Fishery

Certificate No.: **MML-FC-003**

Moody Marine Ltd.
May 2006

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1.0 GENERAL INFORMATION

Scope against which the surveillance is undertaken:

MSC Principles and Criteria for Sustainable Fishing as applied to South Georgia Patagonian Toothfish Longline Fishery

Species: Patagonian Toothfish *Dissostichus eleginoides*

Area: Around the island of South Georgia and the associated plateau to the west around Shag Rocks, within the Government of South Georgia and the South Sandwich Islands (GSGSSI) 200 nm Maritime Zone. The fishery falls within CCAMLR sub-area 48.3

Method of capture: Bottom-set longlines.

Date of Surveillance Visit:	**GSGSSI: 21-25 August 2004** **MRAG: 30 September 2004**			
Initial Certification	**Date: 22 March 04**		**Certificate Ref: MML-FC-003**	
Surveillance stage	**1st**	**2nd**	**3rd**	**4th**
Surveillance team:	**Lead Assessor:** **A Hough** **Assessor(s):** **J Rice, J Cooper, P Medley**			
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2.0 RESULTS, CONCLUSIONS AND RECOMMENDATIONS

This report contains the findings of the second surveillance cycle in relation to this fishery. Accordingly, most findings relate to compliance with the Conditions of Certification set out in the certification report and the issue of Chain of Custody. As conditions are closed out (i.e. actions are completed), the assessment focus will concentrate on the overall ongoing operation of the fishery in relation to the MSC Principles and Criteria.

Following the first annual surveillance, Conditions 5, 6 and 7 have been closed. Where appropriate, issues associated with these are now considered as a part of the overall fishery management.

Information has been collected principally from the Government of South Georgia and the South Sandwich Islands (GSGSSI), their consultants, MRAG and industry representatives.

Item	Comments
0	**Entry of South Georgia Patagonian Toothfish Products into subsequent Chain of Custody schemes**
Activity assessed	As reported following the first annual surveillance, a system has been established by GSGSSI to allow tracking of fish from the certified fishery for members of the GSGSSI Group Chain of Custody Scheme. Moody Marine was satisfied that appropriate procedures are in place to ensure product so labelled originates from the certified fishery and is in a form appropriate for future traceability. Various techniques are also now available to ensure ongoing verification of product provenance. Accordingly, the above Group Scheme is appropriate for certification and contains precautionary measures appropriate to the value and sensitivity of Patagonian toothfish product. The Fishery certificate has been re-issued as a joint fishery/chain of custody certificate. To reiterate the key elements of the scheme, Group Members must comply with the following: • Inspection of vessels, at designated ports, prior to commencing fishing operations • Automated labelling of all boxes of toothfish product to a pre-set specification, detailing all relevant aspects of capture and box contents • Daily uploading of product data onto a central database • Inspection on cessation of fishing operations, including weighing of total catch and sampling of box labels and contents
Observations	The Group Scheme will be operating again over the 2006 season, all licensed companies have joined the scheme and it is anticipated that 'MSC certified' product will be sold in late 2006.
Conclusion	The Chain of Custody Group Scheme operated by GSGSSI continues to meet the requirements of continuing Chain of Custody for product leaving the fishery. The measures implemented function to a higher degree of control than previously with logistical improvements to the scheme.

1	**Condition of Certification 1: Ongoing Surveillance**
Activity assessed	The fishery shall be subject to annual surveillance visits by Moody Marine. This surveillance will specifically include the following issues: • determining that catch limits for sub-area 48.3 continue to be set to achieve long-term management objectives that are at least as precautionary as those that are currently used when determining catch limits and that catches do not exceed catch limits by an extent that would have a long-term negative impact on the probability of sustaining the population • the planning and execution of research focussed on achieving a better understanding of the impacts of the toothfish fishery. The initial focus of this research should be as set out in the following conditions. As research into the impacts of toothfish fishing are discussed in specific detail below, this section deals with catch limits, catches and effects upon the sustainability of the affected population.
GSGSSI Progress Report	Arising from Condition 7, in 2005 one IUU vessel (*Elqui*) was discovered fishing north of Shag Rocks prior to the fishery. Its total catch was 23 tonnes round weight. This was reported to CCAMLR prior to the fishing season and counted by them against the TAC. Furthermore, GSGSSI allocated quota to licensed vessels only up to the TAC minus the IUU catch. The vessel was subsequently arrested, tried in Stanley, Falkland Islands, and fined £250,000. The fine was not paid, and the vessel was sunk in October 2005 in Falkland Island waters. The UK has been examining the assessment method for toothfish since 2004. The detail of this examination was reported last year. In 2005 we further developed the stock assessment methodology and presented an integrated analysis using CASAL (copyright NIWA). This approach uses 4 data sources: capture length frequency, mark-recapture, CPUE and survey-derived recruitment data. It was endorsed by CCAMLR (WG-FSA 2005 Appendix G). Our independent tagging study of toothfish indicated that the stock size in 2005 was practically identical to the stock size in 2004. A detailed, model-based investigation of the effects of low movement rates in toothfish on the modified Petersen mark-recapture estimates of population size demonstrated that current distributions of tag and recapture effort do not lead to major biases in the estimates of population size. Significant progress was made this year in confirming and refining the parameter estimates used in assessment models. This included the first survivorship experiment conducted on toothfish. The current best estimate of toothfish population size shows that SSB remains above the target reference point (50% of Bo). The catch limit for 2006 was calculated using a conservative estimate of growth rate and a lower natural mortality than has previously been assumed for toothfish. Because a full range of options had not been calculated by the Fish Stock Working Group the Scientific Committee calculated the precise level of TAC by interpolating between two calculations made by the working group (the first with low M and the second with low L_{inf}). This resulted in the TAC of 3556 t. Subsequent runs of the CASAL model with both low M and low L_{inf} combined suggest that the TAC could have been slightly higher than this, around 3700 t. Thus the TAC this year is somewhat conservative. Other indicators from the fishery are good: the decline in CPUE has slowed since catches were reduced three years ago, and the upward trend in mean weight caught continues to increase. The management measures taken last year – to close the western shag rocks area, and to re-distribute some effort from shag rocks to South Georgia – were implemented effectively. It should be noted that future planned work for this assessment includes multi-fleet and two-sex models. The model itself uses a Bayesian framework, and final sustainable catch levels are determined from the MCMC runs. The model puts relatively little weight on recruitment and CPUE indices, and most on the well estimated length frequency data (upwards of 10,000 animals are now measured each year by observers) and the mark-recapture data. Thus the work that has been undertaken has largely now answered the criticisms of the assessment and

	objection panel teams, which led to Recommendations 1, 2 and 3 of the original certification report.
Observations	The CASAL assessment model is an improvement over the GY model used previously (and clearly better than the competing ASPM model). The model has been able to explain the observations based on length compositions and mark-recapture well, but is unable to fit to recruitment index data and early CPUE data. The sensitivity analyses suggest results are robust. There is scope for continued improvements, although it is not clear that any model will be able to explain all observations. Considerable work has been put into the (on-going) mark-recapture experiment and estimating the relevant parameters. This appears to be an excellent source of information on the stock. Given the potential problems with CPUE monitoring, the older reported data may not be a useful index of stock size. Therefore a lack of fit to the early data is not critical and may not be achievable. The error variance in this part of the series appears (subjectively) much higher. The lack of fit with the recruitment series is slightly more worrying. The assessment model appears to show fixed recruitment with little fluctuation. In contrast, the index appears to show some change. For example, the 1993 the recruitment index value indicates recruitment would be twice as high as any other year and the standardised CPUE also shows a similarly high value in that year. Overall, the recruitment time series seems fairly well behaved and contains a signal which could represent varying recruitment. The CPUE and recruitment index signals are clearly not compatible with the length frequency and mark-recapture data and could indicate a problem, and this has been raised by the CCAMLR review. The length frequency and mark-recapture data are thought to be the most reliable by the scientists, and should provide the basis for current catch limits. Further development of the model and assessment are required. The TAC is conservative and precautionary. Given the concerns of some members of the CCAMLR working group that the model may tend to overestimate biomass, this is appropriate. It is important to note that IUU catches are being taken into account both in the assessment and in setting the catch quota. The results show some evidence that management is able to control the fishery. Reducing catches should produce a corresponding response in the fishery monitoring data. With increasing mean size and stabilising catch rates, preliminary results suggest this to be the case. Unfortunately good control over the fishery will not produce good contrast in the data, so indices such as the CPUE should have very little information to fit the model. This will make the tagging experiment data more important and it may be necessary to repeat experiments in future.
Conclusion	The assessment scientists have a model that is consistent with the data they believe is most reliable. The model indicates the stock is close to the target reference point. The catch quota is being set consistently with the model, taking into account the uncertainties. It may prove impossible to find a way to explain all observations in every time series of data. However, the work demonstrates active research and improvements in the integrated assessment proposed by CCAMLR, and increasing confidence that the stock is in a good state. Ongoing surveillance audits shall, of course, continue through the duration of the current certification.

2	**Condition of Certification 2: Confirmation of Stock Identity**
Activity assessed	Existing studies shall be reviewed and, where necessary, extended in order to demonstrate that the toothfish stock at South Georgia is sufficiently discrete that locally implemented management measures alone should be sufficient to ensure the sustainability of this stock. This is to include the following: • To review existing studies and where necessary commission supplementary new studies, on genetic characteristics of toothfish populations • To review existing studies and where necessary commission supplementary new studies, involving the tagging of toothfish to determine movement out of South Georgia into adjacent areas. Similar studies involving toothfish populations in neighbouring areas of the South Atlantic should be initiated so as to provide information on any migration into South Georgian waters On the basis of genetic and tagging studies, to examine various scenarios of mixing of adult and/or juvenile toothfish and the implications of this for the sustainability of the stock **Timescale**: Existing studies should be fully reviewed, supplementary studies identified and scheduled, and an estimation of the implications for stock sustainability carried out within 12 months of certification. Additional studies to address any areas of uncertainty should be carried out over appropriate timescales as agreed with the assessment team. The assessment of the implications of such studies for the sustainability of the stock should be reviewed as information becomes available. This will be a subject addressed during annual surveillance audits. **Note**: The words "to demonstrate" in the first sentence of Condition 2 shall be interpreted to mean that stock identification studies will be reviewed and, where necessary, extended in order to determine the degree of stock discreteness and level(s) of mixing with other populations. Ongoing certification will be considered in light of the results of these studies.
GSGSSI Progress Report	Tagging and genetic work has continued over the past year. Some 8096 toothfish have now been tagged at South Georgia. No new records of recoveries anywhere around South America or elsewhere in the Antarctic have been made. Tagging will continue. One UK vessel fished around the South Sandwich Islands (Subarea 48.4) in July, 2005 in accordance with CM 41-03. During this time 42 fish were tagged in order to start a mark-recapture programme to assess the toothfish population. Genetic samples were also taken but have not yet been analysed. Fish tagged at South Georgia were not detected. CCAMLR has approved a UK proposal to conduct a detailed mark-recapture experiment, taking 100 t each year, from the northern part of Subarea 48.4. Genetic work has continued, confirming the results reported last year. This year we also analysed samples from Chile, using partial sequences of the mitochondrial 12S rRNA gene. The results indicate that the samples are indistinguishable from those analysed from the Falkland islands and therefore differ significantly from the SG samples. Therefore our previous conclusion holds that there is no, or very little, effective mixing of migration between South Georgia and South American populations. Last year, we submitted an initial estimate of the effects of mixing to address the condition requirement to "examine various scenarios of mixing of adult and/or juvenile toothfish and the implications of this for the sustainability of the stock". We concluded that it might lead to an increase in effective natural mortality of less than 1%. This remains our conclusion in the light of the above results. In the light of the above results, we request that the value of continuing this condition be reviewed. In the case that Moody agrees with us that this condition has now been satisfied, we will in any case continue to submit information on the GSGSSI tagging programmes in Subarea 48.3 and 48.4 as part of annual surveillance reports.
Observations	The continued research and publications on stock structure and stock identification remains relevant to the condition and of high scientific quality. The numbers of tagged fish is now large enough that with current exploitation rates sufficient numbers of recaptures can be

	expected such that the results can provide insights into movements and mixing within the SGSSI area, and between that area and other areas. The biochemical genetic work also continues to result in high quality publications using methods that are near or at the state of the art. The tagging and genetics results are all consistent with the current approach to management of the stock. Although some of the results suggest toothfish in SGSSI might contribute to other stocks of toothfish (the Chilean tag recovery and some of the genetic results suggesting there may be linkages "downstream" to the east into the Indian Ocean), the rates of "loss" from the SGSSI population are certainly low enough to justify managing the SGSSI population as a functional stock for management purposes. ("Loss" is placed in quotes because *if* this is a true genetic flow from SGSSI eastward, the movement may occur at ages/sizes of toothfish that are younger/smaller than the ones contributing to the recruitment estimate to SGSSI, and hence not constitute a "loss" of individuals from the assessed population.) The biological basis for managing the SGSSI population as a "self-contained" stock is at least as well established as is the case for the large majority of managed fish stocks globally - where "self-contained" does not mean absolutely isolated, of course. Moreover, what evidence there is of linkage between SGSSI and toothfish elsewhere suggests that if anything, SGSSI is a donor population to others, and not a sink. All the more justification for assuming that demonstrably sustainable management of this stock can justify certification – good management of SGSSI cannot be undone by poorer management elsewhere, but there is some chance it may even provide some degree enhanced benefits to other stocks. Rather than showing that the SGSSI toothfish are part of a much larger stock complex that must be managed on a scale much larger than the SGSSI EEZ, the tagging results, especially, are suggesting that there may be some internal structure within SGSSI. This is quite tenuous at this point, and the age-depth migration is far more important to management than the degree of movement among the various areas within the EEZ. However, again the efforts by management to apply some spatial management within the EEZ are appropriately precautionary. If there is some degree of stock structure within the EEZ, the efforts to distribute fishing effort within the area to match estimates of local stock structure should accommodate that well.
Conclusion	Results are excellent both in relevance to the Condition and in scientific quality. The suggestion by the fishery & scientific advisors that it may be time to consider this Condition fulfilled is noted. However, it is also noted that there is a PhD student currently engaged in research on genetics of at least the SGSSI toothfish stock, and possibly some adjacent ones as well. Results of this student's progress seem to comprise part of this Progress Report, and confirm the current approach to stock management. However, given that this student is still collecting and analyzing information, is seems strategically unsound to drop the condition when a major research project is still in progress. Moreover, the tagging has to continue because of the role of mark-recapture estimates in the assessment, not just as a tool to shed light on mixing. It would be undesirable for the Condition to be closed now, and then later results of the PhD research raise new questions about the stock identity, that we would all have to reconsider. It is agreed that surprises which undermine current management are unlikely, given progress to date. However, future progress reports will report on progress of the PhD student, and summarize tag returns, until the PhD student has completed work. Once all those results are in, pending no major changes in findings, the Condition can be considered closed.

3	**Condition of Certification 3: Continuing Monitoring, Control and Surveillance**
Activity assessed	The surveillance, monitoring and associated measures required to achieve certification should be maintained or improved (e.g. through improved/increased surveillance or proven effects of Catch Documentation Scheme). Improvement should include for the development of verifiable indicators of IUU activity in order to provide data for modelling of the extent and effect of IUU fishing.
GSGSSI Progress Report	Compliance by licensed vessels was generally found to be good. All eight of the longliners passed the pre-season licensing inspection. Seven were also inspected midseason and only one problem was identified where a vessel was operating with a shortened streamer line. Monitoring by the observer confirmed that no bird entanglements had occurred as a result. The other event of note was the interception and arrest of the unlicensed longliner, Elqui, which has been covered in section 1. Surveillance has continued at the same or higher rates than were present in 2002 and 2003.Air surveillance has also been provided by routine RAF flights on marine patrol. So far 8 such air patrols have taken place. The advantages of aerial surveillance are clear in terms of increased coverage and providing intelligence for directed operations for the FPV.
Observations	The level of surveillance by fishery patrol vessel continued to increase between 2004/05 and 2003/04, markedly so in comparison to earlier years. This has coincided with the successful interception of the IUU vessel Elqui, which was later deliberately sunk following a successful conviction. It is noted that limited information on air surveillance is given due to the sensitivity of this information. The interception of the Elqui with a recorded illegal catch of 23 t was considered by the CCAMLR subgroup which reviews results of the model of possible levels of IUU fishing and estimates of the potential impact of the catches from such fishing on exploitation of toothfish. That model is designed to estimate the IUU catch attributable to a fishing vessel that has been detected by a fisheries patrol vessel, but for which the actual catch was not observed. The fact that the original interception was not by fisheries patrol vessel means that the model used by CCAMLR to estimate IUU catches does not apply directly, and the catch was recorded directly, so it did not need to be estimated. The Subgroup did consider modifications to the model, but the modifications were related to ways to treat uncertainty in the model parameters, and uncertainty in the estimate of catch due to IUU fishing that was to be accommodated during setting of the TAC.
Conclusion	The observed catch by the unlicensed vessel Elqui appears to have been accommodated correctly in the overall management of toothfish in 48.3. The value was used directly in adjusting the quota available to licensed vessels, to keep the total catch below the estimated sustainable level. The observation was uninformative about the accuracy of the model, as the conditions under which it was taken are not the conditions for which the model was designed. However, the observation was not inconsistent with the types of assumptions structured into the model, suggesting that although there may be room to improve the model, this observation does not suggest that model structure or parameters are seriously in error. Moreover, given the level of surveillance in SGSSI, if the model is basically correct, the actually IUU catch other than that taken by the Elqui and accommodated in management would have to be quite small. In a worst case scenario given the level of surveillance, only very short visits to the area by unlicensed vessels would be missed by the fisheries patrol vessels, and these would result in low catches. The level of surveillance is sufficient to meet the conditions for continued certification. The outline information presented on sea and air patrols should continue to be provided in future annual reports to confirm conditions for continued certification are being met or exceeded. Information should also be provided on any interactions with IUU vessels and/or with IUU lines found at sea.

4	**Condition of Certification 4: Impacts of fishing on rajid populations**
Activity assessed	A strategy (or research plan) should be developed to obtain reliable information on fishery-related impacts on rajid populations. The outcomes of this strategy should be sufficient to determine whether, and to what degree, populations are being maintained, depleted, or placed at risk of extinction and to provide points of reference to interpret the effects of by-catches on populations of these species. The strategy should include, but not be limited to, population estimates of rajids from by-catch and ongoing surveys and may require further research on the biology of the species concerned. Interpretation should include information from IUU effort estimates. Mitigation measures should be developed as part of, or in advance of, the strategy, as appropriate, and the biological basis of mitigation measures should be established. **Timescale**: A suitable strategy/research plan should be developed within 12 months of certification and the strategy fully implemented within three years of certification
GSGSSI Progress Report	The only new development this year is in understanding CPUE trends in rajid populations. Data from tally periods, in which observers record the number of rays caught on an average of 2500 hooks per line (and, now, cut off and returned to the sea), indicate that the catch rate declined up to 2004 and then increased in 2005. The cause of this recent increase is not known, although clearly increased survivorship arising from the cut-off policy introduced in 2003 might be a cause, and it is too early to tell whether this is a trend that will continue. However, it is not the same in the different areas of South Georgia. As previously explained, the UK will conduct a major mark-recapture experiment on rays at South Georgia starting in 2006. The plan for this mark-recapture experiment remains the same as previously.
Observations	Increased catch rates are only a cause for concern if there has been a change in fishing method or activity which could have increased the catchability for these species. No such change in fishing activity is reported, but a review of the standardisation model parameters would help support this. The two other causes for higher CPUE are increased population size and random noise. The lack of local depletion with increased survival rates is likely to be a cause, but needs to be confirmed through the tagging programme. Understanding what affects CPUE values is clearly an important component of the research into mitigation. The observations reported do not elucidate these much, but the results from the standardisation (not reported) could also indicate methods to reduce ray catch rates. Commercial CPUE should not be relied on as a population index. Any mitigation measures are likely to make commercial CPUE measures unreliable to monitor the stock. Management may well need to develop target and/or limit reference points ray CPUE's.
Conclusion	The research plan previously approved remains in place. The plan for the mark-recapture experiment should start this year (2006). The CPUE data should prove more useful when used in combination with the mark-recapture, as the mark-recapture should provide good information over the coming years on the population size and composition. Achievement of the research programme will be monitored during future MSC certification surveillance audits in relation to the time table. The main milestone will be implementation of mitigation measures in the 2008 season. This target remains as originally proposed

5	**Condition of Certification 8: Discard of hooks in fish heads**
Activity assessed	An estimate should be provided, for each vessel, of hooks discarded as part of fishery waste available to birds, primarily in fish heads. **Timescale**: This should be carried out within 12 months of certification. If identified as a significant issue, a regulation should be put into place to address this, with appropriate monitoring, as soon thereafter as practically possible.
GSGSSI Progress Report	As previously explained, GSGSSI carried out monitoring of this problem in 2002, and obtained a CCAMLR Conservation Measure prohibiting the discard of hooks in offal from the 2004 fishing season. We therefore consider that this condition has been satisfied. We were therefore surprised by the surveillance report's comments last year. This is a clear example of GSGSSI being highly pro-active in addressing a problem raised during certification. Furthermore, there has been a demonstrated decline in the occurrence of hooks in albatross nests. In the light of the surveillance report comments last year GSGSSI observers made a detailed examination of the discard problem again in 2005. This was reported to CCAMLR. Of the 8 vessels fishing in Subarea 48.3, 6 reported never discarding hooks, one (the Jacqueline) discarded only rarely. The report of the *Argos Georgia* indicated that this was a daily occurrence during the first half of the season. Once reports of the discarding were made known to GSGSSI, a mid-season crew change was required, the responsible crew member removed, and the discarding of hooks stopped (WG-FSA-05/9 Rev. 2, Table 1; WG-FSA 2005, Appendix O). This is a significant improvement on last year. Data from 2002 suggested that for the 70% of vessels that were discarding hooks in that year, hooks might have been discarded in 14.7% of fish heads (J. Clark, pers comm.). Taking into account recent estimates of discarding (CCAMLR 2005), assuming different discard rates for vessels discarding rarely from those normally operating in the fishery, that for licensed vessels prior to 2002 (and for all IUU vessels) about 70% of the fleet normally discarded hooks in 15% of fish heads, and taking into account the changing mean size of fish caught (see CCAMLR WG-FSA 2005, Appendix G) we can make some estimate of a hook discard index which has significantly dropped both during and since certification as a direct result of actions taken following the certification assessment. There is an excellent correlation (R^2 = .537, n=9) between these two indices and the occurrence of hooks and other longline gear in wandering albatross nests (Forster, 2005). Wandering albatross are the only albatross sufficiently large to be able to ingest whole toothfish heads. A similar relationship is seen with other albatross species, although the data is noisier than for wandering albatross, and for all these species combined (Figure 1) the correlation has an R^2 of 0.334. The decline appears to have three causes: reduction of IUU, declining total catches and increased compliance with the hook discard regulation. Interestingly, although the total catch increased in 2003 both the discard index and number of gear in nests declined, suggesting that this was a real effect of the implementation of mitigation (non-mandatory in 2003) and not an effect of decreasing catches or decreasing IUU catches. An argument may be made that these hooks may not be being collected in the immediate vicinity of South Georgia, especially since the birds (wandering and black browed albatross) forage over the Patagonian shelf and around South Africa. Longline fisheries for toothfish on the Patagonian shelf took off spectacularly in 1995 and since 2003 have been in decline largely as a result of reductions in TAC in Argentine waters. The coincidence of these actions is not as persuasive as the coincidence of actions in the immediate South Georgia fishery (Figure 2), suggesting that although there may be some influence of gear picked up outside the South Georgia, the reduction in discarding in the South Georgia fishery, triggered in part by the MSC certification requirements, has had a demonstrable effect on the amount of gear being picked up by albatrosses.

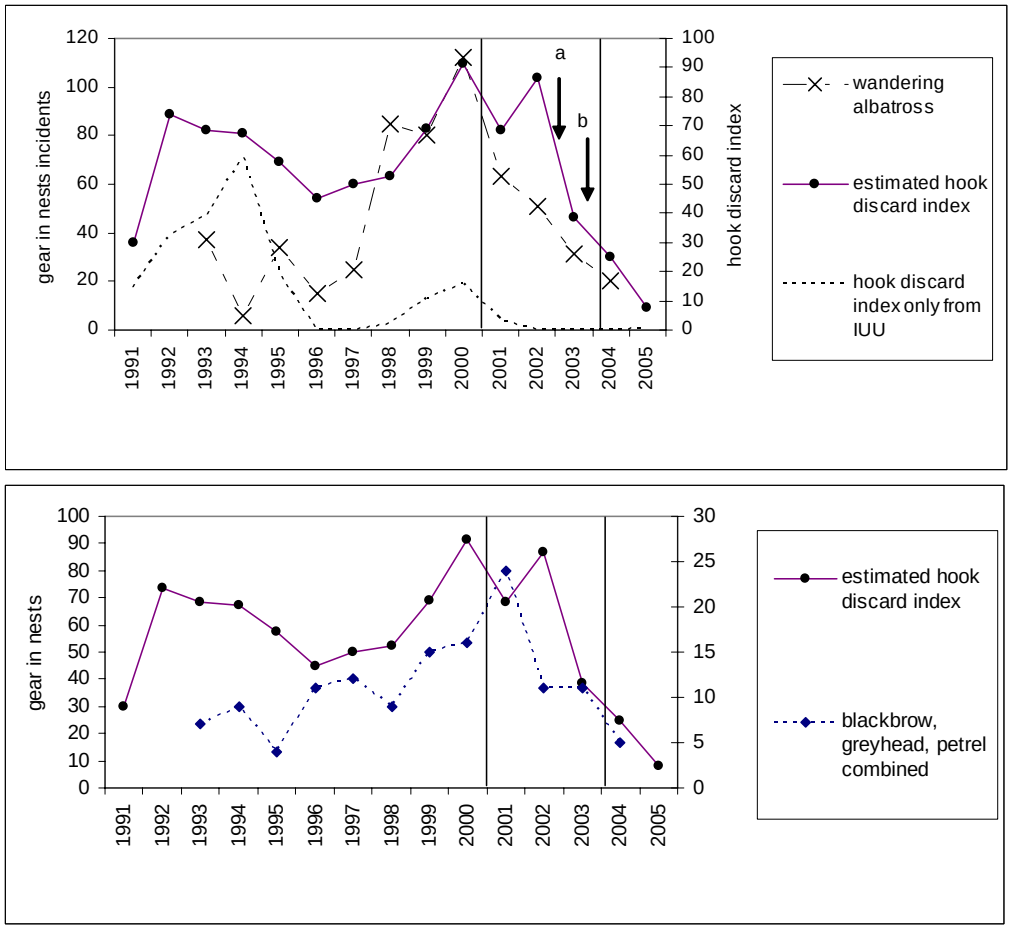

Figure 1 Estimated hook discard index at South Georgia, calculated from both licensed and IUU vessels, plotted with the incidence of total longline gear (hooks and lines) in wandering albatross (upper) and combined blackbrowed/greyheaded albatross and giant petrel nests at Bird Island (Forster 2005). The period of certification is shown. A non-mandatory provision for retention of hooks was implemented in 2003 (a) and enforced as mandatory from 2004 (b). Bird data refer to the summer immediately following the fishing season plotted.

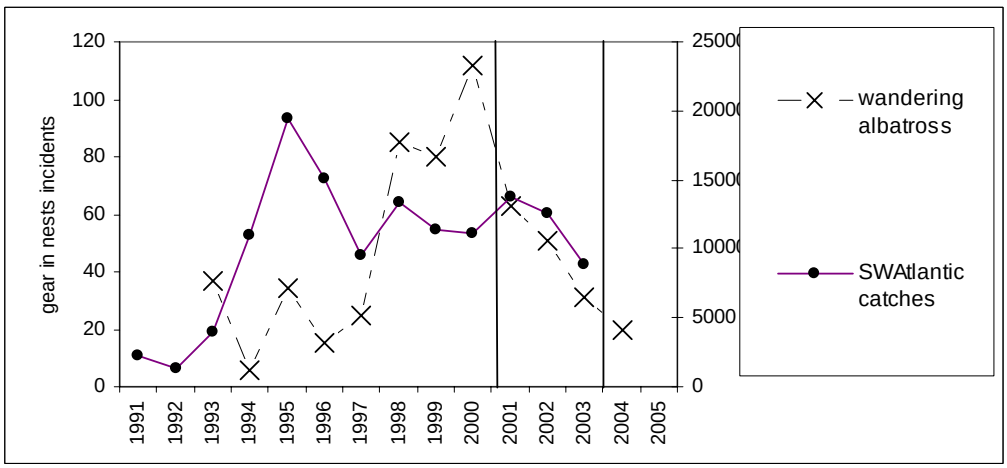

Figure 2 Comparison of SW Atlantic catches of toothfish and the amount of longline gear in wandering albatross nests.

Observations	It is clear that a monitoring system to asses the rate of hook discards is operating effectively, and that, probably at least partially as a consequence, few hooks were discarded, with six of the eight licensed vessels being reported as having discarded no hooks in 2004/05. It is also noted that effective actions were taken to address the problem in the one vessel which regularly discarded hooks. With the relevant CCAMLR Conservation Measure in place and being followed, it is considered that hook discarding in this fishery is no longer a significant issue, with a significant reduction in "hook discard index" reported. The extra information provided for 2004/05 in comparison to that for 2003/04 is noted with approval. The continued reduction of toothfish hooks found in association with Wandering Albatrosses on Bird Island, South Georgia is also noted, which may, at least in part, be attributed to the efforts made within the South Georgia fishery. However, no data are provided on hook type, and whether any of the Bird Island hooks over the years (12 years of data exist) can be positively identified as coming from (or not coming from) the South Georgia fishery. If South Georgia licensed vessels provided examples of the hooks to be used to the licensing authorities as part of the licensing procedure, and if these hooks were than passed on to the British Antarctic Survey scientists working on Bird Island it might be possible to undertake appropriate further analysis. Depending on the findings, this may offer supporting evidence that the South Georgia fishery is not causing significant levels of deaths and injuries of albatrosses by discarding hooks. The value of such an analysis would be improved if hook types from the Patagonian Shelf fisheries, and from IUU vessels such as the *Elqui*, could be obtained for comparative purposes.
Conclusion	The requirements of this condition have been met and the condition now closed. However, as a general requirement of ongoing surveillance, summary information should be provided on ongoing compliance with the CCAMLR Conservation Measure on hook discards. Although not formally required as part of ongoing certification, it is recommended that the British Antarctic Survey be approached by GSGSSI to ascertain whether the hook-type analysis described above and in the 2005 report can be feasibly undertaken, including retroactively over a 12-year period. The licensing procedure should include the depositing of hook types (and attachment methods and examples of line) for this purpose, unless this already forms part of the procedures followed.

6	**Condition of Certification 9: Research into the ecosystem relations of toothfish**
Activity assessed	To direct specific research into the ecosystem relations of toothfish. This condition may be regarded as a sub-section of Recommendation 4. As stated in Recommendation 4, the assessment team recognise that resource requirements to implement a full ecosystem model would be high and the other conditions outlined here are of much greater significance for the fishery. This research should therefore specifically include, but not be limited to, identification of predators of toothfish at various life stages and prey of toothfish prior to recruitment into the fishery. This research should be carried out with development of a quantitative ecosystem model in mind, although production of such a model is not part of this condition at this time. **Timescale**: A research programme should be developed and implementation begun within 12 months of certification
GSGSSI Progress Report	Last year we reported the results of new diet studies on juvenile toothfish (Collins et al 2004). There is no new information on this subject, but considerable information has been presented in the past on juvenile and adult diet. The results of long-term studies of land-based marine predators at South Georgia indicate that Patagonian toothfish make a very small/negligible contribution to the diet of the key study species. In the diet of Antarctic fur seals it occurred in none of the samples collected during 14 years of diet sampling in summer (Reid & Arnould 1996, Reid et al. submitted) and in less than 1% of samples during the winters of 1992 and 1993 (Reid 1995). In addition, Patagonian toothfish has never been recorded in the diet of either gentoo or macaroni penguins in diet samples collected each year from 1988-2005 (British Antarctic Survey unpublished data). This absence of Patagonian toothfish from the diet of these species, at least as determined on the basis of hard-part remains (i.e otoliths) is perhaps not surprising given their relatively shallow diving capabilities and their preference for Antarctic krill and mid-water fish. The only land-based marine mammal with the capacity for diving that would be compatible with feeding on Patagonian toothfish in the Southern elephant seal *Mirounga leonina* which has been observed feeding on Patagonian toothfish on one occasion (Reid & Nevitt 1998). Furthermore, fatty acid analysis of the milk of lactating Southern elephant seals by Brown *et al.* (1999) indicated that during the period prior to pupping, which takes place from September to November, the diet contained a considerable proportion of fish with a fatty acid signature consistent with Patagonian toothfish (although this technique does not provide specific identification of prey species). It is possible that Patagonian toothfish feature in the diet of relatively deep diving odontocete cetaceans in the South Georgia area, the most numerous of which are long-finned pilot whales, southern bottlenose whales and sperm whales (Reid *et al.* 2000). There are no data available on the diet of these species in the region. The diet of sperm whales in other regions is generally dominated by cephalopods (Clarke *et al.* 1993; Smith & Whitehead 2000) although for some populations demersal fish species may also be important (Flinn *et al.* 2002). Data on the diet of southern bottlenose whales is very sparse, but MacLeod *et al.* (2003) suggest that they rarely, if ever, consume fish. Research on this subject is conducted primarily by the BAS Discovery 2010 core research programme, which has as one of its objectives the construction of a marine ecosystem model for South Georgia by 2010. This will focus on krill, but through interaction between scientists in MRAG, GSGSSI and BAS these models could also have the capability to investigate the role of toothfish as both predator and prey in greater detail. Examining these interactions would be assisted by comparing fatty acid signature profiles from milk and tissue samples collected from elephant seals with those from existing analyses of toothfish tissue samples conducted by BAS from material collected at South Georgia.
Observations	There is little change in the situation from the 2005 Report. It is still the case that prey of Patagonian toothfish are better known than predators, although the list of possible predators is probably quite complete – especially of the assessed ages/sizes of toothfish. What is lacking is good quantitative information on the contribution that toothfish make to the energy budgets of

	their predators (i.e. – degree of predator dependency) and good quantitative information on the impact of predators on the population dynamics of toothfish (i.e. predation mortality parameter for population dynamics). However, reliable quantitative information on those properties is missing for almost all other assessed marine species in the world. On a comparative basis, information on trophic linkages of toothfish is sufficient for successful management of the stock; i.e. there is an estimate of natural mortality that seems robust in the assessment; and no evidence that current exploitation rates are likely to deplete the toothfish population to a degree that predators are likely to suffer. It is also noted that killer whales and to a lesser extent sperm whales take toothfish off lines during hauling. This could indicate that they also take them in natural conditions. The information about the BAS Discovery 2010 modelling initiative suggests that what information exists on predator-prey relationships in the ecosystem of which this toothfish stock is a part will be brought together over the coming few years. Noting that such a model is focused on euphausiids rather than toothfish, and at best is likely to be semi-quantitative (i.e run numerically, but with many parameters and functional relationships constrained quite weakly by observations), it is still a welcome step. It at least provides a way to test hypotheses about the role of toothfish relative to their predators and prey, and possibly uncover key relationships on which tractable data collection programmes could focus.
Conclusion	Steady ongoing work has been completed in this area. No results suggest that natural mortality due to predation is substantially higher than assumed in the assessment model, or that there are dependent predators whose productivity is likely to be diminished by the SGSSI toothfish, as currently managed. In summary, there appear no major trophodynamic threats currently suspected to be associated with this fishery, great problems with the feasibility of rigorously quantitative diet studies on potential predators, and noteworthy cost to achieve major increases in knowledge of predator diets. It may be appropriate to focus attention on steady improvement of knowledge of size-specific diets of toothfish of all ages, and on the modelling work to integrate such information as does exist. Progress is steady and supplemented significantly by the BAS Discovery 2010 programme. Further detail on the BAS 2010 programme and the means and focus of interaction with MRAG and GSGSSI could meet the requirements of this condition. The outputs of further research would then be reported as a component of the overall fishery management.

11	**Condition of Certification 10: Determination of significant interactions with benthic habitat.**
Activity assessed	The potential for longline fishing activity to significantly impact upon benthic habitats is generally regarded as being low. However, research should be directed at locating areas of complex benthic habitat, particularly biogenic features, within the areas exploited by fishers. This may be addressed through observer recording of evidence of biogenic features through retrieval in long-lines. If such areas are found, efforts to protect these from gear impacts, including those associated with long-lines should be considered and results documented. **Timescale**: Collection of suitable information takes place at present and should be continued. Initial mapping of fishing activities and areas of complex benthic habitat should be carried out within three years following certification (or earlier if sufficient information is collected) and further developed thereafter as more information is collected.
GSGSSI Progress Report	Following research initiated in 2004, further study of the impact of longline gear on benthic habitats has been made during 2005. A dedicated benthic sampling programme was established during the 2005 fishing season, with particular emphasis on the relative abundance and distribution of deep-water coral. Fisheries Observers identified and collected samples of benthic organisms during routine hook-line observations. Where conditions permitted, a photographic record of specimens was also made to help develop a comprehensive field guide of the major benthic species reported around South Georgia. To assist this process, it is intended that DNA analysis of the coral tissue samples will be conducted to refine coral identification and classification to species level. This work is ongoing with the assistance of the British Antarctic Survey. An analysis of the 2005 Fisheries Observer data is presented here to identify potential coral hot-spots around South Georgia. In the absence of detailed species-specific information, all benthic organisms have been classified at a low taxonomic level (phylum, subphylum or class). The most common benthic organisms retained by longline gear were cnidarians (62.3%), echinoderms (16.9%) and crustaceans (14.8%). Of the cnidarians caught, 96% were coral and the remaining 4% were actiniarians (sea anemones). 59% of the total benthic bycatch taken was either soft or hard coral, principally gorgonians. This research is in its early stages. A number of important requirements for future work have been identified: • The South Georgia benthic field guide, used by Fisheries Observers to identify corals and other important biota, should be developed further. DNA analysis of the coral tissue samples obtained during the 2005 season with the assistance of the British Antarctic Survey, in addition to a growing photographic library, will help facilitate a higher resolution of taxonomic identification. In turn, this should lead to more detailed analysis of benthic ecosystem. • At present, it remains unclear whether the relative abundance of benthic organisms caught on longline gear is due to their absolute abundance or their probability of capture. An experimental ROV or camera sledge survey of particular areas of both high and low coral bycatch will be undertaken in 2007 to establish a relationship between CPUE and coral density and assess longline impact. • The bathymetric analyses, started in 2004, have continued to provide increased information about the underwater topography surrounding South Georgia and Shag Rocks. This information however, needs to be updated in the overall analysis to further improve our understanding and knowledge of habitat preferences of benthic invertebrates and associated fish fauna.
Observations	The substantial increase in research on benthic habitats and impacts of the hook-and-line fishery on fragile habitat components is an important step ahead on this condition. It is noted

	that this work is only in its initial stages, and substantially more information is expected in 2006 and 2007. Both the improved guides for observers and the use of a ROV for on-bottom observations will be important contributions to our knowledge of the impacts (or lack of impacts) of this fishery on the seafloor habitats and communities. There are clearly numerous deep-sea corals found within the fished area. Clarifying the sizes and species of these coral sites/mounds/reefs (even their extent is not well enough known to know which term to apply) will be important to establishing the possible risks to benthic habitats associated with this fishery. The undersea observations using a ROV will be an essential complement to the observer and research collections of coral fragments and other benthos associated with the fishing gear. Deepwater corals are becoming a *cause celebre,* and without that observational information on the interaction between the fishing lines and the corals, there will be significant controversy about the possible impacts of multi-kilometre longlines and fragile corals. Such undersea studies are costly and often technically frustrating, but they are an essential part of the planned research.
Conclusion	Important work has commenced in the past two years. The plans for 2006 and 2007 are sound and appropriate, signifying important progress on this condition. Provision should be made to ensure timely analysis and interpretation of the information from observers, research surveys, and underwater observations, so the results of these studies can be made available as rapidly as possible. This condition will continue to be monitored in future surveillance reports.

15	**Any complaints against the certified operation; recorded, reviewed and actioned**
	No complaints in relation to the fishery management system are noted. One fishing company, Isla Alegranza SA, of Uruguay, applied for judicial review of the GSGSSI decision not to award a licence. Leave to apply was denied in mid 2005. GSGSSI denied a licence on the grounds of Uruguayan companies poor performance in respect to CCAMLR Conservation Measures. This license denial is considered an indication of the positive way (in sustainable management terms) the fishery is managed by the GSGSSI.
16	**Any relevant changes to legislation or management regime.**
	None noted.
17	**Overall Conclusions**
	The overall management of the fishery through CCAMLR and the GSGSSI continues to at least the level as during the main assessment. Systems developed to allow tracking of fish, necessary for toothfish product to enter into future Chain of Custody assessment (and so to carry the MSC logo) continue with improvement as appropriate. GSGSSI have taken appropriate measures to address the conditions of certification raised during the MSC certification assessment. This can be summarised as follows: 1. Conditions where specific requirements are deemed to have been fully met and which will be considered in future surveillance reports, as required, as part of overall fishery management: • Condition 8 2. Conditions which will be subject to further review at the next surveillance audit: • Condition 9 3. Conditions which will be subject to ongoing monitoring to achieve closure, or significant progress to an appropriate level, over the lifetime of the current MSC certificate: • Conditions 1, 2, 3, 4, 10 Some comments and recommendations have been made by the assessment team to assist in further development of measures, as relevant. MSC Certification should therefore continue and surveillance audits continue to the same schedule.

Information Sources:

Meetings

1. South Georgia Fisheries Science Meeting. GSGSSI, MRAG, BAS, Industry representatives. 7 July 2005.
2. GSGSSI. H Hall, G Liddle, R McKee. 23 and 26 August 2005
3. Falklands Conservation. G Munro. 22 August 2005
4. Argos. D Irving. 24 August 2005
5. PolarPesca. A Read. 23 August 2005
6. Quark Fishing. M Summers. 22 August 2005.
7. MRAG. D Agnew, J Pearce. 6 September 2005

Reports etc

1. A Summary Of Scientific Observations Related To Conservation Measures 25-01 (1996), 25-02(2003) AND 25-03 (2003) Secretariat WG-FSA-05/9 Rev 2
2. A.D. Rogers S. Morley E. Fitzcharles, K. Jarvis M. Belchier, Genetic structure of Patagonian toothfish (Dissostichus eleginoides) populations on the Patagonian Shelf and Atlantic and western Indian Ocean Sectors of the Southern Ocean. Marine Biology (2006)
3. Agnew, D.J., G.P. Kirkwood, J. Pearce and J. Clark 2005. Investigation of bias in the mark–recapture estimate of toothfish population size at South Georgia. WG-FSA-SAM-05/6 Rev. 1.
4. Brown D.J., Boyd I.L., Cripps G.C. & Butler P.J. (1999) Fatty acid signature analysis from the milk of Antarctic

fur seals and Southern elephant seals from South Georgia: implications for diet determination. *Marine Ecology-Progress Series*, 187, 251-263
5. Clarke M.R., Martins H.R. & Pascoe P. (1993) The Diet of Sperm Whales (Physeter-Macrocephalus Linnaeus 1758) Off the Azores. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences*, 339, 67-82
6. D.J. Agnew and A. Payne (2005). Proposal for a mark-recapture experiment estimate toothfish population size in Subarea 48.4. WG-FSA-05/57
7. D.J. Agnew and A. Payne (2005). Results of the mark-recapture experiment in Subarea 48.3, 2005.. WG-FSA-05/17
8. D.J. Agnew and A. Payne (2005). Results of the mark-recapture experiment in Subarea 48.3, 2005. WG-FSA-05/17
9. D.J. Agnew, G.P. Kirkwood, A. Payne, J. Pearce and J. Clarke (2005). Parameters for the assessment of toothfish in Subarea 48.3. WG-FSA-05/18
10. D.J. Agnew, J. Moir Clark, P.A. McCarthy, M. Unwin, M. Ward, L. Jones (United Kingdom), G. Breedt, S. Du Plessis, J. Van Heerdon, (South Africa) and G. Moreno (Spain) (2005). A study of Patagonian toothfish post-tagging survivorship in Subarea 48.3. WG-FSA-05/19
11. D.J. Agnew, J. Moir Clark, P.A. McCarthy, M. Unwin, M. Ward, L. Jones (United Kingdom), G. Breedt, S. Du Plessis, J. Van Heerdon, (South Africa) and G. Moreno (Spain) (2005). A study of Patagonian toothfish post-tagging survivorship in Subarea 48.3. WG-FSA-05/19
12. Elqui trial press release
13. Flinn R.D., Trites A.W., Gregr E.J. & Perry R.I. (2002) Diets of fin, sei, and sperm whales in British Columbia: An analysis of commercial whaling records, 1963-1967. *Marine Mammal Science*, 18, 663-679
14. Forster, I. 2005. Fishing equipment, marine debris and hydrocarbon soiling associated with seabirds at Bird Island, South Georgia, 2004/05. CCAMLR, Hobart, paper SC-CAMLR-XXIV/BG/14
15. fsa-04-43.pdf Collins MA, Ross KA, Belchier M (2004) The diet of juvenile toothfish (*Dissostichus eleginoides*) on the South Georgia and Shag Rocks shelf (CCAMLR Area 48.3). CCAMLR WG-FSA/04-43
16. MacLeod C.D., Santos M.B. & Pierce G.J. (2003) Review of data on diets of beaked whales: evidence of niche separation and geographic segregation. *Journal of the Marine Biological Association of the United Kingdom*, 83, 651-665
17. R.M. Hillary, G.P. Kirkwood and D.J. Agnew (2005). An assessment of toothfish in Subarea 48.3 using CASAL. WG-FSA-05/16
18. Reid K. & Arnould J.P.Y. (1996) The diet of Antarctic fur seals *Arctocephalus gazella* during the breeding season at South Georgia. *Polar Biology*, 16, 105-114
19. Reid K. & Nevitt G.A. (1998) Observation of Southern Elephant Seal, *Mirounga leonina*, feeding at sea near South Georgia. *Marine Mammal Science*, 14, 637-640
20. Reid K. (1995) The diet of Antarctic fur seals (*Arctocephalus gazella* Peters 1875) during winter at South Georgia. *Antarctic Science*, 7, 241-249
21. Reid K., Brierley A.S. & Nevitt G.A. (2000) An initial examination of the relationship between the distribution of whales and Antarctic krill *Euphausia superba* at South Georgia. *Journal of Cetacean Research and Management*, 2, 143:149
22. Smith S.C. & Whitehead H. (2000) The diet of Galapagos sperm whales Physeter macrocephalus as indicated by fecal sample analysis. *Marine Mammal Science*, 16, 315-325
23. WG-FSA 2005, part 2
24. WG-FSA report part 2, including Appendix G.

Guidelines used:

1. MSC Principles and Criteria for Sustainable Fishing
2. MSC Fishery Certification Methodology Version 5
3. TAB Directives (All)