

REPORT OF THE JOINT ASSESSMENT GROUP (JAG)
(Walvis Bay, Namibia, 17 to 19 July 2006)

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REPORT OF THE MEETING OF THE JOINT ASSESSMENT GROUP

(Walvis Bay, Namibia, 17 to 19 July 2006)

MEETING OBJECTIVES AND AGENDA

1.1 In accordance with a decision taken by the Commission (CCAMLR-XXIV, paragraphs 8.3 to 8.6), the meeting of the Joint Assessment Group (JAG) was held from 17 to 19 July 2006, in Walvis Bay, Namibia, in conjunction with the meeting of WG-EMM. The meeting was co-convened by Ms R. Tuttle (USA) and Dr D. Agnew (UK).

1.2 In considering its agenda, JAG noted the following requests of the Scientific Committee (SC-CAMLR-XXIV, paragraphs 7.4 to 7.6) and that these fell within the JAG's Terms of Reference (CCAMLR-XXIV, Annex 7):

- (i) to consider development of estimation methods for IUU catches in order to prepare the best estimates of IUU fishing as model inputs (e.g. in CASAL) rather than 'conservative' or 'precautionary' estimates;
- (ii) to continue work to better understand the effectiveness of different levels of observation in detecting levels of IUU activity;
- (iii) to consider undertaking a review of the historical series of IUU catches with respect to the assumptions made by WG-FSA in estimating these catches;
- (iv) to consider whether qualitative information could be provided for each of the CCAMLR areas, so that the level of monitoring needed for those areas can be classified along with an indication as to whether the level of monitoring changed significantly from the previous year.

1.3 The draft meeting agenda prepared by the Commission (CCAMLR-XXIV, Annex 7) was revised in order to streamline and structure JAG's discussion of all items and to facilitate preparation of advice to both SCIC and the Scientific Committee. The revised agenda was adopted.

1.4 The revised agenda, list of participants and list of documents considered by JAG are attached (Attachments I to III respectively).

1.5 Keeping in mind that JAG is a joint body, it is anticipated that its report will be considered by the Commission and the Scientific Committee in the following order:

- WG-FSA (including JAG-06/7);
- Scientific Committee (including comments and recommendations made by WG-FSA);
- SCIC (including preliminary advice received from the Scientific Committee and a Secretariat paper on current requirements on reporting IUU activity);
- Commission (including advice received from SCIC and the Scientific Committee).

CURRENT METHODOLOGY FOR ESTIMATING IUU CATCHES

2.1 Details of past and current methodologies for estimating IUU catches of toothfish were considered (JAG-06/6).

2.2 JAG noted that the current methodology is a compliance-related deterministic approach. The current methodology uses the number of IUU vessels active in a subarea or division, combined with estimates of the likely fishing trip duration for an IUU vessel in the area, the number of likely fishing trips per vessel represented by a sighting, and the likely catch rate in that area to arrive at an estimate of IUU catch of toothfish. The following information is taken into consideration:

- (i) number, type and size of vessels sighted engaged in IUU fishing and reported by CCAMLR Members or reported via other sources;
- (ii) type and size of CCAMLR licensed vessels, their catch and effort, and duration of fishing trips reported;
- (iii) reports of recovered illegal longline gear;
- (iv) reports of undocumented landings;
- (v) catch and effort information from vessels apprehended for IUU fishing by Coastal States in the Convention Area;
- (vi) fish product conversion factors, when necessary to apply them, as agreed by WG-FSA in 1999 and amended in 2000.

Limitations to the current methodology

2.3 JAG noted that the current methodology does not identify uncertainties, in particular that:

- (i) IUU catch estimates do not include a credible minimum and maximum range;
- (ii) there are no criteria by which to categorise levels of surveillance coverage by season or by area;
- (iii) fishing duration as currently expressed is confusing;
- (iv) the extrapolation of IUU catch estimates for periods when surveillance is absent does not identify the number of fishable days per month, particularly for October and November, and per area;
- (v) CPUE (catch rates per day) is not currently defined separately for different types of vessel (for example, it may include gear, hold size and nationality, gross registered tonnage) and the impact of possible transshipments may need to be taken into account;

- (vi) it does not account for known trends in assumed parameters (number of fishing trips, days fished per trip and catch rate per day).

2.4 In considering the Scientific Committee's view that IUU estimates for the 1998/99 to 2000/01 seasons had particular uncertainties attached to them (SC-CAMLR-XXIV, Annex 5, paragraph 8.8), JAG:

- (i) investigated methods of considering uncertainty, including qualitative data;
- (ii) developed criteria for a weighting of each IUU event observed¹;
- (iii) developed an expression of uncertainty in historical periods.

2.5 Further details of the JAG discussions of the items listed above are in sections 4 and 5 below.

SENSITIVITY OF STOCK ASSESSMENTS TO LEVELS OF UNCERTAINTY IN IUU CATCH ESTIMATES

3.1 The Steering Committee of JAG and WG-FSA had asked WG-FSA-SAM to consider the consequences of under- or overestimating IUU on the estimates of biomass and yields (SC-CAMLR-XXIV, Annex 5, paragraph 8.7). The response from WG-FSA-SAM was given in paragraphs 8.5 to 8.9 of the report of the WG-FSA-SAM (WG-FSA-06/6). In summary:

- (i) WG-FSA-SAM agreed that assuming a higher catch for the purposes of assessment is likely, in many cases, not to be precautionary. In general a best estimate of IUU is required for assessments, but it would additionally be useful to have information on the range of the uncertainty of the IUU estimate. The effects of the uncertainty in the IUU estimates on the assessment results and yields could then be evaluated by WG-FSA-SAM, in the same way as uncertainty in other parameters (WG-FSA-06/6, paragraph 8.7).
- (ii) Last year WG-FSA had decided that it should assume two alternative scenarios with respect to estimates of IUU in the current season: (i) that they were accurate up to the date of the meeting, and that these estimates should be included in assessments; and (ii) that they were uncertain and should not be included in assessments (SC-CAMLR-XXIV, Annex 5, paragraph 8.3). WG-FSA-SAM suggested that the long- and short-term consequences of adopting either scenario should be investigated, given a range of assumptions about the true level of IUU catches (WG-FSA-06/6, paragraph 8.8).

3.2 The results of a set of operating model/estimation model experiments that investigated the impact of incorrect assumptions of the level of IUU catch on model estimates of initial and current biomass under a range of scenarios were presented (JAG-06/10). This paper reported simulations conducted using CASAL over a limited range of scenarios for a

¹ For the purposes of JAG, an IUU event is defined as an event, a record of which contains information which enables it to be identified as IUU fishing activity in contravention of CCAMLR conservation measures in force. Such records should include information on the time and geographical location of the event.

hypothetical stock with a hypothetical catch history, and with CPUE, catch-at-age, trawl survey, and tag-recapture observations. The stock assessment models were similar to the CASAL models current being used in Subarea 48.3, Division 58.5.2 and the Ross Sea.

3.3 The results for these simulations suggest that, in general the inclusion of an overestimate of IUU catch resulted in an overestimate of stock productivity, and hence an overestimate of initial and current biomass. However, a limitation of the simulation experiments was that they considered only short series of IUU catch over periods of the fishery either before or during the period when observations were available from the underlying population, and with the exception of tagging data, used observation types that were relative, not absolute, indices of abundance.

3.4 In general, these simulated scenarios suggest that, with these model types (i) the inclusion of an overestimate of IUU catch is not usually conservative, (ii) the time period when the IUU catch occurs within the time period of the model can impact the level of model bias (the degree to which the model over- or underestimates true population status), and (iii) bias was less in scenarios where a greater number of types of observations were included within the estimation model.

3.5 It was explained that these conclusions are broadly within expectations for the type of assessment methods employed by CASAL. JAG noted that roughly opposite conclusions are likely to apply to the assessment methods employed by GYM, which uses forward projections from known stock status rather than the backward fitting of observations. JAG also noted that this confirmed the initial expectations of WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraph 8.7).

3.6 JAG-06/10 also suggested that, until a greater understanding of how different models react to inaccurate estimates of IUU catch, it may be prudent to conduct sensitivity trials for individual stocks for the various alternative scenarios of IUU catch in each specific case.

3.7 JAG noted that while WG-FSA had used the two scenarios for the inclusion of IUU catch in some assessments at WG-FSA-05 (see paragraph 3.1(ii)), WG-FSA-SAM-06 had suggested that the consequences of these approaches would need to be addressed at WG-FSA-06. JAG agreed that the approach used by WG-FSA in 2005 may not be the best method in future assessments and drew attention to its later discussions of uncertainty in sections 4, 6 and 7.

3.8 JAG agreed that assuming a higher IUU catch for the purposes of assessment is likely, in many cases, not to be precautionary for some assessments. In general a best estimate of IUU is required for assessments, but it would additionally be useful to have information on the range of the uncertainty in the IUU catch estimated.

OPTIONS FOR IMPROVING THE CURRENT METHODOLOGY

4.1 Currently IUU catch is estimated as follows:

$$\text{IUU catch} = [\text{number of vessels}] \times [\text{trip duration (days)}] \times [\text{number of trips per year}] \times [\text{catch rate (tonnes/day)}].$$

4.2 There are three scenarios within the current approach where uncertainty needs to be considered:

- (i) uncertainty in whether a reported IUU fishing event was in fact an IUU fishing event;
- (ii) when assuming an IUU fishing event, uncertainty in the catch associated with that event;
- (iii) uncertainty in the level of IUU fishing actually detected within the Convention Area.

4.3 It was agreed that the first two of these issues could be refined within the current methodology so as to provide estimates of uncertainty rather than the current point estimate of IUU catch. The third issue can only be addressed through alternative sampling or simulation-based techniques, and these are considered in section 5. This third uncertainty has led the Scientific Committee to advise, from 1997 to 2001 (SC-CAMLR-XVIII, paragraph 5.32; SC-CAMLR-XIX, paragraph 2.16; SC-CAMLR-XX, paragraph 2.11), that estimates of IUU fishing are probably underestimates of the real level of IUU fishing.

4.4 In considering improvements to the current methodology for estimating levels of IUU fishing, the JAG investigated the use of a decision tree approach to the determination of a relative level of certainty for reported IUU events. JAG also considered a qualitative approach (JAG-06/8) to assessing the relative reliability or uncertainty of information connected with the IUU vessels fishing in CCAMLR waters. While the decision-tree approach showed some value for constructing models, the group proposed a simplified version of the matrix set out in JAG-06/8 (Table 1) as a basis for the estimation of uncertainty of an IUU event occurring that could be applied by the Secretariat.

4.5 It is envisioned that the matrix be used to ascertain a relative value of certainty associated with a reported IUU event, and that the level of uncertainty determined be introduced to the process for calculating IUU catch associated with detected events by converting the relative uncertainty to a probability measure.

4.6 JAG agreed that the Secretariat trial the matrix in 2006 to determine the applicability of the matrix to assessing uncertainty by using historic IUU reports for selected fisheries for the years 2003 to 2005, and to report the results of this trial to the IUU Subgroup of WG-FSA.

4.7 JAG discussed a method for deriving a cumulative total of IUU catch within a season for each area. To do this, two further parameters (probability and distributions of days fished and CPUE) are required to convert the calculation from a deterministic point estimate to an estimate which includes a description of uncertainty.

4.8 Within this context, the relative probability of an individual IUU event (as derived from a reliability score) could be multiplied by the distribution of catch for that event where the distribution of the catch was derived from a distribution of fishing days multiplied by a distribution of daily catch rates, subject to constraints, e.g. hold capacity. Then the total IUU catch may be calculated as the sum of the distributions of each individual event.

4.9 For example, given five IUU events within an area in a season, with probabilities and catches (assumed, for the purposes of this example, to be lognormally distributed with CV 0.3) as given in the Table 2, then (i) a distribution of catch for each event can be derived, and (ii) the distribution of the total catch can be derived as the sum of the individual events.

4.10 In order to investigate this, the distributions of both numbers of days fished per season and catch per day will have to be determined. The Secretariat and WG-FSA are requested to examine the available data from which to calculate these distributions.

4.11 JAG recommended that WG-FSA be tasked with the development of the above method.

Surveillance and reporting

4.12 JAG noted the information in the Secretariat's report (JAG-06/6) regarding the level of surveillance of CCAMLR fisheries. It agreed that there was a disparity between the levels of surveillance of CCAMLR fisheries, and that where this level of surveillance was low, this was likely to reduce the Commission's ability to detect IUU events.

4.13 JAG endorsed a proposal that SCIC determine a level of vulnerability to IUU fishing for CCAMLR fisheries. JAG considered such an assessment could be modelled on the work of ad hoc WG-IMAF on assessing seabird mortality risk in CCAMLR fisheries by statistical subarea or division. In making an assessment, JAG suggested that SCIC consider:

- level of surveillance of the fishery
- fishable ground available
- access to the fishery (ice coverage, access to a port)
- presence of legal fishing vessels
- potential deterrent effect of other activity (e.g. tourist vessels, cargo vessels etc.)
- recorded presence of IUU fishing vessels.

4.14 The level of vulnerability will be later included in the proposed new method for estimating the level of IUU fishing represented by an individual event (Table 1).

ESTIMATING UNDETECTED IUU ACTIVITY

5.1 The present methods are designed to be deterministic estimates of IUU catch based on sightings and information available to the Secretariat or Members. Whilst improvements can be made (see section 4), new methods are required to improve estimates of IUU to capture undetected IUU. Available methods include trade accounting, sampling and modelling methods and estimation within assessment models (JAG-06/4).

Analysis of trade statistics

5.2 JAG-06/5 examined the potential of trade data as an additional check on the total IUU catch taken. It pointed out that under the new Harmonised Commodity Description and Coding System (HS), which comes into force in January 2007, imports and exports of toothfish products will be recorded under specific standardised codes.

5.3 JAG recognised that the acceptance of this code by more than 150 countries, including China and other import countries from which CDS information is currently only partially reported, creates the opportunity to check the proportion of toothfish trade which is being captured by the CDS. However, it was recognised that several limitations within this trade data will continue to exist, including the inability to distinguish between toothfish species and areas of capture, the delay between catches occurring and the product appearing in trade data, and the potential for product to be double-counted in trade data as a result of re-export (CCAMLR-XXIII/BG/17).

5.4 JAG concluded that an analysis of trade data, compared with CDS data, would be a potentially very useful study. It could provide additional information to CCAMLR on the ability of the CDS to comprehensively track the trade in toothfish. JAG welcomed the European Community's initiative in preparing JAG-06/5, and encouraged it to undertake such a comparison when the HS-based trade statistics become available (for instance, 2008).

Sampling methods

5.5 A number of sampling methods have been developed for estimating IUU in CCAMLR waters, including the initial model of Agnew and Kirkwood (2005) being revised by Ball (2005). Both methods work on the same principle, in which sightings by surveillance vessels are considered to be individual samples of the level of IUU fishing, and a simulation model is used to relate the frequency of such sightings to an expected level of IUU fishing given assumptions about the behaviour of IUU vessels and the temporal and spatial coverage of the surveillance platform. Given a certain level of surveillance, the IUU level and its variance can be predicted with a certain probability. However, JAG noted that such an approach may not provide any assistance in developing IUU estimates for those areas where there was very little or no surveillance coverage.

5.6 JAG recommended that such an approach could be developed by using fishing vessel derived observations in addition to, or in the absence of, other surveillance data. Accordingly the role of licensed fishing vessels in CCAMLR fisheries in carrying out a surveillance role in highly vulnerable fisheries was considered in more depth.

5.7 Given the general absence of surveillance capabilities in a number of CCAMLR fisheries JAG recommended that SCIC consider requiring fishing vessels report both sightings (including radar detection) and the absence of vessels, providing positive identification of vessels where possible. It was also recognised that at the moment, unlike surveillance platforms, fishing vessels do not engage in wide-scale searching for IUU vessels.

5.8 JAG recommended that SCIC investigate ways of increasing the surveillance coverage of areas with a high vulnerability to IUU fishing.

5.9 JAG further suggested that SCIC consider developing options for more active mechanism for reporting and surveillance by fishing vessels in areas of high vulnerability.

5.10 JAG suggested that WG-FSA-SAM would be the appropriate body to undertake development of estimation methods such as those referred to in paragraph 5.5, using observations from fishing vessels and VMS vessel movement data. It was recognised that the development of the model would involve considerable effort, but that a secondary benefit would be an investigation of the ability to detect IUU activity and a quantification of the deterrent effect of the presence of licensed fishing vessels in an area.

Estimation in assessment models

5.11 There are ways of estimating unknown catches within assessment models. For instance, if there is an index of IUU activity but the absolute amount of IUU is unknown, assessment models can be constructed that can estimate that amount (see, for example, Plagányi and Butterworth, in prep.). JAG suggested that WG-FSA-SAM or WG-FSA might usefully look at the potential for using such methods.

New gears

5.12 In considering additional uncertainties associated with IUU fishing, JAG noted with alarm reports of the use of gillnets by non-Contracting Parties in Subarea 58.6 and Division 58.4.3 (JAG-06/7). The gillnets are reported to be catching both sharks and toothfish. Some vessels included on the IUU vessel lists fishing inside the Convention Area claimed to be targeting shark when questioned by a patrol vessel. At least seven vessels on the draft IUU Vessel Lists for 2006 are reported to have converted from longliners to gillnetters and five are reported to have deployed gillnets in the Convention Area in the last 12 months.

5.13 The Commission should note that there is no actual prohibition on the development of a shark fishery in the Convention Area except through Conservation Measure 21-01, nor on the use of new fishing techniques such as gillnetting by non-Contracting Party vessels.

5.14 There is no information on the extent of the gillnet fishing activity or catch rates of the vessels involved, and in the absence of such information it is not possible to make an estimate of their potential IUU catch. JAG agreed that information on their operations, including the target species and type and size of gillnets was required. Information on catch rates was also important but secondary to establishing whether the vessels were in fact fishing for either shark or toothfish in the Convention Area using gillnets.

5.15 JAG suggested that WG-FSA might consider, in the light of information available at its 2006 meeting, whether fishable stocks of shark might occur in the Convention area.

REVIEW OF HISTORICAL IUU CATCH ESTIMATES

6.1 JAG examined trends for IUU catch for the period 1996 to 2005.

6.2 JAG recalled that the Scientific Committee has discussed whether Areas 47, 51 and 57, north of the Convention Area, could have supported the high level of catches that were reported from them in the CDS. Instead, it appears likely that these could be IUU catches taken within the Convention Area, misreported as coming from areas outside the Convention Area in an attempt to trade the fish within the CDS. In 2001, the Scientific Committee concluded that practically all the toothfish catches reported from Area 51 represent catches taken as a result of IUU fishing inside the Convention Area (SC-CAMLR-XX, paragraphs 2.12 and 2.13).

6.3 Figure 1 compares CDS data (predominantly from vessels now included on the IUU Vessel Lists) for Areas 47, 51 and 57 with the total IUU estimated by the CCAMLR since 1996. CDS data from 2000 represent a partial year (the CDS came into force in May 2000) but pro-rating to the whole year is not easy because the data from this year includes a number of catches before May.

6.4 JAG noted the close correspondence between the two series. In particular the CDS data appear to confirm that the estimates of IUU made from 2002 to 2004 probably represented a reasonably accurate estimate of total IUU catch in this period. During this time most of the IUU was presumed to originate from Area 58 (Table 3). Prior to this time, the discrepancy between IUU estimates and CDS data could be explained by legitimate catches from Areas 47, 51 and 57, or by under-reporting of IUU from within the Convention Area.

6.5 JAG also examined the uncertainties in a number of the parameters used in the calculation of IUU catches for the period 1997 to 2005. The parameters reviewed were the number of days per fishing trip, the number of trips per season and the mean catch rates per day (Figure 2).

6.6 It is clear that there was considerable variability in the assumptions of number of days per trip and number of trips per season per vessel up to, and particularly in, 1999. Since then, these two parameters have remained relatively constant, but have been assumed to be different between areas. The confusion between these two parameters confirms the need to move to a single estimate of the number of days that an IUU vessel is likely to fish during a fishing season.

6.7 JAG suggested that WG-FSA compare changes in catch rates against changes in stock size predicted by assessment models. However, it also noted that CPUE for all vessels displayed high variability, and that estimating the CPUE that would be achieved by an IUU vessel would depend on the fishing methods used and the experience of the masters. In 1996 and 1997 it would be likely that captains of the large number of opportunistic IUU vessels that were fishing in Area 58 were more 'naïve', and poorer fishers, than those operating in recent years. On the other hand, JAG noted that IUU operations may have higher catching efficiencies than legal vessels because, for example, they are not constrained by conservation measures.

6.8 One way to revisit the likely CPUE achieved by IUU vessels would be to iteratively estimate it within assessment models, but it was acknowledged that this would not be easy.

6.9 JAG concluded that whilst there were uncertainties in the historical series, there was little to be directly gained from revisiting these calculations in detail. JAG requested that WG-FSA consider including uncertainty and running sensitivity trials of its assessments to examine the impact of the following conclusions which flow from Figures 1 and 2:

- (i) In the period 1996 to 1998 estimates of IUU had high uncertainty and unknown bias. This could be explained by a lack of consistency in defining assumptions in the parameters used and fragmented information on the IUU fleet and its activities, landings and trade statistics. WG-FSA could examine the sensitivity of assessments to relatively large errors in estimates during this period.
- (ii) In the period 1999 to 2001 estimates of IUU had high uncertainty and the CDS data suggest that they were negatively biased (i.e. that real IUU catches were higher than estimated IUU catches). WG-FSA could examine the sensitivity of assessments to this bias, for instance by raising the catches to better match the CDS declarations from Areas 47, 51 and 57 for those subareas and divisions with highly uncertain IUU estimates.
- (iii) In the period 2002 to 2004 estimates of IUU had low uncertainty and low bias, and were effectively confirmed by CDS data. WG-FSA could examine the sensitivity of assessments to small unbiased errors in this data.
- (iv) In the period 2005 and onwards, estimates of IUU probably have low uncertainty and unknown bias.

6.10 The figures confirm that since the prohibition by the USA of the importation of toothfish declared taken from Areas 51 and 57, IUU catch is no longer being misreported from these areas. However, the situation has been complicated by such things as reflagging of vessels to non-Contracting Parties and the development of markets in countries not participating in the CDS. JAG concluded that under such circumstances the CDS may no longer be able to provide a complete record of IUU catches, or the total catch, of toothfish (see paragraphs 5.2 to 5.4).

CONCLUSIONS AND RECOMMENDATIONS

7.1 JAG noted that there had been considerable benefit in bringing together representatives dealing with compliance from SCIC and those dealing with assessments from WG-FSA.

7.2 JAG had addressed fully its Terms of Reference (see JAG-06/1 and JAG-06/9) and had also taken into account the various requests and questions raised by the Scientific Committee and WG-FSA in respect to the estimates of IUU catches.

7.3 That said, JAG saw no need for regular meetings. Rather, it recommended that any further meeting should await the outcome of the elements of work recommended to be undertaken by SCIC, WG-FSA and the Secretariat. On the basis of that work, the Commission might then wish to reconvene JAG, on an ad hoc basis, in perhaps three to five years time.

7.4 In consequence, JAG recommended that no changes need to be made, at this time, to its Terms of Reference and that any review of them should be undertaken as and when the Commission might decide to reconvene the JAG.

7.5 JAG recommended that the following actions be undertaken by SCIC, WG-FSA and the Secretariat:

Sensitivity of stock assessment to levels of uncertainty in IUU catch estimates:

- (i) Annual IUU estimates should be described by WG-FSA and the Secretariat by credible ranges and/or distributions, as well as point estimates.
- (ii) WG-FSA should estimate the minimum amount of annual IUU catch that would materially affect assessment advice, and hence provide advice on a threshold level of IUU catch, below which estimates of IUU catch may not need to be included within current yield advice.
- (iii) WG-FSA should consider how IUU estimates that include uncertainty, may be included within the current assessments, and recommended that WG-FSA request that WG-FSA-SAM develop modelling approaches that would allow the incorporation of uncertainty in IUU estimates to be included with assessments and calculation of yield estimates.
- (iv) WG-FSA should investigate the consequences of the uncertainties including biases of the historical estimates as detailed in paragraph 6.10 above.
- (v) WG-FSA, when developing fishery reports and assessments advice, should fully detail the explanation for the exclusion or revision of individual IUU estimates used.

Proposals for improving the current estimation methodology:

- (vi) Regarding the estimation of events, prior to the 2006 meeting of the IUU Subgroup of WG-FSA, the Secretariat should collate the data required to address the elements of the matrix in Table 1 to determine its applicability of assessing uncertainty in historic IUU reports for selected fisheries for the years 2003 to 2005. The Secretariat should test the application of the matrix and report its findings to the IUU Subgroup of WG-FSA.
- (vii) Additionally, WG-FSA should determine the distributions of both numbers of days fished per season per vessel and catch per day per vessel. The Secretariat and WG-FSA are requested to examine the available data from which to calculate these distributions.
- (viii) During the trial period, i.e. before a new standard system for IUU catch estimation is adopted, the Secretariat should continue to prepare IUU catch estimates based on the current methodology. Instead the product of the parameters 'number of trips per season per vessel' and 'number of days per trip' in the current formula (paragraph 4.1) should be replaced by the single

parameter 'number of days fished per season'. Such estimates should be prepared and made available to WG-FSA by 1 September each year, i.e. one month earlier than previous years.

7.6 The subsequent procedures and timelines stemming from this are that WG-FSA should:

- starting in 2006, run a trial of the revised IUU catch estimation method based on data for the last three years and areas selected and revise and re-trial as appropriate;
- consider sensitivities of parameters used in historical series of IUU catch estimates;
- request that WG-FSA-SAM develop a sampling model addressing undetected IUU fishing.

7.7 SCIC, at its next meeting, should categorise subareas and divisions by their vulnerability to IUU fishing as described in paragraph 4.12 above.

7.8 In addition, at its next meeting SCIC should consider improvements to surveillance coverage. This could include developing options for more active reporting and surveillance by Member States licensed fishing vessels in areas of higher vulnerability.

7.9 In order for SCIC to address this matter, JAG recommended that the Secretariat prepare a paper setting out the current requirements on reporting IUU activity. This paper should:

- identify the conservation measures and Commission decisions relating to the requirements for reporting IUU fishing by both fishing vessel masters and scientific observers;
- suggest consolidation and strengthening of such decisions, including consideration of placing specific emphasis on such reporting from areas of high vulnerability to IUU fishing within the conservation measures of such areas.

7.10 Furthermore, to enhance surveillance, SCIC might wish to consider requesting IAATO to arrange for its member company vessels to report all sightings (including radar detection) of fishing and fishing support vessels in the Convention Area.

Estimating undetected IUU activity

7.11 When HS-based toothfish trade statistics become available (see paragraph 5.4), SCIC should undertake a comparison of such data with the CDS data. JAG recognised that some Parties, particularly active in analysing trade statistics, could greatly assist in undertaking this task.

7.12 The Secretariat should prepare a paper conveying information on the change of gear by IUU vessels from longlines to gillnets, the possible scale of deployment of gillnets in the Convention Area, and the species being apparently targeted.

7.13 On the basis of that information, WG-FSA should consider whether, *inter alia*, fishable stocks of shark occur in the Convention Area.

ADOPTION OF THE REPORT AND CLOSE OF THE MEETING

8.1 The report of the meeting was adopted.

8.2 In closing the meeting, the Co-conveners of JAG, Ms Tuttle and Dr Agnew, thanked the participants and the Secretariat for their work and contribution during the meeting. JAG has made a significant progress in its work, the success of which is a combination of the effort of specialists from both the Commission and the Scientific Committee.

8.3 Participants expressed their gratitude to the Co-conveners for their leadership which had ensured success of the meeting.

8.4 The meeting was closed.

REFERENCES

- Agnew, D.J. and G.P. Kirkwood. 2005. A statistical method for estimating the level of IUU fishing: application to CCAMLR Subarea 48.3. *CCAMLR Science*, 12: 119–141.
- Ball, I. 2005. An alternative method for estimating the level of illegal fishing using simulated scaling methods on detected effort. *CCAMLR Science*, 12: 143–161.
- Plagányi, É.E. and D.S. Butterworth. In prep. A spatial- and age-structured assessment model to estimate poaching and ecosystem change impacting the management of South African abalone (*Haliotis midae*).

Table 1: Criteria for assigning weights to observations of IUU activity.

Category	Weighting factor				
	High 5	4	3	2	Low 1
Sighting	Longline fishing vessel sighted in CCAMLR waters		Gillnet fishing vessel sighted in CCAMLR waters	Fishing gear detected in CCAMLR waters	Fisheries support vessel (fish carrier, refuel) detected in CCAMLR waters
Identification	ID Confirmed and unlicensed for CCAMLR waters				ID unconfirmed
Information source	Surveillance platform, at-sea inspection	Multiple legal fishing vessels	Legal fishing vessel		Other
Vessel Activity	Gear deployed and fishing	Vessel in area on known fishing grounds but not fishing		Vessel in area on unlikely fishing grounds and not fishing	Unknown
Vulnerability	History of extensive IUU activity		History of limited IUU activity		Area unlikely to support IUU activity (e.g., depth, ice constraints, extensive surveillance)

Table 2: Example of five IUU events within an area in a season, with probabilities and catches (assumed, for the purpose of this example, to be lognormally distributed with CV 0.3).

IUU event	Probability	Catch [= days*CPUE] with 95% quantiles in parentheses		Expected catch	
1	1.0	400	(240–620)	400	(240–620)
2	0.6	400	(240–620)	240	(140–370)
3	0.8	400	(240–620)	320	(190–490)
4	0.2	400	(240–620)	80	(50–120)
Total				1040	(780–1340)

Table 3: IUU catch estimates for Areas 48, 58 and 88.

Area	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
48*	0	0	146	667	1 015	196	3	0	0	23
58	16 666	32 673	14 960	5 201	6 629	8 606	11 762	10 070	2 237	2 317
88	0	0	0	0	0	0	92	0	240	173

* Note that the IUU estimates from 1998 onwards have been made using the statistical estimation method of Agnew and Kirkwood (2005) which includes both detected and undetected IUU.

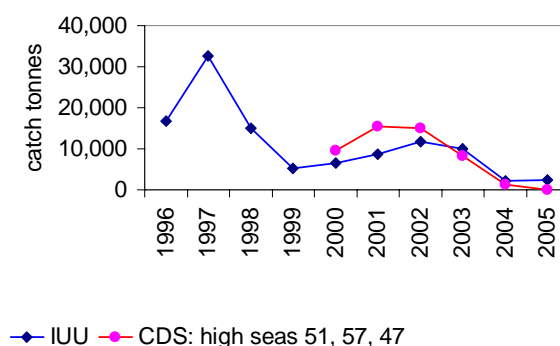


Figure 1: The total IUU catch estimates for the Convention Area and CDS catch data for Areas 47, 51 and 57.

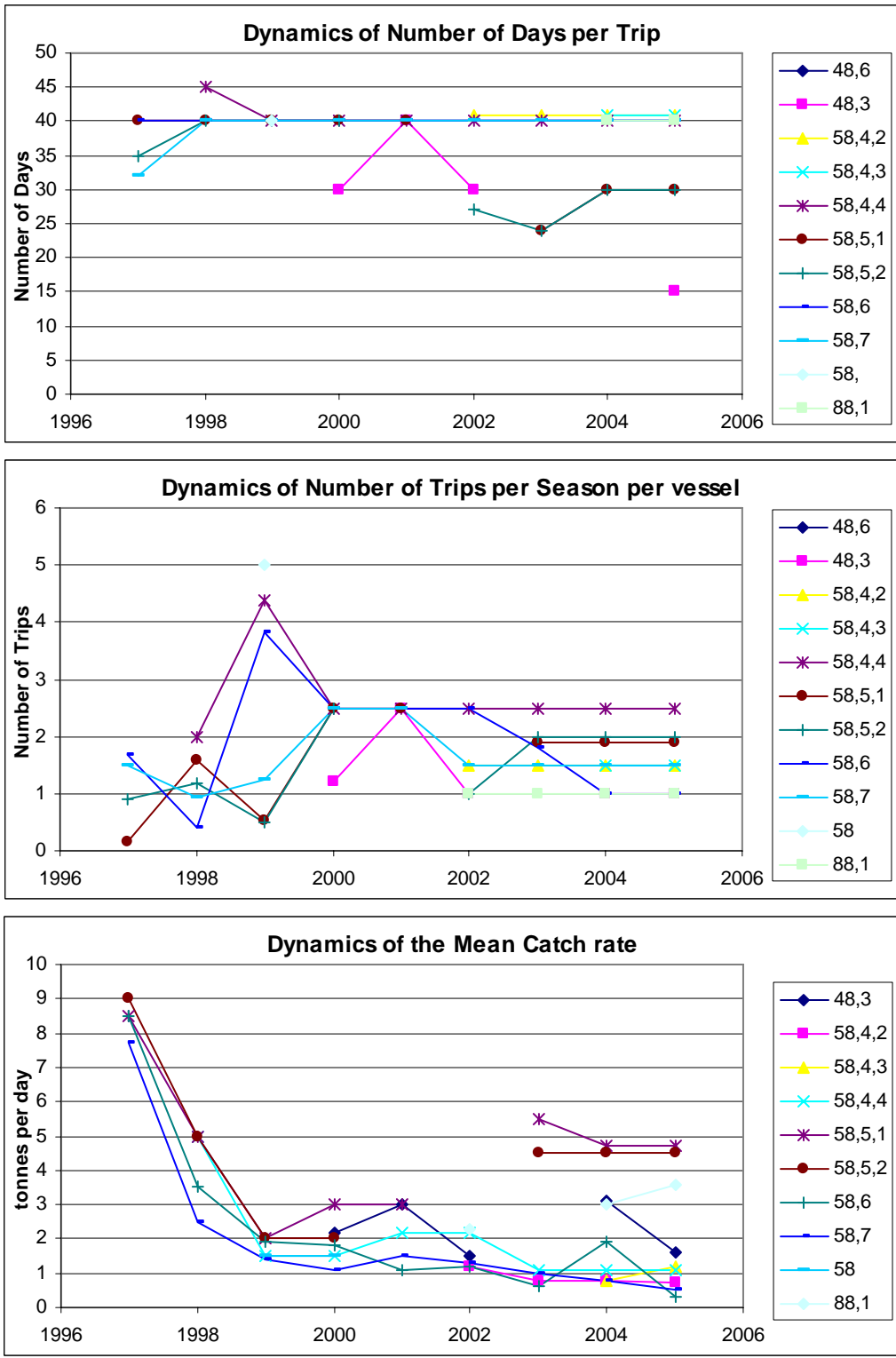


Figure 2: Days per trip, trips per season per vessel and mean catch rates for all areas, 1997 to 2005. Some of the values are imputed values for example mean catch rates for Division 58.5.2 prior to 2002.

AGENDA

Joint Assessment Group (JAG)
(Walvis Bay, Namibia, 17 to 19 July 2006)

1. Meeting objectives and agenda
2. Review of the current methodology for estimation of IUU catches
3. Sensitivity of stock assessments to levels of uncertainty in IUU catch estimates
4. Options for improving the current methodology
5. Estimating undetected IUU activity
6. Review of historical IUU catch estimates
7. Conclusions and recommendations
8. Adoption of the report and close of the meeting.

LIST OF PARTICIPANTS

Joint Assessment Group (JAG)
(Walvis Bay, Namibia, 17 to 19 July 2006)

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Dr E. Sabourenkov (Secretariat)
Ms N. Slicer (Secretariat)

LIST OF DOCUMENTS

Joint Assessment Group (JAG)
(Walvis Bay, Namibia, 17 to 19 July 2006)

- | | |
|-----------|--|
| JAG-06/1 | Provisional Agenda and Terms of Reference for the 2006 Meeting of the Joint Assessment Group (JAG) |
| JAG-06/2 | List of participants |
| JAG-06/3 | List of documents |
| JAG-06/4 | Methods for the estimation of IUU fishing
D.J. Agnew, I. Payne, G. Parkes and R. Mitchell
(European Community) |
| JAG-06/5 | Contribution of Unit B/4 to the JAG Meeting
European Community |
| JAG-06/6 | Overview of IUU catch estimation methodology and its application for the period 1997 to 2005
Secretariat |
| JAG-06/7 | Information to consider in reviewing past and preparing for future IUU catch estimates
Secretariat |
| JAG-06/8 | A qualitative system for reporting the relative reliability or uncertainty of information on IUU vessels fishing in CCAMLR
Delegation of New Zealand |
| JAG-06/9 | Requests and questions to JAG from the Scientific Committee and WG-FSA (extracts from SC-CAMLR-XXIV – 2005) |
| JAG-06/10 | Evaluations of the impact of alternative estimates of illegal catch on estimates of CCAMLR yields from a statistical catch-at-age model
A. Dunn (New Zealand) |
| JAG-06/11 | Consequences of under- or overestimating IUU fishing
(extract from the report of WG-FSA-SAM-06) |