

GBYP Proposal

**Modelling in Support of Stock Assessment and Management
Advice**

Background

A draft multi-year workplan, including objectives, time lines and deliverables, for the modeling work to be conducted under the GBYP was presented to the GBYP Steering Committee (SC) in December 2012. The SC thought that this was very useful proposal to help plan future activities, allocate budget and review progress. It was therefore recommended that this draft be completed and circulated to the SC. The SC also recommended that a group be formed under the SCRS to help develop an operating model. A draft based on that presented at the SC was originally to be drafted and then to be presented for discussion at a 3 day GBYP meeting to be held directly after the BFT Biological Parameters meeting. Unfortunately this was not possible, due to the GBYP budget being agreed later than anticipated. The objective of this planned meeting was to have helped developed specifications for the operating model following on from the Bluefin Biological Parameters (BFT-BP) meeting.

Instead, it was decided to take advantage of the Tenerife Biological Parameters meeting to carrying out this preparatory work, using the original time frame only for developing the draft, based on the work of the BFT-BP meeting, this draft will then be circulated to the BFT group. The work on the Operating Model design (following this informal drafting group) is now be conducted intersessionally including full participation of BFT SCRS scientists in advance of the Boston BFT SCRS meeting. The Boston meeting would now be responsible for discussing the draft proposals and agree future steps in the development of the OM design.

To facilitate the production of the draft an informal group was formed by the BFT rapporteurs with help from SCRS colleagues already involved in developing operating models to develop a limit reference points (LRP) for North Atlantic Albacore. This meeting produced the draft for circulation to the BFT-WG. This draft would then be further developed by the SCRS to provide the basis of discussions for the BFT Modelling Working Group in Boston 21-23 July 2013, as discussed at the 2013 Methods WG.

Description of Work

This proposal is addressing the third objective of the GBYP, i.e.

To improve assessment models and provision of scientific advice on stock status through improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use of biologically realistic operating models for more rigorous management option testing.

Work will be conducted under the GBYP in collaboration with CPC scientists.

The new scientific advice framework will be evaluated using management strategy evaluation (MSE). The approach will be similar to that used by CCSBT for resolving the major uncertainties for the provision of management advice.

MSE involves a number of steps [Punt and Donovan(2007)] i.e.

- Identification of management goals (and performance measures to quantify the extent to which those goals have been achieved).

- Selection of hypotheses which pertain to the situation at hand, and development of operating models which represent those hypotheses. The set of operating models form the 'trials structure'.
- Conditioning of the operating models on the available data (and possible rejection of hypotheses [or combinations of hypotheses] which are not compatible with the data).
- Identification of candidate management strategies.
- Simulation of the performance of the management strategies by projecting the operating model forward in which catch limits are set using the management strategy.

This document provides a draft proposal of the work to be conducted under the modelling programme of starting in phase IV of the GBYP. The work is part of a multi-year workplan, which includes objectives, deliverables and milestones.

Work Summary

Objectives

Propose to the Commission by 2016 a robust Scientific Management Framework, developed using Management Strategy Evaluation (MSE), that includes

- a) New stock assessment methods that use the new data and knowledge gained under the GBYP
- b) Reference points that are robust to uncertainty
- c) A long term management plan

Milestones

These are used to monitor the progress of the work, the first three are presentation at the SCRS of the work done on the development of the new framework and the fourth is presentation of the proposed new advice framework to the Commission. the new framework to the Commission.

M1 SCRS 2013

M2 SCRS 2014

M3 SCRS 2015

M4 COM 2016

Deliverables

The following are examples of the types of deliverables that may be expected under the proposal. These will include SCRS (and peer review papers) to be agreed at the beginning of each Phase of the GBYP.

Phase 1 Phase IV

- i) SCRS Paper; Risk Assessment that identifies the main sources of uncertainties and associated risks
- ii) SCRS Paper; Quantitative Risk Evaluation (based on results from Data and Modelling Workshop).
- iii) SCRS Paper; Specification of Operating Model, including data to be used for conditioning and hypotheses to be considered (based on results from Data and Modelling Workshop).
- iv) SCRS Paper providing an example of statistical stock assessment methods.

Phase 2 Phase V

- i) SCRS Paper; Example of Management Procedures, empirical (SBF), VPA and size, RH etc.
- ii) OM(s) implemented in software
- iii) MP(s) implemented in software
- iv) SCRS Paper; Detailing preliminary evaluations conducted, and identifying of scenarios to be used in next Phase.

Phase 3 Phase VI

- i) Proposed new assessment framework, including stock assessment methods, reference points

Phase 4 Deliverables in year 2016

- i) Proposed new management framework including HCR

Work Packages

Work packages

Work package list

WP No	Work package title	Type	Lead participant no.	Person-months	Start month	End month
WP1	Operating Models	R&D	GBYP	37.0	1	36
WP2	Data Mining	R&D	GBYP	37.0	1	24
WP3	Management Procedures	R&D	GBYP	37.0	1	36
WP4	Risk Analysis	SKH	GBYP	37.0	1	36
	TOTAL			148		

Deliverables list

List of Deliverables to be Submitted to SCRS for Review

Deliverable no.	Deliverable name	Work package no.	Nature	Dissemination level	Delivery date	Lead	EMM
DIV.1.1							
DIV.1.2							
...							

N.B.: Deliverable Copyright is retained by ICCAT.

Abbreviations for nature of deliverable: P=SCRS Paper, Software=S, D=Demonstration, ...

Abbreviations for dissemination level: PU = Public, CO = Confidential.

Work package 1: Operating Model

Work package leader: Gian Maria Volonté

Work package number	1	Start date or event:						Phase IV
Work package title	Operating Model							
Participant number	1	2	3	4	5	6	7	8
Participant short names	GBYP	SCRS	Sec					
Person-months per participant	30	1	1					

Objectives:

The objectives are to

- Specify stock and fishery dynamics to be implemented as Operating Models (OM) within an MSE framework.
- Implement code in a common framework as ADMB/C++ libraries or R packages
- Run simulation trails
- Propose appropriate analyses and data collection procedures that resolve uncertainty about stock dynamics

Description of work:

The first task is to provide an ‘*general*’ specification of the Operating Model (OM). Where an OM is a mathematical–statistical model used to describe resource dynamics in simulation trials and to generate resource monitoring data when projecting forward. Initial Scenarios (i.e. the main factors/effects in a factorial design.) will be specified based on the risk analysis. Potential weighting schemes based on plausibility and/or likelihoods will be proposed.

The OM will allow the impact of the various sources of uncertainty on management objectives to be evaluated by testing alternative assessment and advice frameworks [Kell et al.(2003)Kell, Die, Restrepo, Fromentin, Ortiz de Zarate, Pallares, et al.]. This requires conditioning the OM on alternative assumptions and data sets with respect to biological processes [Fromentin and Kell(2007)], stock structure [Kell et al.(2009)Kell, Dickey-Collas, Hintzen, Nash, Pilling, and Roel], fleet dynamics and historic catches.

The work in this WP requires specifying and parameterising key processes, then proposing a variety of analyses to quantify the relative importance of the different sources of uncertainty identified in the risk analyses WP. This will eventually allow a set of scenarios to be chosen that will allow alternative candidate assessment and management procedures to be evaluated with respect to achieving management objectives with a given level of risk.

Rather than using a grid like CCSBT for their MSE, where a single parameter, (e.g. M_0 or steepness), is varied independently a systematic approach will be taken. This will explicitly recognise that life history characteristics, such as age at first reproductive, survival, growth and number of offspring are related. This will require hypotheses about various processes to be developed and so there will be five main *themes* i.e.

Scenario	Levels	
Stock Structure		
Historic Catches		
Indices of Abundance		
Spawning Recruit Potential		
Stationarity of Processes		

Alternative hypotheses will be based on the data and knowledge obtained under the GBYP. Initially an example operating model will be developed that can be used to illustrate the approach to the SRCS. This will be refined using the Risk Analysis. Where uncertainty in knowledge about processes are shown to have an impact on management, studies and data collection procedures will be proposed to reduce uncertainty.

Deliverables:

Name	Due date	Description
D1.1	t0+6	...

Work package 2: Data Mining

Work package leader: Marianne Koch

Work package number	2	Start date or event:						Phase IV
Work package title	Data Mining							
Participant number	1	2	3	4	5	6	7	8
Participant short names	GBYP	SCRS	Sec					
Person-months per participant	30	1	1					

Objectives:

The objectives are to conduct analyses in order to improve the data and assumptions used in stock assessment and to help develop hypotheses for conditioning the Operating Model. Data sets will include those recovered under the GBYP, the ICCAT data bases, published in SCRS and other papers and from other RFMOs.

Where appropriate analyses will be written up as SCRS papers and presented to the SCRS, e.g. either the bluefin working group or the the working group on stock assessment methods. As appropriate papers publish findings in the scientific peer-reviewed literature in order to provide clear transparent advice consistent with Commission Resolution [Res 2011-17].

Description of work:

Under Phases I-III numerous data sets have been recovered, the main task now to complete validation of the recovered data, to perform extractions for analysis and to work with the SCRS on conducting analyses.

Paper IV.3.1

Paper IV.3.2

Deliverables will be updated at the beginning of each phase depending on the needs of the development of the Operating Model and the Management Procedure.

Deliverables:

Name	Due date	Description
Paper IV.3.1	t0+6	SCRS paper
Paper IV.3.2	t0+6	SCRS paper

Work package 3: Management Procedures

Work package leader: Wolfgang Lukschy

Work package number	3	Start date or event:						Phase IV
Work package title	Management Procedure							
Participant number	1	2	3	4	5	6	7	8
Participant short names	GBYP	SCRS	Sec					
Person-months per participant	12	18	10					

Objectives:

The objective of this workpackage are to implement MPs in a common simulation framework to allow alternative data collection procedures, stock assessment methods, reference points, harvest control rules and management plans to be evaluated. Software will be developed using R, ADMB and C++. All software will be released under an Open Source Licence, and where possible run on a variety of platforms (e.g. Windows, linux and iOS). Development will be done in collaboration with other initiatives (e.g. ADMB, R, FLR), the tRFMOs and other RFMOs.

The objectives of this work package are to code the

Current Advice Framework i.e. adapt-VPA advice framework as an implicit management procedure and

Alternative Advice Frameworks which should include model free and model based variants that use both existing data and the new data sets collected under the GBYP, e.g.

- biomass based models
- statistical models
- model free, e.g. empirical indices based on trap CPUE, aerial surveys,...

Description of work: Once alternative stock assessment models have been identified, these need to be coded and implemented in a common framework so that they can be evaluated using the OM. It will also be necessary to identify data requirements and sources of measurement error, appropriate reference points and management based upon them.

Deliverables:

Name	Due date	Description
D1.ii	t0+6	MP1

Work package 4: Risk Assessment

Work package leader: Clint Eastwood

Work package number	4	Start date or event:						Phase IV
Work package title	Risk Analysis							
Participant number	1	2	3	4	5	6	7	8
Participant short names	GBYP	SCRS	Sec					
Person-months per participant	18	6	2					

Objectives:

The objectives of this work package are to

- Identify the identify the main sources of uncertainty of concern for stock assessment and management by conducting a qualitative risk assessment.
- In collaboration with other WP conduct a quantitative risk analysis to evaluate the relative importance of the different sources of uncertainty
- Help design scenarios to be used in the managment strategy evaluation and development of alternative management procedures with respect to meeting management objectives
- Develop tools for use with stakeholders to identify appropriate management procedures for implementation

Description of work: Under Phases II and III a qualitative Risk Assessment (RA) was conducted with members of the SCRS and the Commission. This identified the main sources of uncertainty of concern, whether they were considered in current advie and their relative impact. A next step is to conduct a quantitative study to assess the impact under the current and alternative advice frameworks. There are a variety of techniques that can be applied, from relatively simple sensitivity analyses to complex approaches such as MSE. The MSE will include

Qualitative scenarios, i.e. that think are likely and potentially important but not able to probabilistically decide between and

Quantitative scenarios, i.e. things we believe we can either estimate or define a priori

Once these scenarios have been identified methods will be developed to evaluate alternative candidate advice frameworks and management proceedures with stakeholders.

The intention is to produce four papers that detail the development of a Risk-based managment advice framework. The first paper will be a qualitative analysis of the concerns of stakeholders with respect to risk. The second will show how a qualitative study can be

turned into a quantitative analysis. The third paper will identify the utility functions of the different stakeholder groups and evaluate the value of information and control in reducing uncertainty and risk. While the final paper will review the case study.

Deliverables:

Name	Due date	Description
D.RA.IV.1	t0+6	Paper on Risk Identification
D.RA.V.1	t0+6	Paper on Quantitative Risk assessment
D.RA.VI.1	t0+6	Paper on Value of information and control
D.RA.VII.1	t0+6	Review Paper

Tentative schedule of project reviews

Review No.	Tentative timing, i.e. after month X = end of a reporting period ¹	planned venue of review	Comments, if any
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¹Month after which the review will take place. Month 1 marking the start date of the project, and all dates being relative to this start date.

Work package dependencies

Bibliography

- [Fromentin and Kell(2007)] J. Fromentin and L. Kell. Consequences of variations in carrying capacity or migration for the perception of atlantic bluefin tuna population dynamics. *Canadian Journal of Fisheries and Aquatic Science*, 67:627–836, 2007.
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- [Kell et al.(2009)Kell, Dickey-Collas, Hintzen, Nash, Pilling, and Roel] L. Kell, M. Dickey-Collas, N. Hintzen, R. Nash, G. Pilling, and B. Roel. Lumpers or splitters? evaluating recovery and management plans for metapopulations of herring. *ICES Journal of Marine Science: Journal du Conseil*, 66(8):1776–1783, 2009.
- [Punt and Donovan(2007)] A. E. Punt and G. P. Donovan. Developing management procedures that are robust to uncertainty: lessons from the international whaling commission. *ICES Journal of Marine Science: Journal du Conseil*, 64(4):603–612, 2007.