ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA
(ICCAT- GBYP)
PHASE 2
EC GRANT AGREEMENT SI2.585616

DELIVERABLE F1.1

REPORT ON THE ICCAT-GBYP MODELLING APPROACHES

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June 27, 2011

REPORT ON THE ICCAT-GBYP MODELLING APPROACHES

The ICCAT-GBYP activity on Modelling Approaches in Phase 2 strictly follows the course decided by the GBYP Steering Committee, endorsed by ICCAT-SCRS and approved by the ICCAT Commission, reflected on the EC Grant Agreement SI2:585616.

After many consultations among the SCRS Chair, the BFT Rapporteurs, the WG Chair and the ICCAT Secretariat, the ICCAT Working Group on Stock Assessment Methods (WGSAM) was postponed from the original date of March 21-24, 2011 and instead held on June 27 - July 1, 2011, with one day (June 28) was devoted to the bluefin tuna issues (Annex 1). This was done in order to get peer review from WGSAM of work being proposed under GBYP.

Therefore to ensure that modelling work would be started this year, the GBYP issued a Call for tenders for contracts in 2011 (Call for Tenders GBYP 04/2011 on Stock Assessment Modelling, ICCAT Circular n.954/2011 issued on March 15, 2011, annex 2). These were: a) a contract on a risk analysis to identify the main perceived sources of uncertainty related to assessment and advice, and, b) two contracts to help develop new assessment and advice based on the data sets being collected and the new knowledge being gained under the GBYP. Unfortunately, only one bid was received for the second theme.

The contract on Risk Analysis was awarded to to IC Consultant Ltd, Imperial College (UK), and the second on Assessment and Advice was awarded to Ph.D. Justin G. Cooke (Germany).

The main objectives of the ICCAT Bluefin Research Programme (GBYP) are to improve knowledge about key biological processes and develop new methods for stock assessment and advice. The knowledge gained under the GBYP will allow the development of biologically based simulations or operating models to evaluate the robustness of alternative advice frameworks. Therefore, a first trial was also conducted to develop an example of Management Strategy Evaluation based on population structure that could be developed in the next phases of the GBYP.

The Risk Analysis will help identify the main uncertainties and provide along with MSE the gaps in data, knowledge and modelling. This will help identify alternative approached to address those gaps both in terms of population dynamics and modelling approaches, as well as a detailed description of the preparatory work carried out in March. The work undertaken under the GBYP contracts was presented at WGSAM to ensure review by ICCAT scientists not involved in the bluefin stock-assessment, as well as by the steering committee. The report from that meeting and all presentations, are available in the attached appendix.

It was agreed to have two presentations from GBYP contractors during the ICCAT Working Group on Stock assessment methods, in order to review the proposed approaches in plenary.

Summary of the work presented

The day of the ICCAT Working Group on Stock Assessment Methods devoted to bluefin tuna (June 28, 2011) was organized as a dedicated session.

Dr. Laurie Kell (ICCAT Secretariat) chaired the session and presented some preliminary work being conducted on a management strategy evaluation (MSE) framework to analyze the robustness of the current, VPA-Adapt based implicit management procedure. This work was conducted during an operational meeting held in Sete (France), on June 13-17, 2011, with the participation of Dr. Jean-Marc Fromentin and Dr. Sylvaine Bonhommeau, organized by GBYP with the purpose to cover the gap caused by the lack of bids for the second theme of the Call for Tenders. Current management procedures consider many but not all sources of uncertainty. It was noted that the Kobe Strategy matrix actually provides a generic framework for evaluating the impact of uncertainty on management advice. MSE is also an important way to show how the results from the new research funded by GBYP can be incorporated into new assessment and modeling approaches for providing more robust advice.

Dr. Kell presented a generic MSE approach for simulation (SCRS-xxxx, in preparation), evaluating the robustness of alternative management advice frameworks with respect to various sources of uncertainty (Annex 3 and Annex 4). This involved the use of an Operating Model (see Rademeyer *et al.*, 2007 for definition of terminology) to evaluate the impact of structural uncertainty on the perception of stock status obtained via Adapt-VPA and particularly the structural uncertainty related to population structure (i.e. 2 subpopulations) and the stock recruitment relationship (i.e. constant recruitment or compensatory dynamics). Dr. Kell found that structural assumptions (1 stock versus 2) and the source of various indices (stock 1 or stock 2) were critical assumptions, which had much greater impact than the stock recruitment assumptions. This has important implications for the structure of assessment models and for the development of management procedures that are robust to structural uncertainty and demonstrated the importance of fisheries independent data and a better understanding of stock dynamics as being provided by the GBYP.

Subsequently, the chair informed about the two short-term contracts on modelling awarded under the GBYP to IC Consultant Ltd (Imperial College) on risk analysis and to Dr. Justin Cooke to develop new alternative methods to provide scientific advice for fisheries management.

A presentation on the work being conducted by IC Consultant Ltd (Imperial College) showed how different risks will be identified and their relative importance determined (Annex 5). The authors had developed a questionnaire to obtain the perception of stakeholders of the importance of uncertainty on management advice, the extent to which this uncertainty is already considered in management advice and how strongly they responders believed this. These characteristics would be important in helping to identify scenarios for quantitative modeling (i.e. with an MSE framework). There was concern that different stakeholders may have varying levels of understanding of the critical assessment factors, leading to differing priorities. However, it was explained that identifying the difference in perceptions about risk was an important aim of the questionnaire and that the results of the survey would be useful general guide for future activities, e.g. to develop better methods of risk communication as well as developing MSE scenarios which would be used to evaluate and subsequently manage the actual risks.

It was decided to test practically test the questionnaire as a first trial of the exercise, by using the scientists participating to the ICCAT Working Group. The group completed the questionnaire in order to allow the contractors to obtain feedback before conducting the actual survey. Following this exercise suggestions on how to improve the form were made.

The group felt that the questions were probably too technical for non-scientific stakeholders. However, it was pointed out that restricting the audience to scientists might be appropriate, if the primary objective of the questionnaire is to identify the main uncertainties in the provision of scientific advice. Modifying the questionnaire for different stakeholder groups was out of the scope of the small contract awarded to IC Consultant Ltd (Imperial College) but could be awarded in future calls under the GBYP.

The second contract was for the development of a prototype of an alternative assessment and advice framework. The intention is that alternative frameworks will be evaluated using an MSE framework currently under development by BFT-SG. This will allow a range of scenarios to be constructed to first evaluate the existing BFT assessment and management framework and then to compare the performance of alternative frameworks. This will be used to evaluate how well candidate assessment and advice

frameworks perform relative to the management objectives specified by the Commission. It is of interest to the SCRS to determine both how the various methods perform: (i) when supplied only with the data used for assessments to date (catch at size/age, abundance indices, growth curves) and (ii) when additionally supplied with data of the kind being collected under the GBYP (e.g. aerial surveys, electronic tagging).

A short presentation on the initial part of the work carried out under the second contract was given by Dr. Cooke (Annex 6). It involves an assessment method and a harvest control rule, designed to work in tandem, which form the management procedure (MP) component of an MSE. The assessment method proposed is broadly similar to that already used for BFT, but in order to be able to make use of a variety of different kinds of data, and to capture most of the main sources of uncertainty, it is cast in a formal Bayesian form with specific likelihood functions for each kind of data. The choice of prior distributions of parameters is driven primarily by the requirement for good management performance, rather than by prior beliefs about likely values. Prior information about likely ranges for parameter values can be taken into account in the construction of the test scenarios which be used to test all candidate procedures. The conventional management reference points B_o, B_{MSY} and F_{MSY} are used, but defined in a way such that they remain appropriate in the presence of possible regime changes. A simple harvest control rule is proposed: constant F when the stock is above B_{MSY}; F linearly proportional to B/B_{MSY} when $B < B_{MSY}$. The harvest control rule is based on a notional unselective standard fishery. To convert the results to an actual TAC for a real mix of fisheries, weighting factors are determined for each fishery to relate the effect of a unit catch from each fishery to the effect of a unit catch from the notional standard fishery.

In the discussion it was noted that under the management objectives being developed by ICCAT and other RFMOs, F_{MSY} and B_{MSY} may implicitly become limits rather than target reference points; harvest control rules should preferably be consistent with this. The management targets are expressed in terms of the probabilities of being above or below the applicable limit reference points. The results of the simulation tests of candidate procedures will need to be tabulated or displayed in a form which shows clearly how each procedure performs relative to these targets. Candidate procedures generally have one or more tunable parameters that can be adjusted up or down to make the procedure more or less conservative. The results of the simulation tests can be used to tune procedures to better meet management objectives.

While it is desirable that candidate procedures show robust performance across a broad range of scenarios, it was noted in discussion that the determination of whether a procedure meets quantitatively specified management objectives may depend on the relative weight given to different scenarios. Therefore, even under an MSE approach, the SCRS will not completely escape the necessity, as with conventional stock assessments, to discuss the relative plausibility of different assumptions.

Discussion of the presented approach focused largely upon the structural complexity of the operating models (OM) which serve as the underlying data generating process for the MP. Development of the OM will be a complex task due to the multiple structural, biological and human dimension aspects that could potentially be considered. It was noted that success of the MSE depends upon making the process accessible to all involved parties and making the software widely accessible.

Further actions

- ⚔ The results of the Risk Analysis will be presented at the SCRS and used to inform discussion on the "Unquantified Uncertainties". Where appropriate they may be used to specify what scenarios to include in any MSE work conducted in later phases.
- ⚔ The example assessment and management procedure present by Dr. Justin Cooke included many elements that would be important in building a robust advice framework taking advantage of new data and knowledge made available under the GBYP. These will have to be further developed in later phases before they can be utilised in providing management advice.
- ⚔ The preliminary MSE framework showed how the data and knowledge gained under the GBYP can be used to develop alternative robust advice frameworks. However, much work still needs to be conducted in later phases before such and advice framework can become operational.