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SOUTH-WEST PACIFIC SWORDFISH STOCK ASSESSMENT WORK-PLAN PROPOSAL FOR 2008

WCPFC-SC3-SA SWG/IP-2

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WCPFC-SC 2007 Stock Assessment SWG Information Paper

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Abstract

This paper represents notification to WCPFC-SC participants and other interested parties that an updated SW Pacific swordfish stock assessment is planned for delivery into the WCPFC-SC in 2008. We outline the process and timeline that will be followed in this assessment, and request that parties interested in the relevant scientific issues engage in the process in a timely manner to help ensure an open and rigorous exchange of ideas. In particular, we are seeking endorsement from the SA-SWG and SC to hold a dedicated workshop (around Apr 2008) to examine the swordfish fisheries data, fisheries independent research and assessment modelling methods that will be employed, and which will be open to everybody with an interest in the scientific issues.

Introduction

The first formal stock assessment for SW Pacific swordfish was presented to the WCPFC-SC in 2006 (spatial definition in fig. 1). The presentation consisted of 2 Methods Specialist Working Group (M-SWG) working papers (Kolody et al 2006a, and Davies et al 2006), and a synthesis of results for the Stock Assessment Specialist Working Groups (SA-SWG) (Kolody et al 2006b). Subsequent to the SC, a final report to the funding body was produced which we recommend as a single reference for the derivation of the final assessment (Kolody et al 2006c).

This assessment, and an exploratory version the previous year (Kolody et al 2005), were discussed at the WCPFC-SC M-SWG and SA-SWG, with little substantive criticism. However, the European Community raised a number of concerns at the subsequent Commission meeting (EC 2006). These concerns were aimed partly at the biological inputs and assumptions of the swordfish assessment, and (presumably) partly at the WCPFC-SC interpretation of the assessment (i.e. the assessment applied only to the SW Pacific east of 175W, while the management advice applied to the WCPFC convention area south of 20S and east of 135W, see fig. 1). Australian and New Zealand delegations provided a rebuttal to the EC objection (ANZ 2006), and the 2006 assessment was ultimately accepted as part of the justification for WCPFC Conservation and Management Measure 2006-3 (CMM06-3, WCPFC 2006). CMM06-3 stipulated constraints to the number of swordfish vessels allowed to operate in the WCPFC convention area, south of 20 S, subject to a review in 2008. Since the Commission meeting was not a scientific forum, and most of the relevant scientists were not present, it remains unclear how much scientific disagreement remains with respect to the assessment.

This paper is intended to provide advance notice that an updated swordfish stock assessment is planned for 2008, to be presented to the WCPFC-SC in August 2008. As in 2006, there is a collaborative arrangement planned between Australian and New Zealand scientists. We briefly outline the key issues that we are planning to revise in the new assessment, and request that parties interested in the relevant scientific issues engage in the process in a timely manner to help ensure an open and rigorous

exchange of ideas. To facilitate this process, we are seeking the endorsement of the SA-SWG and SC for the convening of a WCPFC swordfish assessment workshop prior to the SC (around April 2008).

SW Pacific Swordfish Stock Assessment in 2006

In the 2006 assessment, we attempted to analyze and integrate all the available fisheries data (total catch, standardized catch rates, and catch size composition) with biological studies (on age, growth, reproductive dynamics and stock structure), to provide a summary of the current stock status, and projections of future status assuming 2004 effort levels. Through 2005-6, the assessment went through many exploratory iterations, including different assessment frameworks (Multifan-CL was compared with CASAL and spatially-structured, age-aggregated production models), different spatial structures (1, 3, 5 and 7 areas), alternative migration dynamics, and different assumptions about process and observation errors.

As with all stock assessments for large pelagic species that we have seen, there remains a large degree of stock status uncertainty. This seems to be an inevitable consequence of (among other things) the simple fact that integrative assessment models require arbitrary constraining assumptions to form tractable estimators, and unfortunately, stock status estimates are usually sensitive to some of these assumptions (e.g. Schnute et al 2001). In attempting to provide a "realistic" overview of the assessment uncertainty, several hundred models were fit and compared. The final results represent a synthesis across 10 Multifan-CL specifications (the most plausible ensemble) that appear to be reasonably consistent with the data and our prior expectations of stock dynamics (on the basis of arbitrary, but explicitly-defined criteria). While we consider MSY-related reference points to be of questionable use, particularly for stocks that are susceptible to long term recruitment regime shifts, fig. 2 provides a convenient summary plot of key results of the 2006 assessment, illustrating a wide range of statistical and model selection uncertainty.

Key Assessment issues to be examined in 2008

Part of the 2008 assessment will involve a relatively straight-forward "mechanical" update of the 2006 assessment, which will primarily quantify the implications of new data. However, we also plan to progress some of the more challenging issues in the assessment, related to spatial structure and mixing dynamics, and sex-specific characteristics. We have identified the following priorities:

1) There will be 2-3 years of additional fisheries data from all fleets since the last assessment. Given the recent declines in fishing effort from Aus and NZ, this may provide enough informative contrast to improve stock productivity estimates (i.e. if the effort cuts are substantial enough to disrupt the "one-way trip" nature of the fishery, we may have a better ability to distinguish between a relatively large unproductive stock, and a relatively small productive stock). The new assessment will also include substantial new catch size and sex composition data from the recent NZ observer and port sampling programs (Davies & Griggs, 2007), and the full data

from the Spanish fishery. Additional size data from the historical Japanese fleet in the 1950s has been identified and may be included.

2) The spatial domain of the assessment will be revisited to attempt to better address the broader management needs of the WCPFC. There is a poor understanding of the mixing between the Western (fig. 1, areas 1-5) and Eastern (area 6) sub-populations. But there are obviously large numbers of swordfish in both regions. Any boundary for a swordfish population (short of the whole Pacific Ocean) might be criticized as an artificial construct given what we know about movement of large pelagics. Our original boundary was established in part to reflect the region on which we had the most familiarity with the data (though biological continuity arguments were also invoked). While probably reasonable for the management needs of the South-Western nations of the WCPFC, the SW Pacific boundary obviously precluded useful recommendations for the Eastern region. In 2008 we will attempt to expand the assessment into the eastern region, and will look to our colleagues from the Distant Water Fishing and Pacific Island Nations operating in the region for guidance, particularly on the interpretation of catch rates.

3) Migration hypotheses will be revisited with respect to recent satellite tag deployments and conventional tag recoveries from Australia and New Zealand (and potentially elsewhere). Preliminary examination of these tracks provides some indication of seasonal movement patterns and distances covered by individuals. While limited in number, these data will help to evaluate the appropriateness of diffusive mixing and site fidelity models, and the operational bounds used to demarcate the assessment region. New genetic analyses may also be available to revisit the assumed population structure.

4) The methodology used to estimate SW Pacific swordfish maturity, and age-size relationships is being reviewed in relation to other international studies (Jock Young, CSIRO, Australia, pers. comm.). Direct growth increment validation observations are now available from a handful of conventional tag recoveries to assist in this. Preliminary results suggest that there are methodological differences among studies. We may update the assumed relationships, or add sensitivity analyses to admit alternatives, as appropriate.

5) Some versions of the assessment might include sex disaggregation, as swordfish are known to be sexually dimorphic, with seemingly different spatial distributions and size at maturity. However, this creates a need for a lot of additional assumptions that are not directly supported by much data, and this may prove to be a lower order concern.

As with the 2006 assessment, we anticipate that the data will not be sufficiently informative to allow us to identify a uniquely preferable model, and will endeavour to illustrate this model sensitivity as formal model selection uncertainty.

We hope to have the assessment peer-reviewed by independent assessment scientists prior to the WCPFC-SC in 2008.

A Swordfish Assessment Workshop in 2008

We are requesting constructive feedback on both the 2006 assessment, and the proposal for 2008, to improve the assessment. To facilitate the exchange of knowledge and ideas, we are attempting to instigate a swordfish assessment workshop around April 2008, to discuss the fisheries data, swordfish research, and modelling methodologies. The SPC has been identified as a likely venue for the workshop, and we are hoping to have it endorsed as a WCPFC event. Any parties with an interest in the relevant scientific debate will be encouraged to attend. National scientists have insight into particular datasets that is invaluable, and we encourage any analyses that will help us to understand the fishery dynamics. We hope for a concensus on methods for moving forward, but recognize that this may not be attainable, in which case the workshop will provide a means for recording differing opinions and possible means for resolving the issues. Given the time constraints of the workshop, the non-trivial nature of proposed model extensions, and the manner in which we expect to examine model selection uncertainty, we would not expect that the final assessment could be produced at the workshop.

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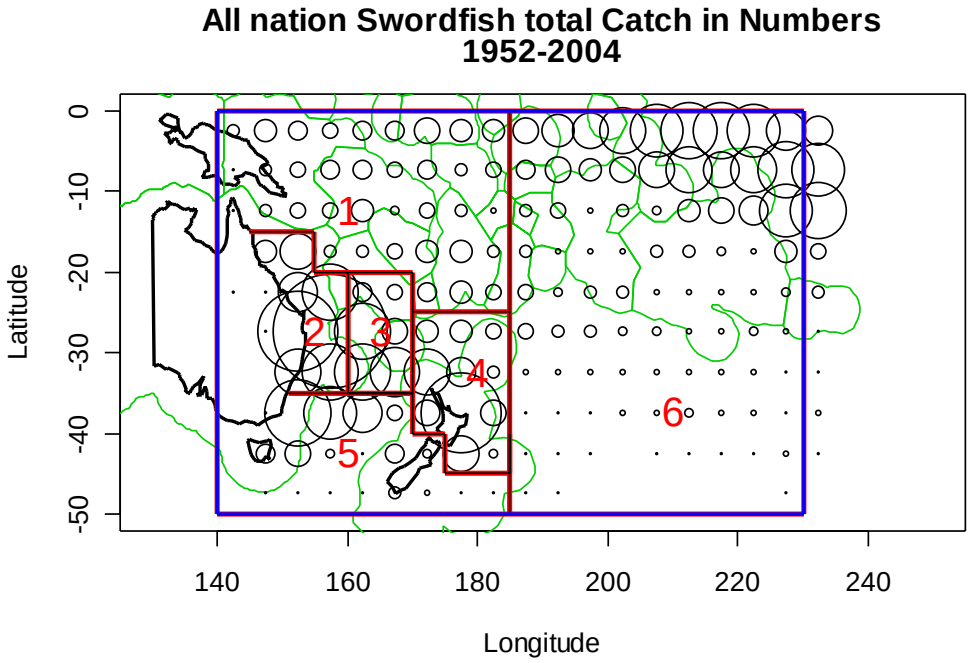

Figure 1. Spatial structure of the SW Pacific swordfish assessment in Kolody et al (2006a-c). Regions 1-5 correspond to the assessment domain. Area 6 was initially defined for sensitivity trials but this was not pursued for reasons described in the 2006 assessment. The area of the black circles represents the relative catch in each 5x5° region summed over the period 1952-2004.

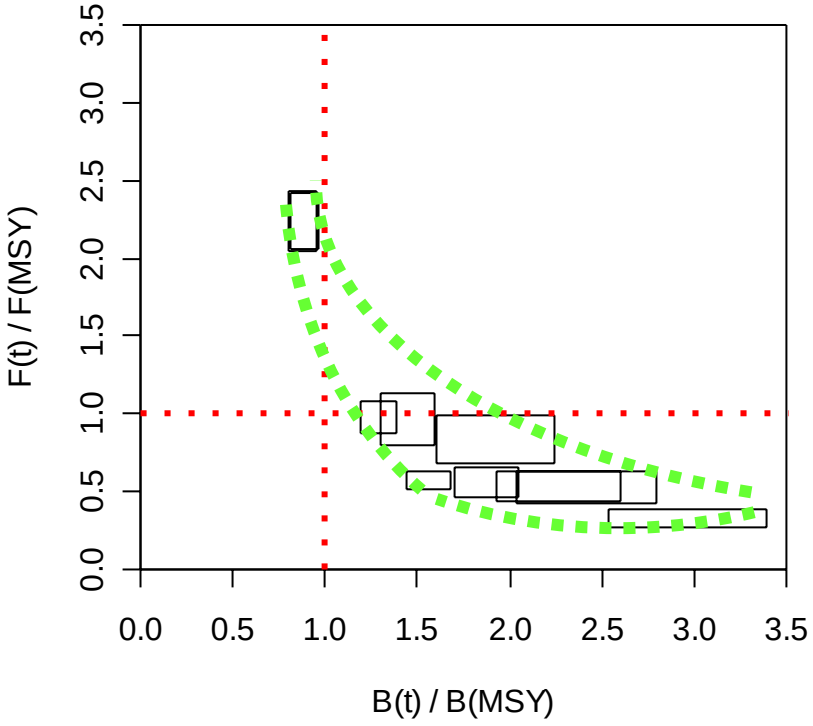

Figure 2. From Kolody et al (2006c) SW Pacific swordfish assessment. Plot of current biomass and current fishing mortality relative to MSY levels for the most plausible ensemble of models. Each black box indicates the 95% confidence intervals (though not the correlation) associated with an individual model. The dashed (green) banana shape roughly outlines the space that we consider plausible (even though none of the models covered some of the region).