REPORT OF THE 2009 INTER-SESSIONAL MEETING OF THE SUB-COMMITTEE ON ECOSYSTEMS
(Recife, Brazil, June 8 to 12, 2009)

1. Opening, adoption of Agenda and meeting arrangements

Dr. Victor Restrepo (ICCAT Secretariat) opened the meeting on behalf of Mr. Driss Meski, Executive Secretary, and welcomed participants. Dr. Restrepo thanked the Brazilian hosts, especially Dr. Fabio Hazin, Chairman of the Commission, and Dr. Sergio Mattos, of the Brazilian Special Secretariat for Aquaculture and Fisheries, for the excellent arrangements made in organizing the meeting.

The meeting was chaired by the Sub-Committee's Convener, Dr. Haritz Arrizabalaga (EC-Spain). Dr. Arrizabalaga welcomed participants and reviewed the objectives of the meeting, with emphasis on the need to finalize the sea bird assessments that have been ongoing for several years. The Agenda (**Appendix 1**) was adopted with a minor change in the order of items. The List of Participants is attached as **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**.

The following participants served as rapporteurs for various sections of the report:

Section	*Rapporteurs*
1, 7	V. Restrepo
2.1	R. Wanless
2.2, 2.3	G. Tuck, N. Klaer, R. Thomson
2.4	G. Scott
3	A. Domingo, H. Arrizabalaga
4	A. Domingo
5, 6	G. Diaz

2. Seabird assessment

The 2007 Inter-sessional Meeting of the Sub-Committee on Ecosystems agreed on the methodology for the ICCAT seabird assessment and adopted a six-stage framework:

1. Identify seabird species most at risk;
2. Collate available data on at-sea distribution of these species;
3. Analyze the time area overlap between species distribution and ICCAT longline fishing effort;
4. Review existing by-catch rate estimates for ICCAT longline fisheries;
5. Estimate total annual seabird by-catch (number of birds) in the ICCAT Convention area;
6. Assess the likely impact of this by-catch on seabird populations.

The first two stages were addressed by the Sub-Committee in 2007 and 2008. This report pertains to stages 3 to 6, above, and it includes some management recommendations.

2.1 Analysis of overlap between fishing effort and bird area distribution

Methods used to investigate seabird distribution in the ICCAT area and overlapping with longline effort

The 2008 Inter-sessional Meeting of the Sub-Committee on Ecosystems revised and agreed upon methods for conducting the assessment. Document SCRS/2009/085 presented the revised methodology and results for 23 populations of 10 species in the Atlantic Ocean. The analysis used a 'simple' method to define seabird distribution, using (1) total range and (2) a measure for foraging radius during breeding. Overlap does not necessarily imply interactions with ICCAT fisheries. Distribution maps were created per month, and overlap (based on average maximum range) was calculated with ICCAT longline fishing effort, using three measures of overlap.

Index 1. Percent seabird distribution within the ICCAT area, by month. This reflects the percentage seabird distribution in which ICCAT longline fishing effort occurs

Index 2. For each 5x5 grid square, the percent seabird distribution multiplied by number of hooks, by month

Index 3. Percent ICCAT longline fishing effort that overlaps with each seabird distribution, by month

In undertaking this analysis, a number of limitations in the methodology were exposed:

- Concerns about the accuracy of foraging radii based on data other than tracking data;
- Foraging radii vary significantly with stage of breeding e.g. incubation, brood-guard, post-brood;
- Inconsistency in literature in reporting of foraging radii (e.g. maximum range vs. average maximum range);
- In many cases, a circular foraging distribution around the colony is unlikely;
- Range maps (used to represent the distribution of non-breeding birds) are for a species as a whole. For example, black-browed albatross (*Thalassarche melanophris)* from South Georgia may not distribute throughout the entire range of the species;
- This simple analysis does not use density or activity of the tracked birds;
- There were several populations for which no data were found on foraging range.

In consequence, the decision was to pursue this analysis for those 23 populations for which remote tracking data exist, but at the same time emphasizing the limitation and uncertainty of the analysis. Albatrosses are relatively well represented in this sample, whereas species from Mediterranean and North Atlantic are poorly represented, constituting an important data gap and indicating a priority for research. In addition there are significant data gaps for species of conservation concern and/or which are known to interact with ICCAT fisheries elsewhere in the ICCAT region.

Results

Broadly speaking, there was a high degree of overlap of distribution with ICCAT effort for the Mediterranean population of Cory's shearwater (*Calonectris diomedea*) (the only seabird species from the North Atlantic and Mediterranean region for which reasonable tracking data exist). An illustration of distribution and effort overlap is shown in **Figure 1**. The albatross species breeding on the Tristan and Gough islands (Tristan (*Diomedea dabbenena)*, Atlantic yellow-nosed (*Thalassarche chlororhynchos)* and sooty albatrosses (*Phoebetria fusca)*) also had a high degree of overlap, especially in the austral fall and winter (March-August). There was a partial overlap of albatross species from other island groups, including South Georgia, Falkland Islands (Islas Malvinas) and the Indian Ocean.

Per method, the results for the 23 populations show that for:

Index 1 (basic overlap estimate)

- Tristan and Atlantic yellow-nosed albatrosses and Cory's shearwater have at least a >75% of spatial overlap distribution throughout the year in the ICCAT area where longline fishing effort may be deployed
- Sooty albatross (Gough Island population) and Cape gannet (*Morus capensis)* have at least a >50% of spatial overlap distribution in the ICCAT area
- Albatrosses and petrels from South Georgia, Falklands (Malvinas), Argentina, Chile and the Indian Ocean have up to a 30% spatial overlap distribution in the ICCAT area

Index 2 (distribution overlap x longline effort)

- Cory's shearwater scored highest on this overlap index
- Tristan, Atlantic yellow-nosed and sooty albatrosses (Tristan and Indian Ocean populations) and Cape gannet also had a high score
- For albatross and petrels, overlap is generally higher during March-August (mostly austral winter) and lower in September-February (mostly austral summer)

Index 3 (longline effort overlap with seabird distribution)

- 56-63% longline effort overlaps with Cory's shearwater
- Overlap with albatross and petrel species is lower overall, however it shows a seasonal pattern with higher overlap from March to August (up to 28% effort) compared to September through February (<15% effort)

2.2 Review of by-catch rates and substitutions

Document SCRS/2009/084 presented information on the spatial and temporal distribution of the incidental capture of albatrosses and petrels by the Uruguayan pelagic longline fleet. CPUE values for 12 species were presented by month and by 5x5º in the operational area of the fleet (15º-45ºS y 20º-55ºW) for the period 2004-2007. The higher by-catch rates for *Diomedea exulans*, *Thalassarche cauta/steadi*, *T. melanophrys*, *Procellaria aequinoctialis* and *Puffinus gravis* were recorded mainly over the continental slope, while for *Diomedea dabbenena*, *T. chlororhynchos* and *Procellaria conspicillata* the higher CPUE values were observed over deep oceanic waters.

Document SCRS/2009/060 presented an updated seabird by-catch from pelagic longline monitoring at sea in southern Brazil between 25º and 37ºS. Species with the highest number of captures were Black-browed albatross (*Thalassarche melanophris*) and White-chinned petrel (*Procellaria aequinoctialis*). Separate by-catch rates were calculated for warm months (Nov-May) and cold months (Jun-Oct). During cold months 71,050 hooks were observed and the by-catch rate was 0.605 bird/1000 hooks. In warm months 48,966 hooks were observed and no birds were captured.

Document SCRS/2009/075 described estimates of seabird by-catch by pelagic longline in the ICCAT Convention area for selected species or species groups for the years 2003 to 2006. The estimates were made by making several assumptions to fill observations in space and time. Observations were based on the results of seven published studies that identified per-species seabird by-catch in recent years in the ICCAT Convention area. The observed hooks in these studies totaled about 17 million, which represents 0.3% of the total ICCAT effort in the period 2003-2006.

The Sub-Committee noted that the number of observed strata by fishing fleet, quarter, broad region and year was very low compared to the total, so a large amount of extrapolation was required to fill unobserved strata. The Sub-Committee recognized that although the estimation method is appropriate given the available data, the level of observed data is very low which lead to a high but unquantified uncertainty in the estimates. The method provides imprecise alternative estimates to those provided from modeling seabird population overlap with fishing effort. Monte-Carlo/jack-knife procedures may be used to calculate precision, and would improve the utility of the method.

Albeit the limitations of the method and the uncertainty associated to the results, the annual estimates of total seabird by-catch, in number of birds, from ICCAT pelagic longline fisheries were 16,568 in 2003, 10,021 in 2004, 9,879 in 2005 and 12,081 in 2006. The reduction in estimated total birds caught from 2003 to 2006 was 27%, whereas total pelagic longline effort declined by 13% in that period. The greater reduction in bird by-catch was likely due to changes in the spatial and temporal distribution of the fishing effort. Over the four years from 2003-2006 the total seabird by-catch estimate was 48,548.

Estimates of per species proportions of the total seabird by-catch over the three years were 32% Black-browed albatross, 17% Atlantic Yellow-nosed albatross, 6% albatross species, 1% Wandering albatross (*Diomedea exulans)*, 1% Cory's Shearwater, less than 1% Tristan albatross and 42% other species. Results indicate that about 60% of the ICCAT pelagic longline seabird by-catch was albatrosses.

The average number of Wandering albatross caught annually from 2003 to 2006 was estimated to be 149. If the ratio of Wandering albatross in the unclassified albatross was the same as estimated per species, an upper limit for this estimate would be 166. If despite the uncertainty of the results it is assumed that the estimated numbers are correct and given that the number of annual breeding pairs in the South Georgia population in that period was observed to be in the order of 1,400 breeding pairs (SCRS/2009/074), then the estimated level of b-catch in combination with observed population trends is of serious concern (refer Section 3). Similar concerns apply to Tristan albatross, which is classified as critically endangered by the IUCN. The Yellow-nosed albatross population is estimated to be about 30,000 breeding pairs, and the estimated average annual catch from 2003 to 2006 was between 2,090 and 2,323.

2.3 Estimation of the number of birds caught and the effect of by-catch mortality on seabird populations

Document SCRS/2008/073 described the fishing effort datasets and reported by-catch rates for fleets with distributions that overlap with the foraging distributions of southern hemisphere albatross species. As part of the ICCAT seabird assessment, it was necessary to identify all key fisheries that may be impacting seabirds that inhabit waters within the ICCAT region. Due to the extensive foraging ranges of the birds and their known interaction with multiple gear-types, fleets from outside of the Atlantic Ocean, and those that use gears other than pelagic longline, were also considered.

This document describes each of the fleets included in the quantitative impact assessment of seabird populations. In particular, the trends in the magnitude of effort and spatio-temporal distributions are described. A brief description of the by-catch rates and seabird species caught is provided for each fleet where observations exist.

This document also highlighted that, in some circumstances, fishery effort data were not complete, were poorly maintained, were not publicly available or were non-existent. In these cases, effort data were modeled using auxiliary information, such as catch or number of vessels. The methods and assumptions behind the data modeling are illustrated. Nonetheless, this effort may represent an incomplete dataset. Fishing effort data is broadly categorized into fleets with similar physical and operational characteristics, referred to as super-fleets.

The Sub-Committee considered whether the fishery datasets included in the paper were comprehensive and whether the effort data adequately represented these fleets.

The Sub-Committee noted that limited data exist for the Brazilian small-scale hook and line fleet, which is known to interact with several species of seabirds. Data collection is seen as a high priority and mechanisms have now been established to provide further information from this fishery.

The Sub-Committee noted that Uruguayan pelagic longline data from within the ICCAT Task 2 database were under-represented. An update of the Uruguayan pelagic longline fishing effort data covering years 1981 to 2007 was provided for the use of the Sub-Committee. These updated data were included in the quantitative seabird assessment models revised during the meeting. It was noted by the Sub-Committee that the Uruguayan trawl effort data were modeled and that the assumptions underlying the effort estimation procedure may not be correct. Revised data for this fishery were not available to the Sub-Committee.

Due to the incomplete nature of some of the more recent years of pelagic longline effort data in the ICCAT Task 2 dataset, in particular that of 2006 for Chinese Taipei fleet, the Sub-Committee requested that the analyses that use these data be updated.

The Sub-Committee agreed that the super-fleet structure for the quantitative seabird assessment be composed of (i) all pelagic longline fleets, (ii) regulated demersal longline fleets, (iii) IUU demersal longline, and (iv) trawl.

Document SCRS/2008/057 presents the method used for the quantitative seabird assessment. The assessment model includes a population dynamics component, a fisheries by-catch component and an estimation component. The model caters for both annual and biennial breeding schedules. Birds are categorized as actively breeding adults, adults that have failed in that year's breeding attempt, non-breeding adults that were either successful or unsuccessful in their previous breeding attempt, juveniles or chicks. The model is sex-disaggregated, and allows the user to specify the at-sea distribution of birds of each life-stage category and each gender in each month of the year.

The model estimates the numbers of birds caught as a function of fishing effort, bird numbers, catchability for each super-fleet, and the spatial overlap of birds and fisheries. The model estimates the super-fleet catchabilities, the density dependent parameter for chick mortality, the pre-fishing fledgling success rate and population size. A statistical best fit is then made between the observed and model estimated annual breeding population size, numbers of fledglings, adult and juvenile survival rates and, where available the population age distribution.

The Sub-Committee recognized that there are other populations of seabirds caught within the ICCAT region that have not been assessed by the quantitative model. The models were applied to 4 of the 22 (out of a total of 64 analyzed) populations that were considered of high concern from the prioritization analyses and with sufficient data on bird distribution and demography.

Document SCRS/2008/074 described the results of an application of the quantitative seabird assessment on the wandering albatross population of South Georgia. This population is extremely wide-ranging across the Southern Ocean and is known to interact with longline fisheries both within the ICCAT region and in other oceanic regions. Census data shows that this population has declined from 2592 breeding pairs in 1972 to 1394 in 2006.

While fits to the early years of the census data are relatively good, the model was unable to replicate the steepness of the recent observed decline in the breeding population size, and recent declines in adult and juvenile survival rates. Diagnostic plots, estimated fishing mortality, time-series and maps of by-catch are provided in **Figures 2** to **6**. To explore this lack of fit, a simple model was constructed that does not use the fishery effort data, but uses the observed breeding success, adult and juvenile survival rates to compare with the resulting estimates of the number of breeding pairs and those observed. The observed numbers of breeding pairs can be closely approximated when using the simple population dynamics model (**Figure 7**). Consequently, this shows that the observations of survival rates and number of breeding pairs are internally consistent.

Reasons for the lack of fit by the more complex population model may include an inappropriate spatio-temporal scale for the distributions of the birds and fisheries, missing fishing effort data for a fleet or component of a fleet that is catching a number of wandering albatross, and/or other unaccounted sources of mortality.

Document SCRS/2008/077 described an application of the quantitative seabird assessment to the black-browed albatross population of South Georgia. This population is wide ranging over the southern Atlantic Ocean, with non-breeding and juvenile birds also found in waters off eastern Australia. Census data shows that this population has declined from approximately 300,000 breeding pairs in 1975 to 70,000 in 2006. Observations of by-catch exist from trawl, pelagic and demersal longline fisheries.

The assessment model estimates show a good fit to the observed data. Diagnostic plots, estimated fishing mortality and the time-series and maps of by-catch are shown in **Figures 8** to **12**. Due to the lack of trend in observed breeding success during a period of marked decline in breeding size, the model does not predict a density-dependent response. The model attributes all by-catch to the trawl super-fleet (**Figure 11a**). The main areas of estimated by-catch were from the Patagonian shelf, southwestern Africa and Australia (**Figure 11a**). While substantial by-catch of black-browed albatross from trawl fisheries has been recorded, it is also known that this species is caught in pelagic and demersal longline fisheries (**Figure 11b**). The Sub-Committee agreed that including observed by-catch rates in the model might enable a more appropriate apportioning of by-catch for this population.

Document SCRS/2008/079 described an application of the quantitative seabird assessment to the yellow-nosed albatross population of Gough Island. This population is largely restricted to the southern Atlantic Ocean. The numbers of breeding pairs used in the model declined from approximately 7,000 during the 1980s and then recovered from the late 1990s. Observations of by-catch mainly exist from longline fisheries, and in particular pelagic longline fisheries.

The model provides reasonable fits to the observations. Diagnostic plots, estimated fishing mortality and the time-series and maps of by-catch are shown in **Figures 13** to **17**. The model is unable to match a recent increase in the observed number of breeding pairs, however this may be because the observations came from a small study colony whose population trends may not match those of the whole population. The model attributes the by-catch to the pelagic longline super-fleet. There are on-board observations of yellow-nosed albatross by-catch from these vessels, but they are also known to be caught in other fisheries including hand-line, troll (Bugoni *et al.*, 2008) and trawl.

Document SCRS/2008/078 described a preliminary application of the quantitative seabird assessment for the Tristan albatross population of Gough Island. This population is largely restricted to the southern Atlantic Ocean, with individuals known to traverse into the Indian Ocean, but at an unknown frequency. In addition to incidental mortality from fisheries, Tristan albatross also face serious levels of predation on eggs and chicks by introduced mice. Limited records of population size indicate a decline in numbers of breeding pairs from approximately 4000 pairs in 1965 to 1270 in 2007. Observations of by-catch exist mainly from pelagic longline fisheries.

Model results are preliminary at this stage and the Sub-Committee believed that they were not in a position to make recommendations based upon the results presented in this document. The Sub-Committee encouraged further work on the knowledge of this population.

The Sub-Committee agreed that projections of future dynamics be conducted on yellow-nosed albatross, black-browed albatross and wandering albatross. For projections, the fishing effort levels and spatio-temporal distribution of 2006 was assumed constant into the future while alternative catchability scenarios were evaluated. Each scenario applied a specific change in the seabird catchability of the super-fleets (i) a 25% increase in seabird catchability, (ii) no change in catchability, (iii) a 25%, (iv) a 50%, (v) 75% reduction in catchability, and (vi) a zero by-catch scenario (to consider the trajectory of maximum rate of recovery).

In the light of the projection results for all populations, the Sub-Committee concluded that any reductions in by-catch are desirable in terms of improving population status (**Figures 18** to **20**). The projected yellow-nosed albatross population trajectories are more responsive to a reduction in by-catch than those of wandering and black-browed albatross. This is due to a greater level of predicted productivity for this population. Both the wandering albatross and black-browed albatross populations show negligible estimated density-dependence. As a consequence, the model indicates that any additional mortality above which they would experience naturally is not able to be sustained by these populations.

The results to date provide an important advancement in assessments of seabird populations interacting with ICCAT fleets. The Sub-Committee noted, however, that results for some applications failed to account for observed by-catch of some fleets. Therefore, the by-catch attributed by the model to some of the fleets was considered to be an unlikely scenario (Wandering albatross, black browed albatross). The Sub-Committee indicated that incorporating observed seabird by-catch rates by fleet into the model fitting, would allow for a more accurate attribution of by-catch among fleets. The Sub-Committee also noted that because of a general lack of data, the modeling conducted thus far only covered a small number of the seabird populations that interact with ICCAT fisheries. It was also noted that the lack of data limited the applicability of the model to other threatened seabird populations. The Sub-Committee also identified the need to refine model applications for all the populations listed above, plus Tristan albatross and yellow-nosed albatross, and also identified the need to collect much more detailed data on seabird by-catch rates.

2.4 Seabird management recommendations including potential modifications to Rec. [07-07]

The seabird assessments conducted indicated that ICCAT fisheries have some measurable impacts on populations of seabirds which can be found in the Convention area, including some species of seabirds that are threatened with extinction. The assessments conducted also indicated that reducing seabird mortality due to ICCAT fisheries can result in improvement in future seabird population status, potentially leading to lessened conservation concerns for those populations, in some cases.

Lessons from ICCAT areas where seabird by-catch was formerly high but has been reduced (*e.g.* South Africa demersal and longline fisheries, SCRS/2009/086) clearly showed that no single measure can effectively reduce seabird by-catch. It is important to employ, simultaneously, a suite of measures. Document SCRS/2009/076 indicated that the following measures, used simultaneously, are considered to have the strongest empirical support, to be cost-effective, safe, and to have minimal negative or to have positive effects on catch rates of target species:

- Tori lines (minimum aerial extent of 100 m)
- Night setting
- Weighted branchlines (minimum 60 g weight within 3 m of the baited hook)

Pending research into efficacy, other measures might include:

- Side-setting,
- Strategic discard management – no dumping during line setting, only dumping during hauling on opposite side of vessel to line hauling,
- Blue-dyed bait
- Thawed bait/punctured swim bladder,
- Testing alternative line weighting regimes which do not negatively impact target catch.
- And other innovations as indicated in SCRS/2009/076

To improve efficacy of tori lines, it is necessary to (see SCRS/2009/087):

1. improve the sink rate of baited hooks
2. reduce the setting speed to increase the period of protection offered by the tori line
3. improve through better designs, the acceptance and proper utilization of these measures by the fleet

Research continues on improvement of mitigation measures. Document SCRS/2009/060, for example, described the Brazilian efficacy testing of *light tori lines*, which differ from a conventional tori line by using nylon monofilament (branch line) as the tori main line and other light materials as streamers. A reduction of 60% of the capture of seabirds from 0.904 birds/1000 hooks in sets without a tori line to 0.366 birds/1000 hooks with a tori line was reported. In addition, sets with tori lines reported higher catch of main target species catch (average increases of swordfish 33.6%; blue shark 19.3%; other teleost fishes 20.4%, and other elasmobranchs 18.3%) compared with sets that have non-tori lines, which may result in economic benefits for the fleet and higher adoption by the fishers (Document SCRS/2009/060). This research represents advancement toward the development/improvement and acceptance of mitigation measures for some pelagic longline fisheries and continued cooperative experimentation between Brazil and Uruguay on improving mitigation measures is underway.

Rec. [07-07] incorporates some measures intended to reduce seabird by-catch, focused on the southern hemisphere. It is of particular concern regarding [Rec. 07-07] that no tori lines are required for swordfish effort using night setting as an alternative. There is clear empirical evidence from nighttime fishing operations (Jiménez *et.al.* 2009) that a number of seabirds are very vulnerable to by-catch during periods around the full moon (6-8 nights per month) and still others have high vulnerability during dark nights.

Considering the wide-ranging interactions between seabirds and pelagic longline fisheries in the Convention area, including species of critical conservation concern in areas north of 20^{o} S latitude, and the scarcity of detailed seabird interaction information, the Commission should, at a minimum, require CPCs to use tori lines in combination with weighted branch lines whilst longline fishing throughout the Convention area, until such time that it can be demonstrated through direct observation of the longline fisheries, that by-catch levels are of insignificant magnitude for seabird populations. The Commission should also encourage research into increasing the efficacy of existing mitigation measures and development of additional measures, which, upon demonstrating proof of concept, should be adopted by CPCs.

3. Ecological risk assessment for target and by-catch species caught by ICCAT fleets

Document SCRS/2009/082 presented information on the incidental capture (1998-2008), assemblage composition and behavior of seabirds (2005-2008) associated to vessels of the Uruguayan pelagic longline fleet operating in the Southwestern Atlantic. Information that should be taken into account when scoring “Susceptibility” of different species was analyzed. This information might be very useful in a Productivity Susceptibility analysis (PSA) of seabirds caught by this fleet, within an Ecological Risk Assessment (ERA) approach. The feeding behavior of the species occurring around a fishing boat, their size and the composition of the assemblage (species and abundance) were considered as aspects that can potentially affect the susceptibility analysis. For instance, species of small size are less susceptible to capture if species of larger size are present in the assemblage (since the bait is mostly taken by the larger species). Also larger, less diving species are more susceptible to capture if small species are around since, given their higher diving performance, they can bring baits back to the surface.

No attempt was made so far to get susceptibility scores using these data. However, the Subcommittee noted that this is very valuable information and that it would be worth trying to integrate this information in future Productivity Susceptibility applications. In spite of the effort required, it was also noted the importance of obtaining new information with such level of detail.

A more global and less detailed ecological risk assessment for species caught in ICCAT fisheries was presented in SCRS/2009/058. This document included a two-stage approach to try to identify the species groups most at risk. Firstly, a coarse analysis of the whole ICCAT by-catch list was conducted. This list includes all (242) species reported to be caught by any of the gears operating in ICCAT waters. According to this list, most species are reported to be caught in longline fisheries, followed by gillnet and purse seine fisheries. According to the IUCN red list, 7 of the 242 species are critically endangered and other 16 species are endangered. At a second stage, a productivity susceptibility analysis for the species caught by EU tropical tuna purse seine and US pelagic longline fleets was conducted. The analysis revealed two main risk groups. The first one included pelagic and coastal sharks, characterized by relatively low productivities, and the second one included teleosts (both ICCAT and non ICCAT species), characterized by higher productivities but also by higher susceptibility to fishing.

The Sub-Committee expressed concern about the accuracy of the ICCAT by-catch list, because the range of by-catch species might be better represented for some gears than for others.

Regarding the PSA approach, the Sub-Committee noted that the SCRS is already paying attention to sharks, tuna and billfish, and other RFMOs are also dealing with other teleosts that show high risk scores. The Sub-Committee identified the need for other major longline and gillnet fleets to conduct similar analyses so as to have a more complete picture of the risk associated to ICCAT fisheries. However, the Sub-Committee noted the difficulty to obtain a satisfactory measure of productivity for species groups with different biological characteristics (e.g. sharks, tunas and turtles). For that reason, it was suggested to analyze the sensitivity of the results to alternative measures of productivity and susceptibility. Also, it was discussed the merits of conducting separate PSA analyses for each of the species groups, since this would allow to use appropriate and comparable measures of productivity and susceptibility within similar species. However, the Sub-Committee also noted that separate PSA analyses would not necessarily help to establish future research priorities among different taxa.

4. Review of new information regarding ecosystems

Two documents were presented in this section:

Document SCRS/2009/059 presented information on the by-catch of the Maltese bluefin tuna longline fisheries. General Linear Mixed Models (GLMMs) were used to analyze the effect of environmental and spatio-temporal variables. The data were obtained during 85 fishing days in area concentrated in the Central Mediterranean. The by-catch of three species represented 81% of the total capture in number of individuals, corresponding to loggerhead sea turtle (*Caretta caretta*) 40%, swordfish (*Xiphias gladius*) 31%, and pelagic stingray (*Pteroplatytrygon violacea*) (10%). An effect of the moon phase on the catch and by-catch rates was observed.

The document SCRS/2009/083 presented data on nine oceanic juvenile loggerhead sea turtle movements and habitat use, obtained through the use of satellite telemetry. During the entire tracking period, these turtles (225±37 days, n=9) remained in a restricted area off southern Brazil and Uruguay. This new information, combined with the by-catch and genetic studies presented by Uruguay to the Sub-Committee during the last four years, demonstrates that this region is a very important developmental area for juvenile loggerhead sea turtles, and that it requires international efforts in research and management.

There was a presentation on an Observer Program Information System (SIPO) being developed by Uruguay. The system provides scientific observers with a new way to digitize the data, making the data collection process easier, and to check its consistency and integrity. Through simple steps, the system allows to load this information into a relational database. This system also offers the data analyst an easy and secure way to access that database, produce reports (data subsets), and/or export the data according to the analysis requirements. These data can be used with other tools, such as GIS and Statistical Tools. This system will be freely available to any interested user. The Sub-Committee noted that once SIPO is ready, it could be a useful tool for those CPCs that require support for data collection and analysis.

During the discussion, it was mentioned that ACAP has dedicated some effort to standardize data collection and reporting procedures for all of it parties and has also identified as a priority the need to improve seabird by-catch data collection from observer programs operating in relevant South American fisheries.

5. Other matters

It was reported to the Sub-Committee that the US is conducting terminal gear experiments to reduce the by-catch of Atlantic bluefin tuna in the Gulf of Mexico. During 2008, 72 experimental longline sets were deployed with two types of circular hooks: (1) a 16/0 circular hook with no offset (4.0 mm steel wire) commonly used by the yellowfin tuna fleet operating in the area, and (2) a 'weaker' 16/0 circular hook with no offset constructed from 3.65 mm steel wire (same material used for 15/0 circular hooks). The rationale behind the experiment is that the weaker hook will bend if a large bluefin tuna is caught in it but not with a yellowfin tuna (the target species). Preliminary results indicated that the catch rate of yellowfin tuna did not decrease with the weaker hooks. During the experiment, four bluefin tuna were caught with the normal hooks but only one with the weaker hooks and this hook had a major deformation and was almost straightened. Although the results are considered preliminary and the sample sizes were small, the researchers conducting the experiment believe that such results are very encouraging. New experimental cruises are planned for the 2009 summer season.

Given the need to quantify by-catch (including seabird) in ICCAT fisheries, understand the factors that contribute to by-catch, and monitor the efficacy of by-catch mitigation measures, it is essential that observer programs designed to collect such data be implemented by those CPCs lacking such programs. The SCRS has on several occasions recommended that CPCs institute data collection procedures that enable quantifying the total catch (including by-catch), its composition and its disposition by tuna-fleets and report these data to ICCAT. However, sufficient observer sampling remains lacking for most fleets.

The Sub-Committee discussed the need for observer programs or schemes to be established and implemented with sufficient coverage of fishing effort to obtain reliable by-catch estimates for assessment and management purposes. Studies have shown that, in the case of seabirds, 20% observer coverage (of fishing effort in number of hooks) is required (Lawson 2006) to obtain reliable by-catch estimates. However, the Sub-Committee indicated that further work is required to determine minimum observer coverage that would adequately cover other taxa caught as by-catch. It was pointed out that IOTC have recently instituted an observer program with 5% coverage of fishing effort.

It was also pointed out that the development of observer programs should be based on models already in place, or in development by other RFMOs, including the WCPFC (Lawson, 2006), CCAMLR, IOTC and CCSBT to ensure, as far as possible, consistency and the harmonization of protocols to avoid burdensome observer training requirements and to reduce as much as possible multiple reporting formats for countries that are members of multiple RFMOs. It is also important that a high level of regional coordination be provided by the Commission covering data collection, data exchange, training and the development of guidelines for the operational aspects of such a program.

6. Other recommendations

The Sub-Committee continues to recommend that, if they have not yet done so, Contracting Parties and Cooperating non-Contracting Parties, Entities or Fishing Entities (CPCs) institute data collection procedures which permit quantifying the total catch (including by-catch), its composition and its disposition by the tuna-fleets and report those data to ICCAT. The Sub-Committee recommends scientific observer and logbook programs, in combination, to be used for this purpose and further recommends that CPCs adequately fund such programs in order to meet data reporting obligations.

The Sub-Committee recommends that National Scientists use available data from existing observer programs to determine the level of observer coverage required to obtain reliable estimates of by-catch for different taxa. Minimum observer coverage and data collection standards should be established and implemented.

The Sub-Committee recommends once again that CPCs provide data on seabird by-catch on a 5x5^{o} spatial scale or the best available resolution. The lack of specific catch rate information by fleet and area required many assumptions be made and it hampered some of the Subcommittee’s effort to assess the impact of ICCAT fisheries on seabird populations.

The Sub-Committee recommends that observer programs collect the necessary data to assess the effectiveness of mitigation measures already in effect.

The Sub-Committee encourages CPCs to pursue research to develop new mitigation measures and/or to improve existing ones.

The Sub-Committee reiterates the need to update and improve by-catch species identification material and general information on by-catch species in the ICCAT manual.

The Sub-Committee recommends that research be conducted to develop (and assess the utility of) ecosystem indicators to assess the status of ecosystems potentially impacted by ICCAT fisheries.

7. Report adoption and closure

The report was adopted during the meeting. The Chairman thanked participants for their hard work. He also thanked the Brazilian hosts for the excellent logistical support provided.

The meeting was adjourned.

References

Bugoni, L., Neves, T.S., Leite, N.O., Carvalho, D., Sales, G., Furness, R.W., Stein, C.E., Peppes, F.V., Giffoni, B.B. and Monteiro, D.S., 2008. Potential by-catch of seabirds and turtles in hook-and-line fisheries of the Itaipava Fleet, Brazil. Fisheries Research (Amsterdam), 90(1-3), pp. 217-224.

Jiménez S., Domingo A., Brazeiro, A., 2009. Seabird by-catch in the southwest Atlantic: Interaction with the Uruguayan pelagic longline fishery. Polar Biology 32: 187-196.

Lawson, T., 2006. Scientific aspects of observer programmes for tuna fisheries in the western and central Pacific Ocean. WCPFC-SC2-2006/ST WP-1

Appendix 1

Agenda

1. Opening, adoption of the Agenda and meeting arrangements.
2. Seabird assessment
   - 2.1. Analysis of overlapping between fishing effort and bird area distribution
   - 2.2. Review of by-catch rates and substitutions
   - 2.3. Estimation of the number of birds caught and the effect of by-catch mortality on seabird populations
   - 2.4. Seabird management recommendations including potential modifications to Rec. [07-07]
3. Ecological risk assessment for target and by-catch species caught by ICCAT fleets
4. Review of new information regarding ecosystems
5. Other matters
6. Other recommendations
7. Adoption of the report and closure

Appendix 2

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Appendix 3

List of documents

SCRS/2009/057	Modeling the impact of fishery by catch on albatross populations: model specification. Thomson, R.B. and Tuck, G.N.
SCRS/2009/058	Ecological Risk Assessment for species caught in ICCAT fisheries. H. Arrizabalaga, P. de Bruyn, H. Murua, et. al.
SCRS/2009/059	Non-target by-catch in the Maltese bluefin tuna (*Thunnus thynnus*) longline fishery (central Mediterranean). Burgess, E., Dimech, M., Caruana, R., Darmanin, M., Raine, H. and Schembri, P.J.
SCRS/2009/060	Update of seabird by-catch and the effect of light toriline on seabird by-catch and fish catch rates in the pelagic longline fishery off southern Brazil. Mancini, P.L., Neves, T.S. and Nascimento, L.A.
SCRS/2009/073	Summary of fishery effort statistics, observed by-catch and super-fleet description for the ICCAT seabird assessments. Tuck, G.N. and Thomson, R.B.
SCRS/2009/074	Modeling the impact of fishery by catch on the wandering albatross at South Georgia. Thomson, R.B., Phillips, R.A. and Tuck, G.N.
SCRS/2009/075	Estimates of total seabird by-catch by ICCAT pelagic longline fisheries in recent years. Klaer, N.
SCRS/2009/076	Mitigation measures for pelagic longline gear: a report to ICCAT on the work of the ACAP Seabird By-Catch Working Group. ACAP
SCRS/2009/077	Modeling the impact of fishery by catch on the black-browed albatross at South Georgia. Thomson, R.B., Phillips, R.A. and Tuck, G.N.
SCRS/2009/078	Modeling the impact of fishery by catch on the Tristan albatross of Gough Island. Thomson, R.B., Wanless, R.M. Cuthbert, R., Ryan, P.G. and Tuck, G.N.
SCRS/2009/079	Modeling the impact of fishery by catch on the Yellow-nosed albatross from Gough Island. Tuck, G.N., Thomson, R.B., Ryan, P. and Cuthbert, R.
SCRS/2009/081	Estimation of overall longline effort distribution (month and 5 by 5 degree squares) on the ICCAT Convention area, between 1950 and 2007. Palma, C., Kebe P. and Gallego J.L.
SCRS/2009/082	Suceptibilidad de las aves marinas a la captura incidental en palangre pelágico Jiménez, S., Domingo, A., Abreu, M. and Brazeiro, A.
SCRS/2009/083	Developmental area for juvenile loggerhead sea turtles (*Caretta caretta*) in the southwestern Atlantic. Barceló, C., Domingo, A., Miller, P., Ortega, L. and Swimmer, Y.
SCRS/2009/084	Distribución espacial y temporal de las tasas de capturas de albatros y petreles obtenidas en palangreros uruguayos. Domingo, A., Jiménez, S. and Abreu, M.
SCRS/2009/085	An analysis of seabird distribution in the ICCAT area and overlap with ICCAT longline fishing effort. Taylor, F., Anderson, O. and Small, C.
SCRS/2009/086	Seabird by-catch on pelagic long-lines in the ICCAT area off South Africa in 2007 and 2008: the effect of individual vessel limits on by-catch rates. Ryan, P.G., Goren, M., Petersen, S.L. and Smith, C.
SCRS/2009/088	Technical description of hookline sink rates and protection offered by streamer lines. . Wanless, R.B. and Waugh, S.

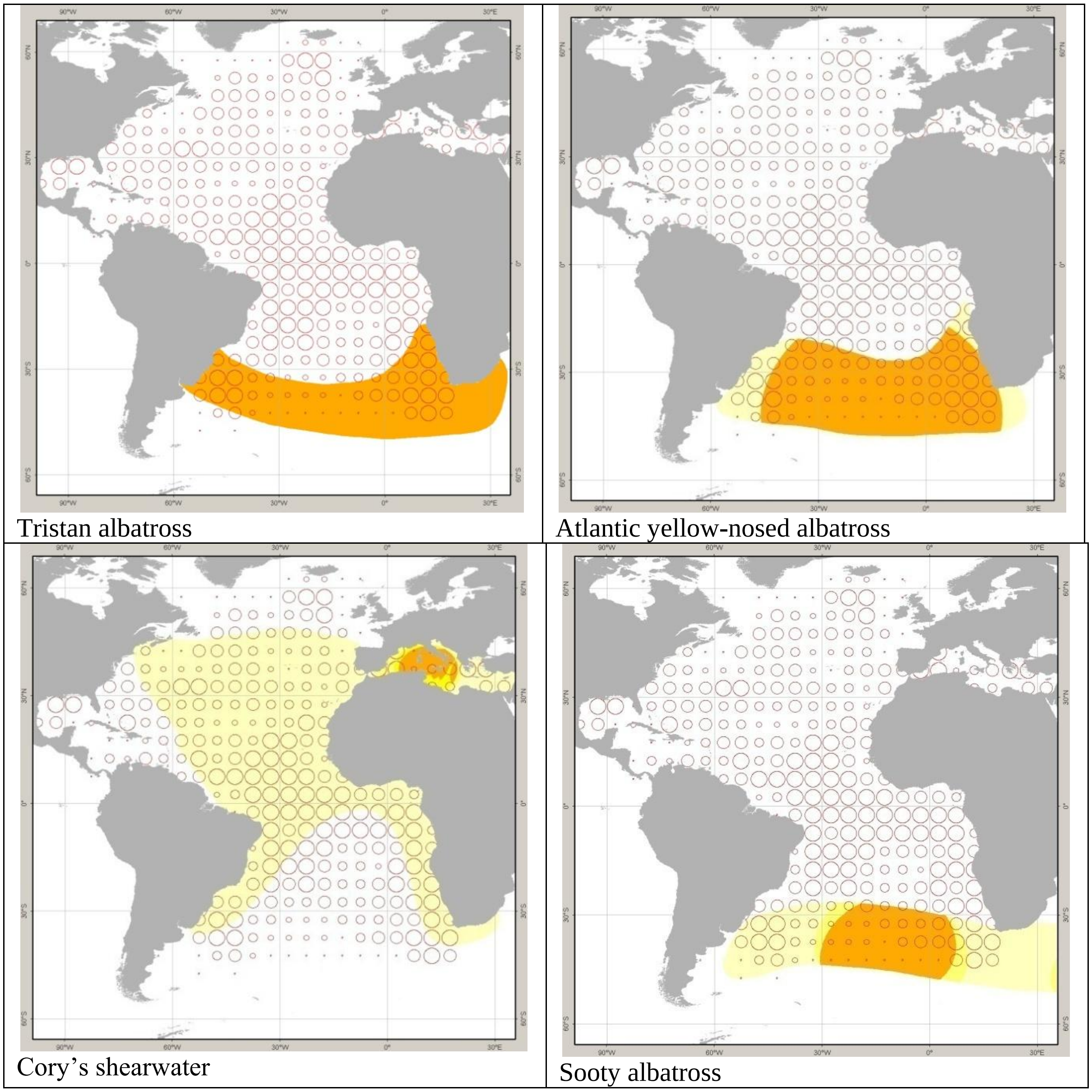


Figure 1. Examples of seabird species/populations with a high degree of overlap (Index 1) with reported ICCAT longline fishing effort in 5º× 5º squares for 2000-2005. Seabird distribution is divided into incubation (darker orange) chick-rearing (intermediate color) and non-breeding (pale orange) stages. Breeding distribution data for Cory's shearwater and sooty albatross are from the Mediterranean and Gough Island populations, respectively.

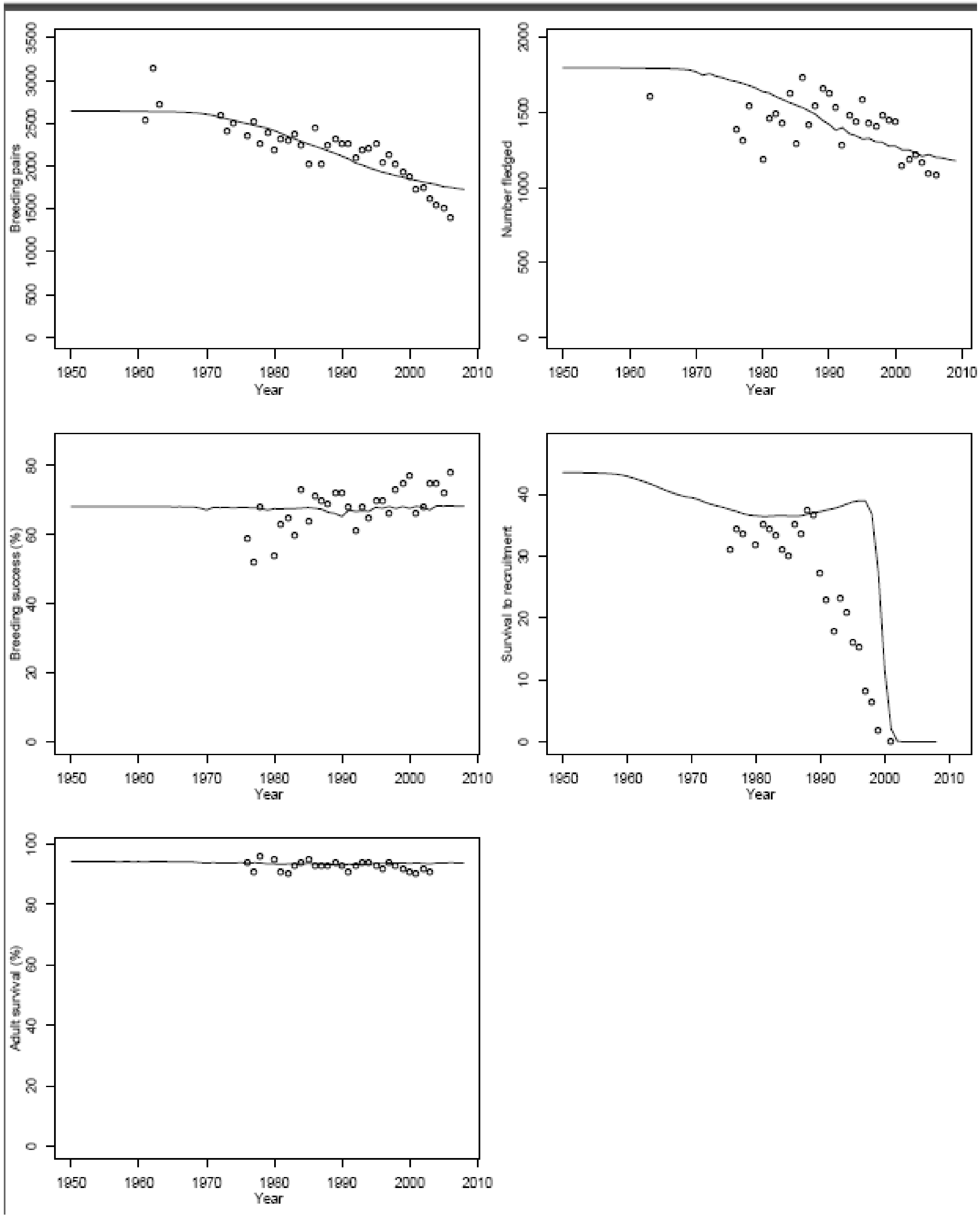


Figure 2. The observed (circles) and model estimate (lines) quantities on which the model is conditioned for the wandering albatross of South Georgia.

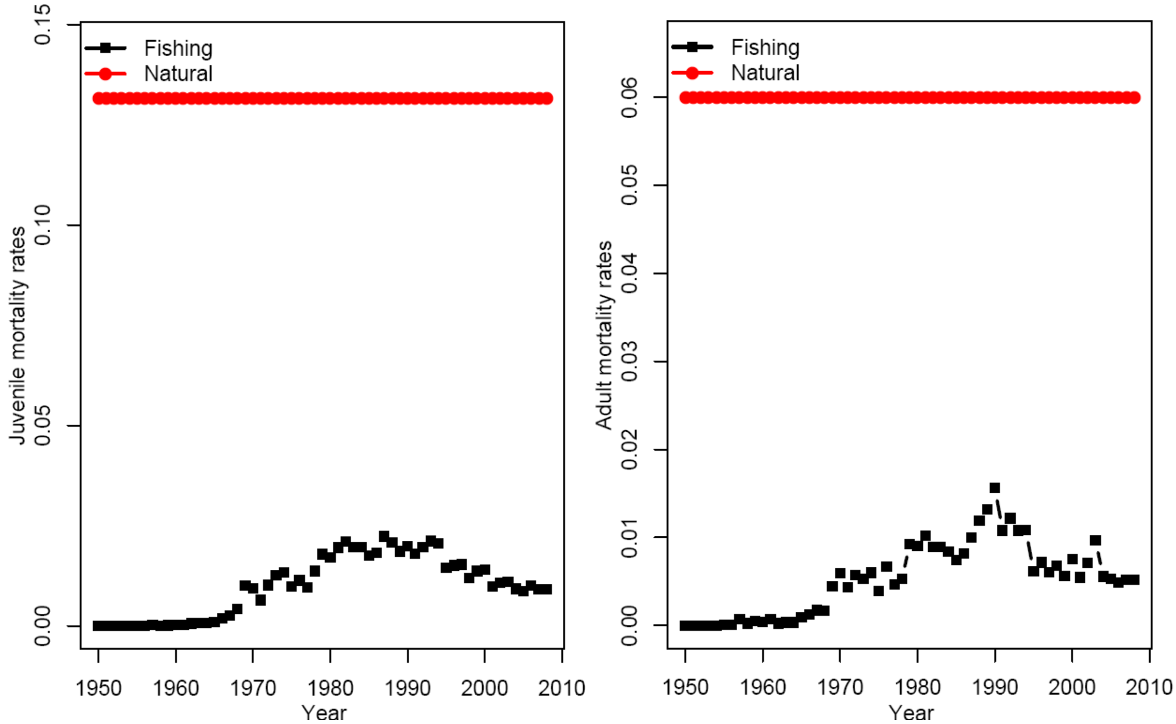


Figure 3. Estimated annual fishing mortality and assumed natural mortality for two stages of wandering albatross of South Georgia.

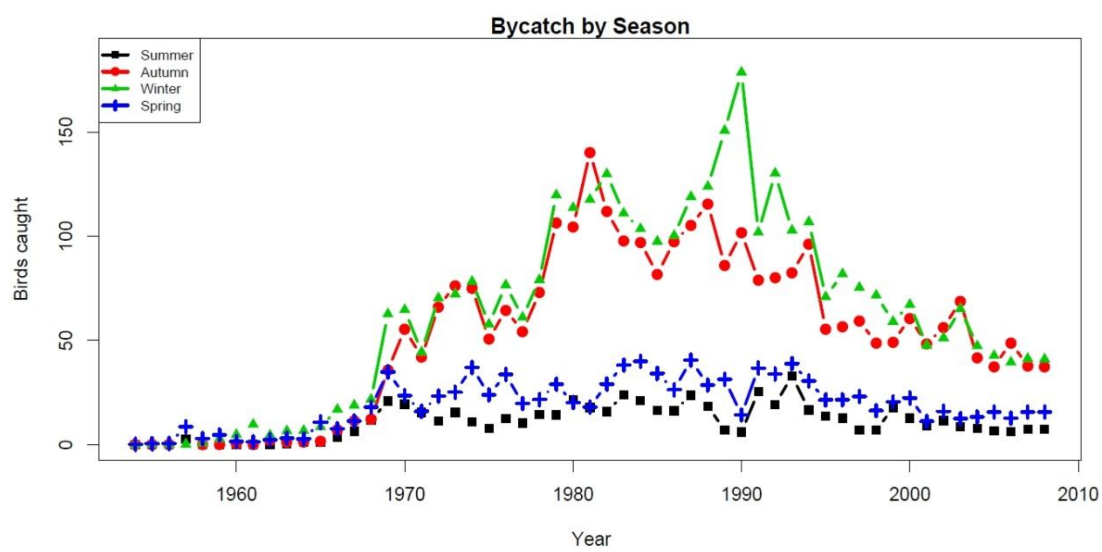


Figure 4. Estimated time-series of numbers of wandering albatross of South Georgia caught by season.

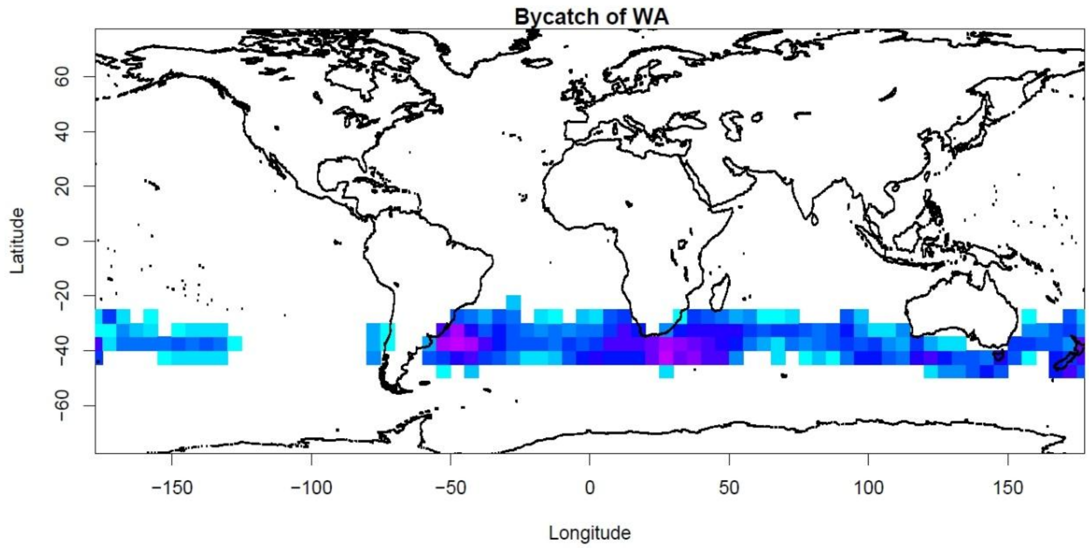


Figure 5. Distribution of wandering albatross by-catch (South Georgia population) from the pelagic longline super-fleet estimated for the model. Light blue indicates areas of low by-catch, purple high b-catch.

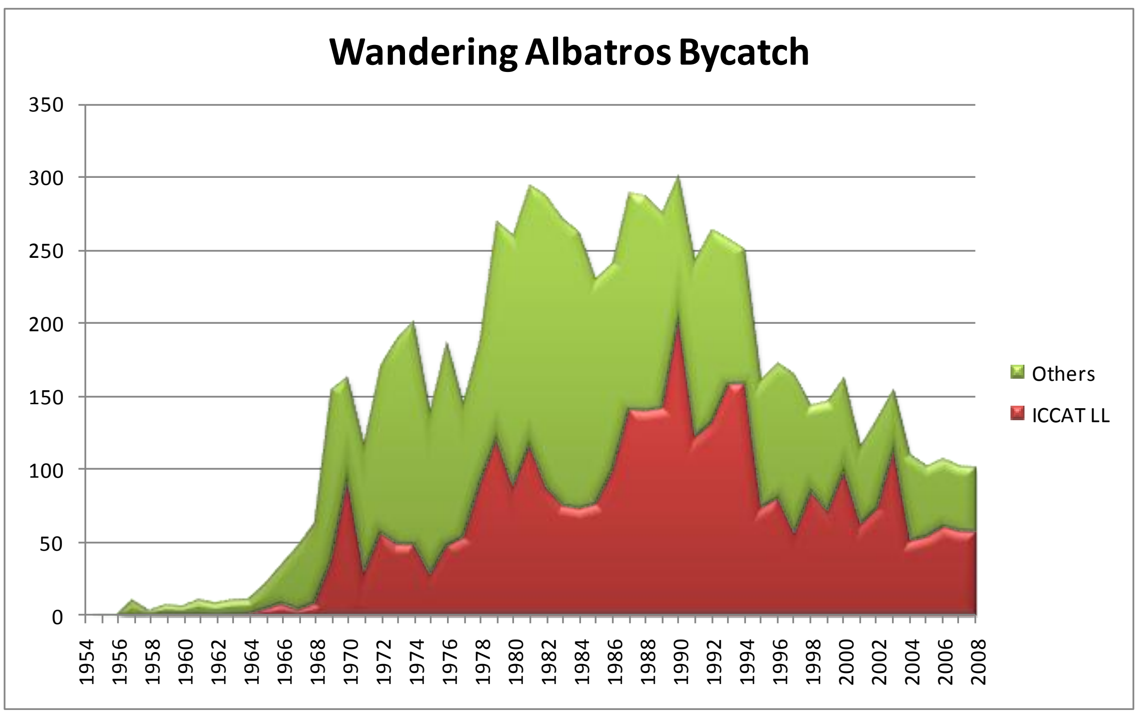


Figure 6. Estimated time-series of by-catch for the wandering albatross population of South Georgia by super-fleet and by effort attributed to the ICCAT fleets.

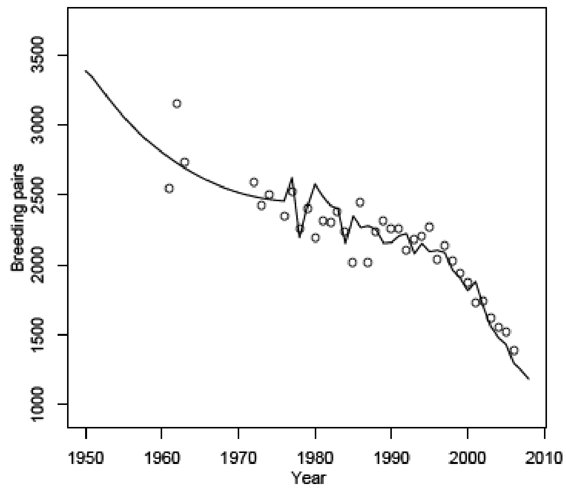


Figure 7. Observed (circles) and estimated (line) numbers of wandering albatross breeding pairs (South Georgia population) using a simple population model.

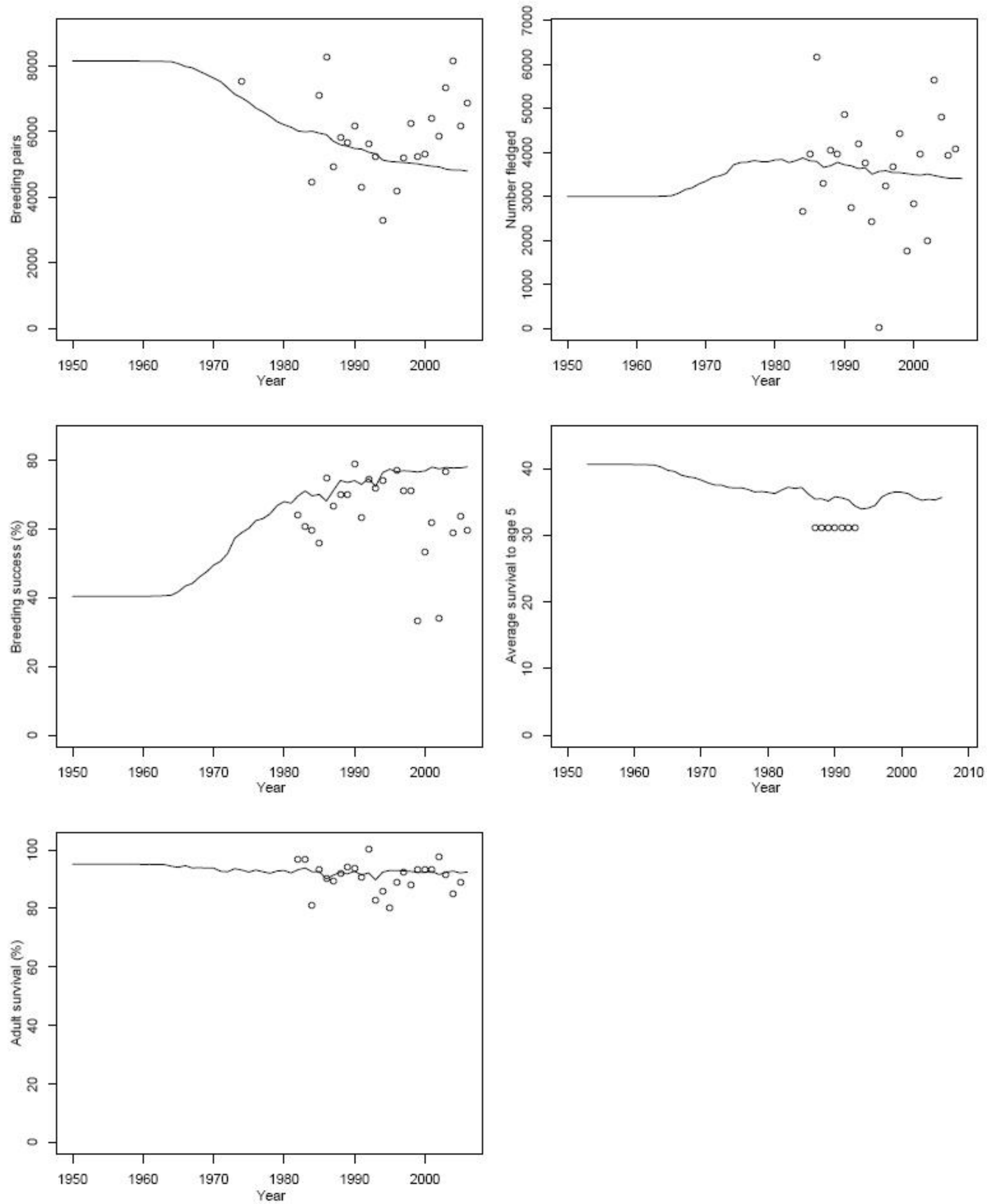


Figure 8. Observed (circles) and model estimate (lines) quantities on which the model is conditioned for black-browed albatrosses of South Georgia.

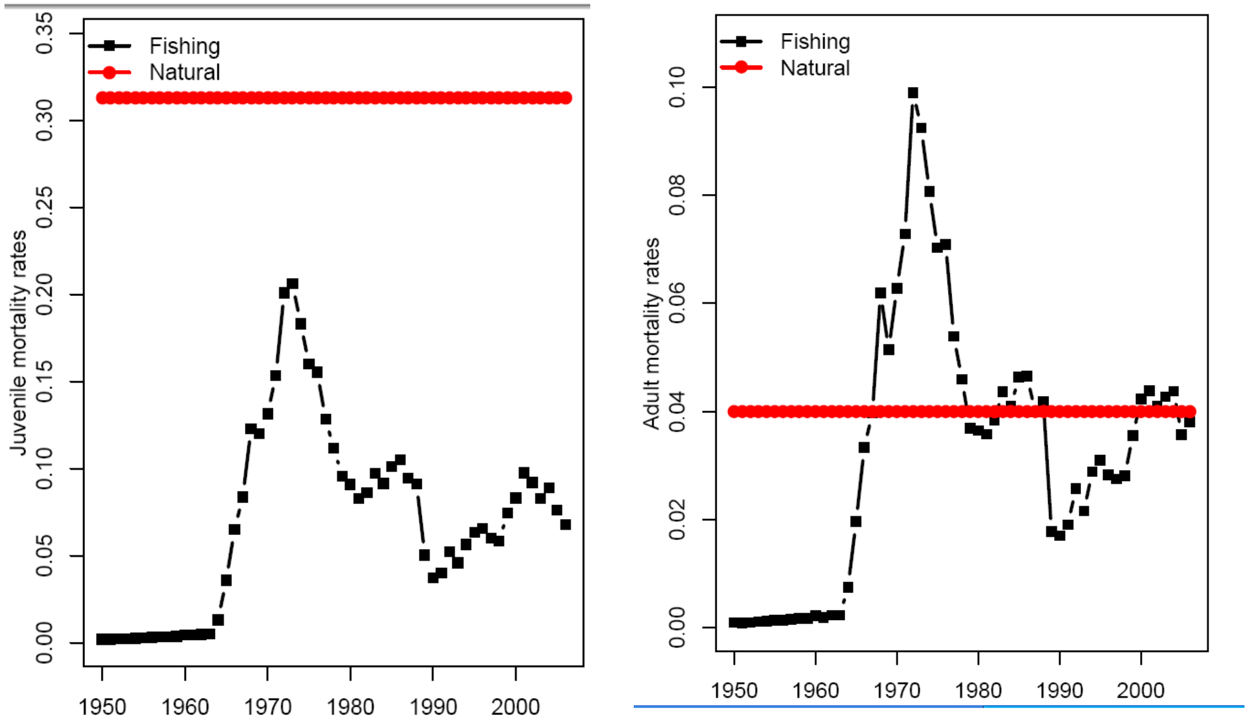


Figure 9. Estimated annual fishing mortality and assumed natural mortality for two stages of black-browed albatross of South Georgia.

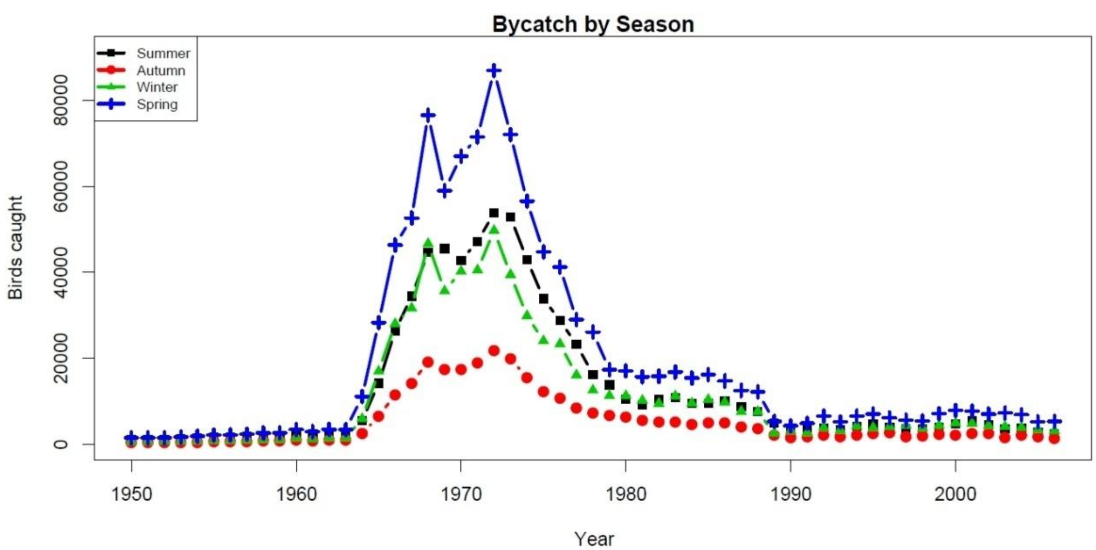
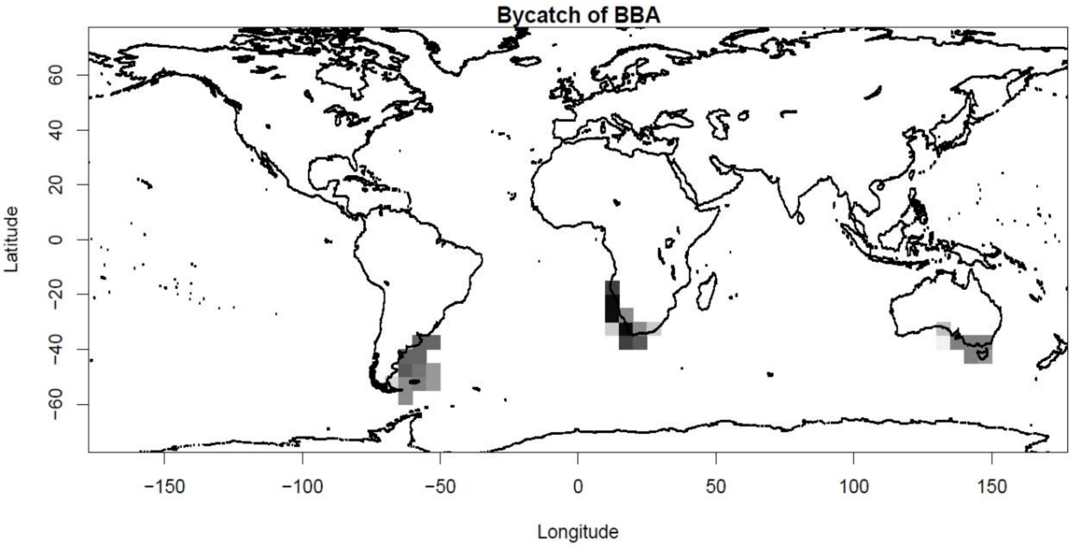


Figure 10. Estimated time-series of number of South Georgia albatrosses caught by season.

a)



(b)

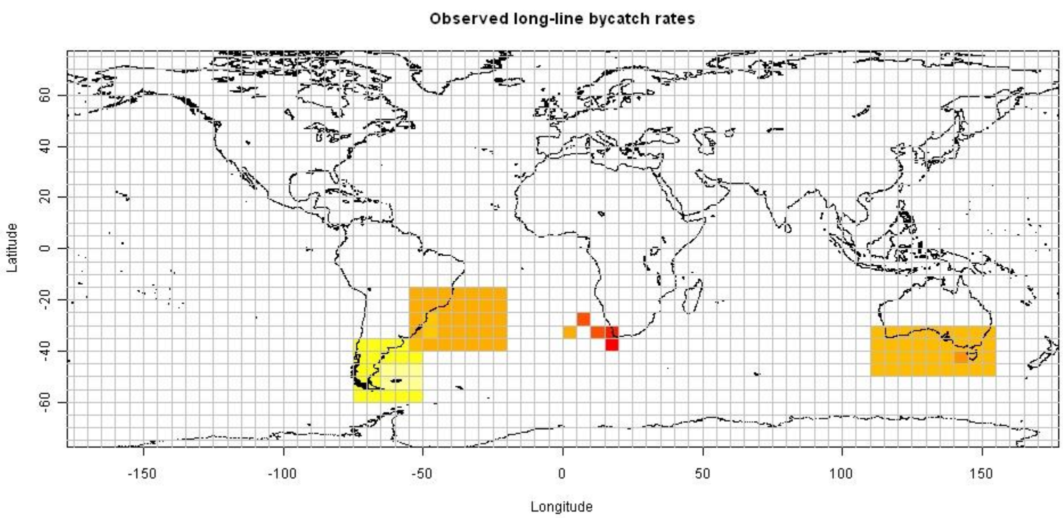


Figure 11. (a) Distribution of South Georgia black-browed albatross by-catch from the trawl super-fleet estimated for the model. Light grey indicates areas of low by-catch, dark gray high by-catch. (b) Spatial distribution of observed South Georgia black-browed albatross by-catch rates from demersal and pelagic longline. Red indicates a relative high by-catch rate, yellow lower.

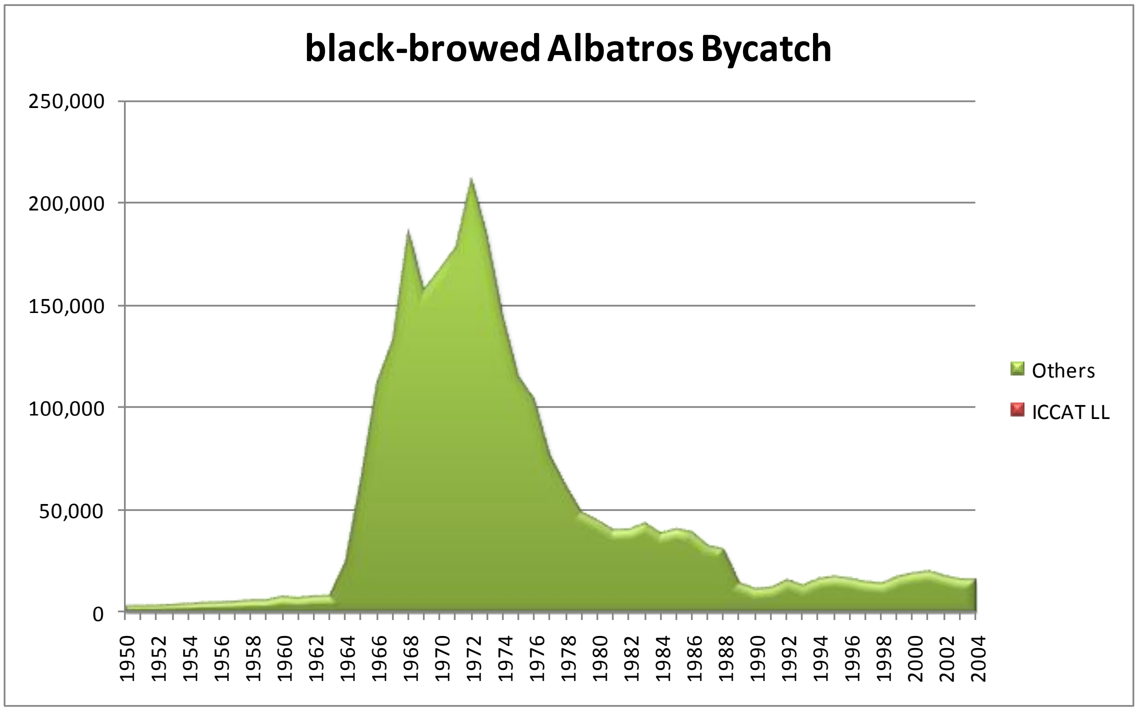


Figure 12. The estimated annual time-series of by-catch for the black-browed albatross population of South Georgia by super-fleet and by effort attributed to the ICCAT fleets.

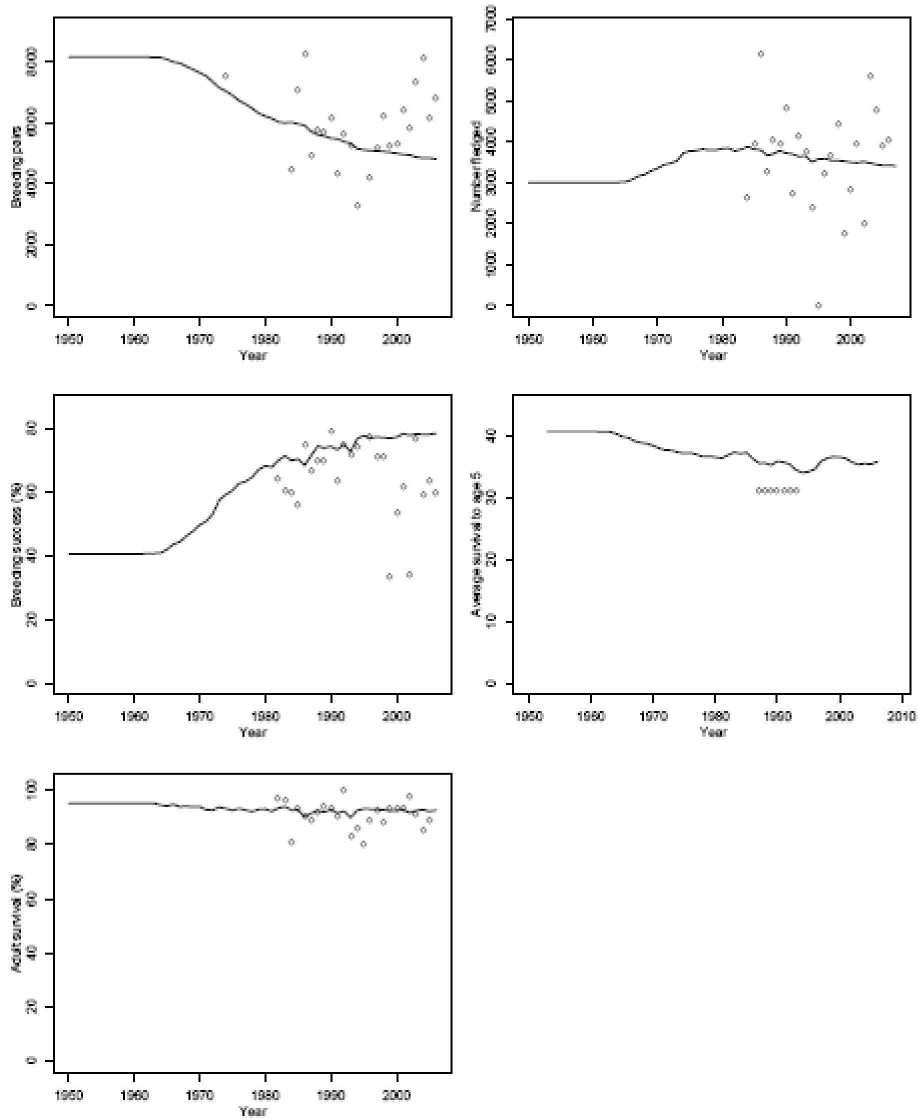


Figure 13. The observed (circles) and model estimate (lines) quantities on which the model is conditioned for yellow-nosed albatrosses of Gough Island.

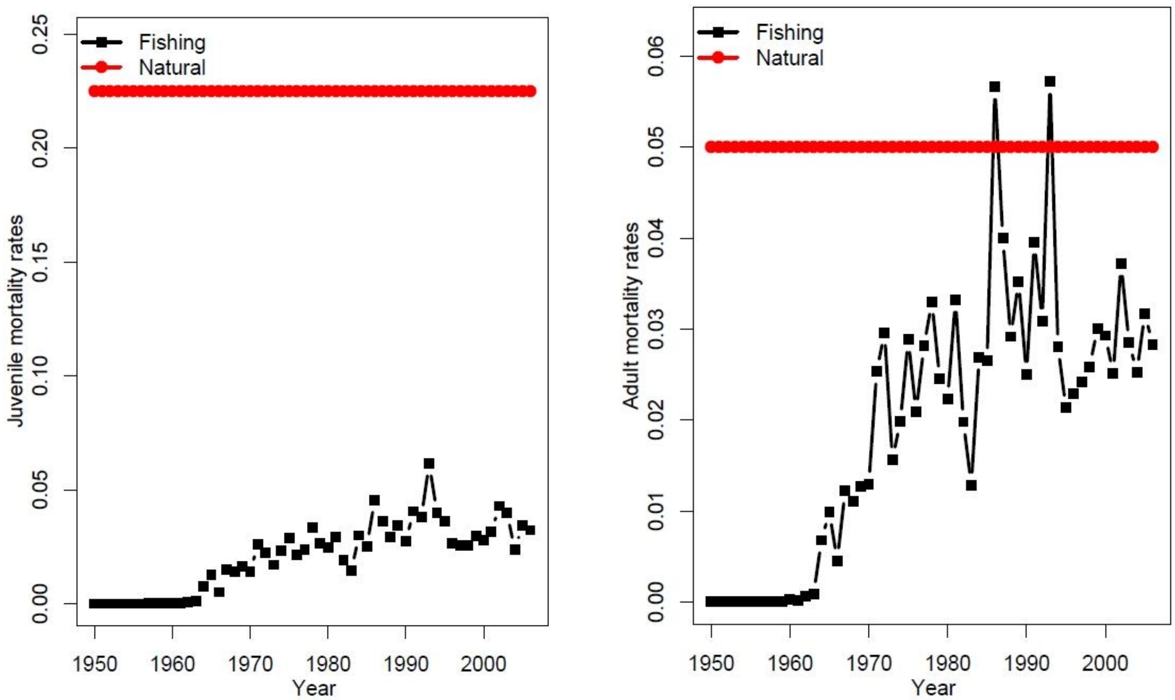


Figure 14. The estimated annual fishing mortality and assumed level of natural mortality for yellow-nosed albatross of Gough Island.

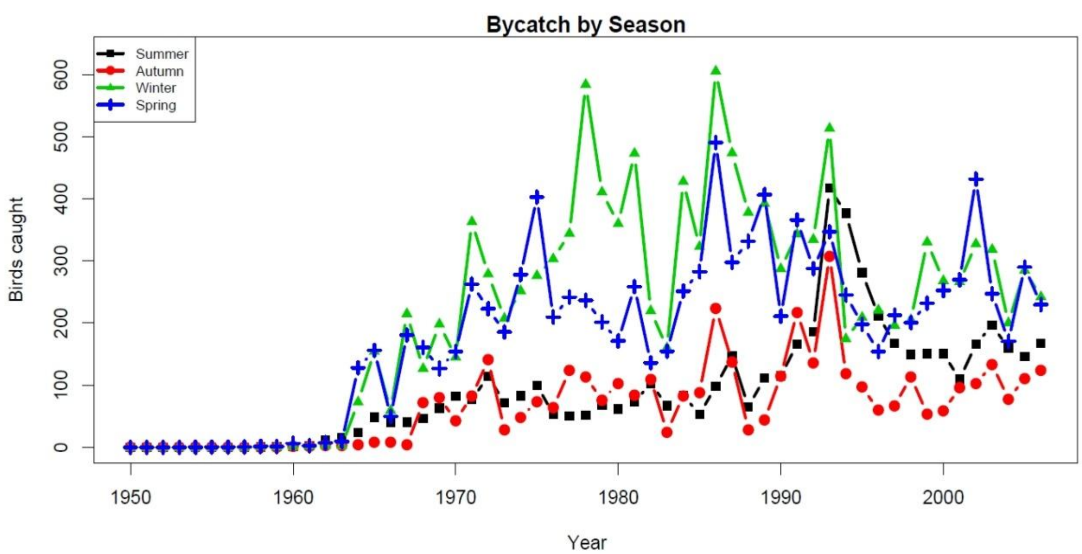


Figure 15. The estimated time-series of annual birds caught by season for yellow-nosed albatross of Gough Island.

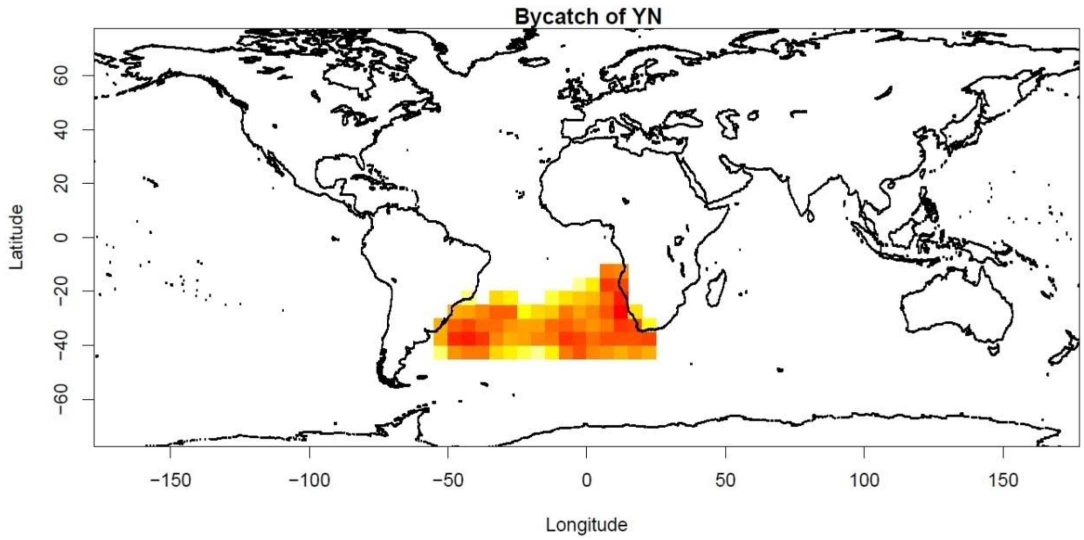


Figure 16. The distribution of by-catch estimated for the model applied to the yellow-nosed albatross population of Gough Island. Yellow indicates areas of low by-catch, red high by-catch.

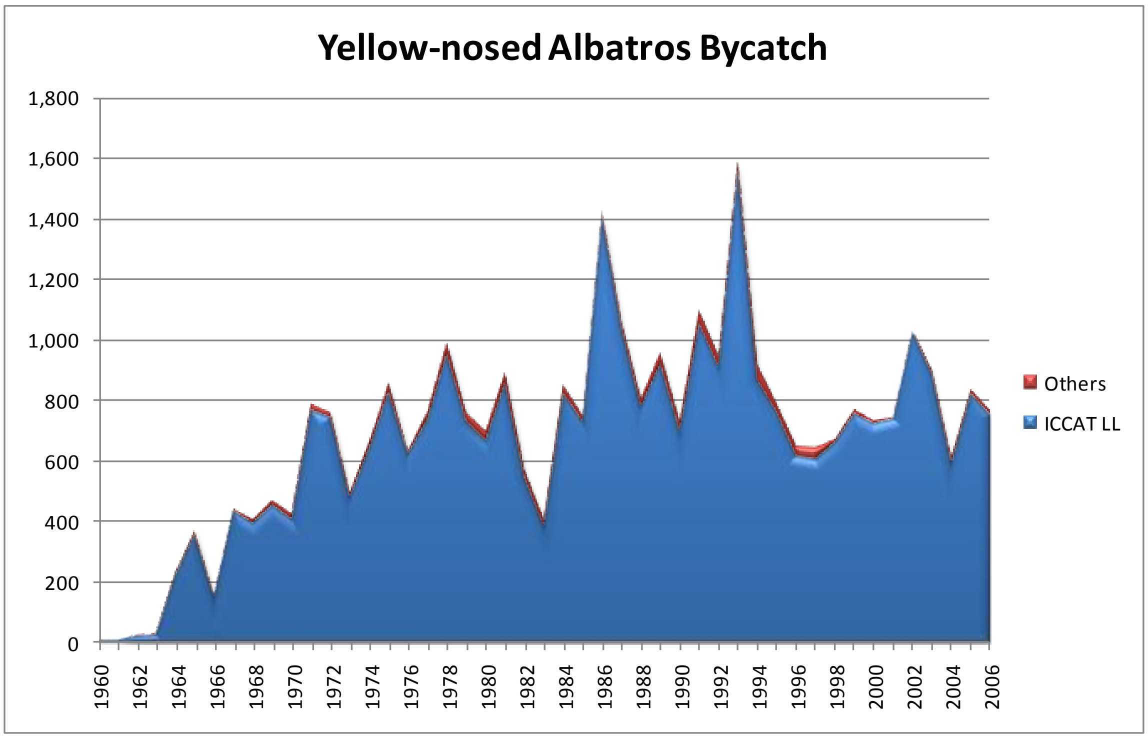


Figure 17. The estimated annual time-series of by-catch for the yellow-nosed albatross population of Gough Island by super-fleet and by effort attributed to the ICCAT fleets.

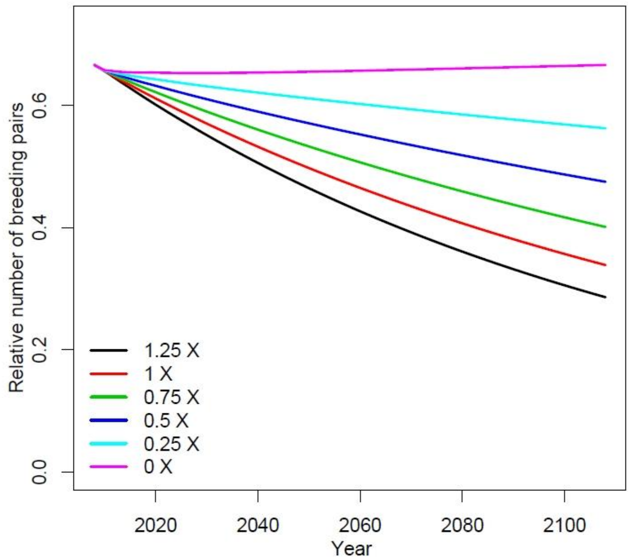


Figure 18. The projected trajectory of numbers of breeding pairs relative to initial levels for various adjustments to super-fleet catchability (0.5 implies that the seabird catchability of super-fleets has decreased by half). The effort magnitude and distribution is assumed to remain at that of 2006. Trajectories are shown for wandering albatross of South Georgia.

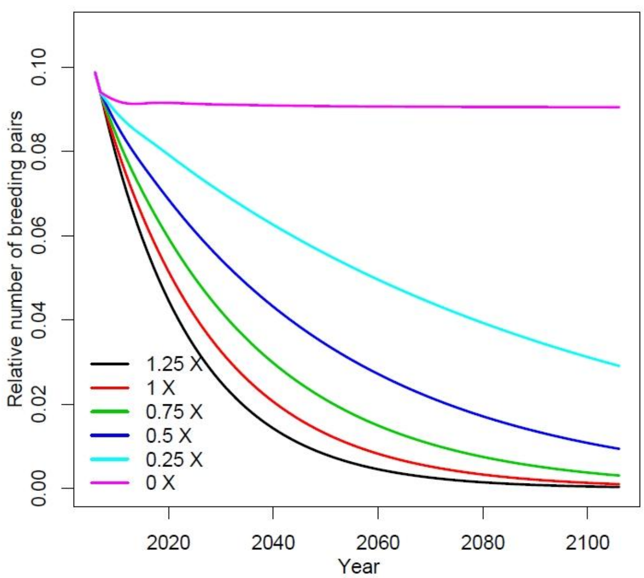


Figure 19. The projected trajectory of numbers of breeding pairs relative to initial levels for various adjustments to super-fleet catchability (0.5 implies that the seabird catchability of super-fleets has decreased by half). The effort magnitude and distribution is assumed to remain at that of 2006. Trajectories are shown for black-browed albatross of South Georgia.

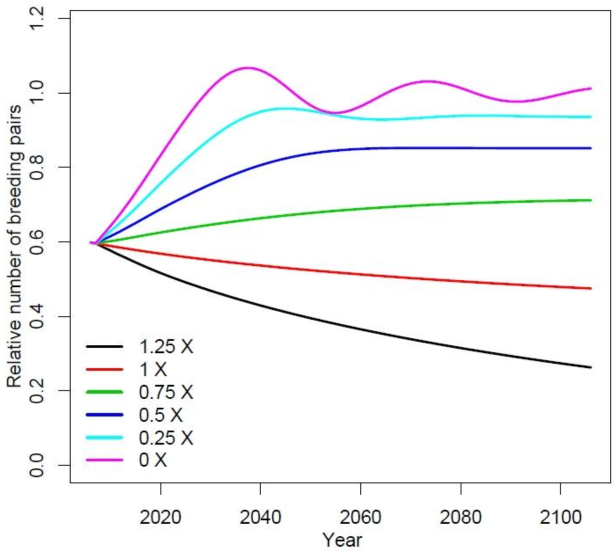


Figure 20. The projected trajectory of numbers of breeding pairs relative to initial levels for various adjustments to super-fleet catchability (0.5 implies that the seabird catchability of super-fleets has decreased by half). The effort magnitude and distribution is assumed to remain at that of 2006. Trajectories are shown for yellow-nosed albatross of Gough Island.