

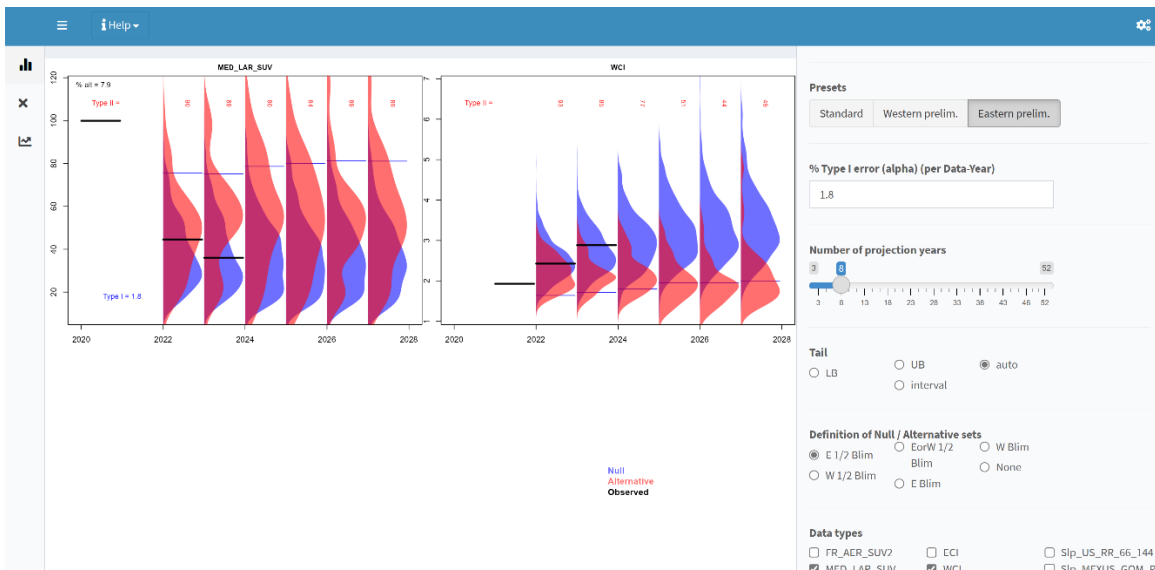
Evaluating Management Strategies for Atlantic Bluefin Tuna

Report 11: Exceptional Circumstances Protocols, ECP App, Guide to R Package Building.

July 19th 2023

SHORT-TERM CONTRACT FOR THE MODELLING APPROACHES: SUPPORT TO BLUEFIN TUNA STOCK ASSESSMENT(GBYP 03/2023) OF THE ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (ICCAT GBYP – Phase 12)

-FINAL REPORT-



ECP App (<https://shiny.bluematterscience.com/app/ecp>)

Tom Carruthers¹



This project is co-funded by the European Union



¹ tom@bluematterscience.com 2150 Bridgman Ave, North Vancouver, Canada. +1 604 805-6627

Executive Summary

This contract included the development of an exceptional circumstances app that can help design effective protocols given the various data types available to Atlantic bluefin tuna.

The computer code was commented and supporting documentation developed, that guide a technical user on how to reproduce and rebuild the ABTMSE R package from scratch.

All tasks and deliverables listed in the contract were completed on time with the exception of a presentation of example exceptional circumstances protocols (insufficient time at September species group meeting).

Principal developments

- Documentation for building the ABTMSE R package and ECP app
- Open-source ECP R package that contains all code, functions and diagnostics.
- A new ECP Shiny app for exploring and developing ECP for bluefin tuna
- Draft SCRS on ECP background and proposals for bluefin tuna
- Adopted MP code check.

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1 Review of contract activities

All contracting tasks were completed on time. Although not all of the observed data have been shared by data providers, it is trivial to add these once they are made available.

1.1 Documenting processes to run MSE and ECP (exceptional circumstances protocols) and update the ABTMSE GitHub repo.

A technical user guide on the production of the ABTMSE R package, including operating model specification and fitting, was developed in R markdown and is presented here ([Appendix A](#)) in a format that can be uploaded to the ABTMSE splash page.

Similarly, a user guide was also developed for the construction of the ECP object that is used by the ECP app ([Appendix B](#)). The use of the App itself is fairly self explanatory but this guide allows MSE analysts from other MSE to use the app with their data (or allows others to update the bluefin data at a later date).

1.2 Stock Composition exploration

Model fits to historical stock composition data were evaluated and the statistical properties of these were used to develop posterior predicted data for the genetics stock of origin data. For efficiency and consistency, these were included in the [ECP app](#), making results directly comparable with the index-based ECP.

1.3 Electronic tag exploration

Similarly to stock of origin data, the fraction of fish moving to given areas was added to the [ECP app](#) and can now be used to compare observed tag transition frequencies (the number of tags moving to/from areas) to those of the operating models.

1.4 ECP investigation, coding and presentation

ECP were formalized in a set of functions, figures and diagnostics that interacted with a standard format for ECP data. These are available in a new R package 'ECP' ([Appendix C](#)). This is public and can be installed using the R command `devtools::install_github('blue-matter/ECP')`.

Using this package, the bluefin ECP data were organized and used to explore preliminary options for ECP for the western and eastern stocks. These findings were presented to the MSE technical team in June ([Appendix D](#)).

1.5 Draft ECP proposal (SCRS draft paper, app),

A collaborative SCRS paper was drafted with experts from the MSE technical team to explain the background to ECP, ECP for stocks elsewhere, considerations for Atlantic bluefin tuna and results for bluefin tuna. That is a living document available as a Google document [[here](#)] (also [Appendix E](#)). Finalizing this SCRS document requires provision of observed data by data providers after which results and the discussion can be completed. The ECP app is available [[here](#)] and can be run locally using the R command `library(ECP); ECPapp()`


1.6 Preliminary investigation of exceptional circumstances protocols / indicator systems

As per #1.4, an in-depth investigation of western and eastern ECP options was conducted and presented to the group. These are also available as presets in the ECP app.

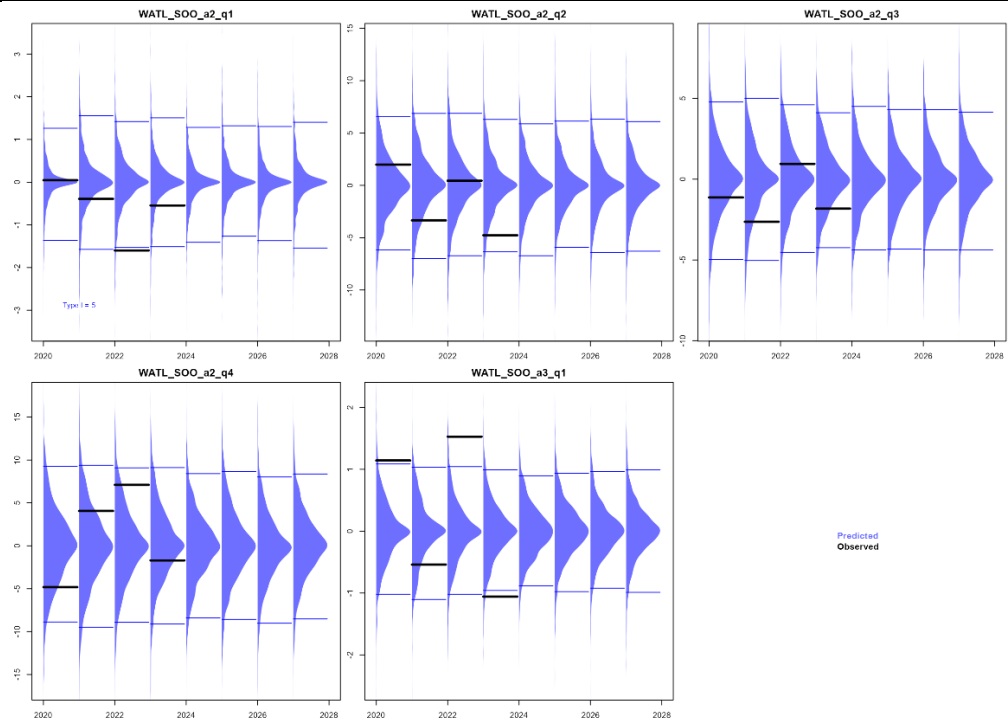
1.7 Code checking of the adopted management procedure

Drs Rademeyer and Butterworth provided the code and equations for the adopted MP. The equations were compared against the code, no errors were found.

Table 1. Products developed in this contract.

<p>1 Documenting processes to run MSE and ECP (exceptional circumstances protocols) and update the ABTMSE GitHub repo</p>	<div> <p>Background</p> <p>Objective of this document</p> <p>ABTMSE Github repository and file structure</p> <p>The 5 Steps to Specify Operating Models, Fit Operating Models and Build the ABTMSE R Package.</p> <p>Step 1: Construct a base OM for the various trial specifications (RScripts/Operating_models/Step 1 Build base OMI.R)</p> <p>Step 2: Construct reference OMs (RScripts/Operating_models/Step 2 Build OMs.R)</p> <p>Step 3: Construct robustness OMs (RScripts/Operating_models/Step 3 Build robustness OMs.R)</p> <p>Step 4: Copy data to package (RScripts/Packaging/Copy data to package.R)</p> <p>Step 5: build package in RStudio</p> <p>References</p> </div>	<h3>ABTMSE: Package Developer Guide</h3> <p>ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP)</p> <p>Tom Carruthers (tom@bluematterscience.com)</p> <p>2023-07-19</p> <p>Background</p> <p>Acknowledgements</p> <p>The Atlantic Bluefin Tuna Management Strategy Evaluation is funded by the ICCAT GBYP (coordinated by Francisco Alemany francisco.alemany@iccat.int). The technical aspects of this modelling work are overseen by the GBYP MSE technical team including David Die, Doug Butterworth, Shuya Nakatsuka, Harritz Arrizabalaga, Ai Kinoto, Toshi Kitakado, Miguel Santos, John Walter, Alex Hanke, Carmen Fernandez and Nick Duprey. Previous collaborators include Paul de Bruyn, Yukio Takeuchi, Laurie Kell, Clay Porch, Joe Powers and Campbell Davies.</p> <p>This research benefits from the contributions of a large number of scientists from ICCAT contracting parties and public institutions.</p> <p>This R package and documentation were produced by Tom Carruthers (technical assistant) under the provision of the ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP), funded by the European Union, several ICCAT CPCs, the ICCAT Secretariat and by other entities (see: http://www.iccat.int/GBYP/en/Budget.htm). The contents of this document do not necessarily reflect the point of view of ICCAT or other funders and in no way anticipates future ICCAT policy in this area.</p> <p>GBYP and Management Strategy Evaluation</p>  <p>The Atlantic-Wide Research Programme on Bluefin Tuna (GBYP) aims to develop a new scientific management framework by improving data collection, knowledge of key biological and ecological processes, assessment models and management. A critical component of the GBYP is the construction of a robust advice framework consistent with the precautionary approach (GBYP 2014). A Management Strategy Evaluation (MSE, Cochrane 1998, Butterworth 1999, Kell et al. 2014, Punt et al. 2014) approach has been proposed to address this goal (Anon. 2014b). MSE establishes operating models that represent credible hypotheses for population and fishery dynamics which are used to quantify the efficacy of various management procedures. These management procedures may encompass a wide range of complexity from conventional stock assessments linked to harvest control rules (Hilborn 2003) through to</p>
	<div> <p>1 Introduction to Exceptional Circumstances Protocols</p> <p>2 Objective of this document</p> <p>3 Installing from the ECP Github repository and running the App.</p> <p>4 The ECP object</p> <p>5 Using the new ECP object</p> <p>6 Support</p> </div>	<h3>ECP Object Formatting Guide</h3> <p>Exceptional Circumstances Protocols for Adopted Management Procedures</p> <p>Tom Carruthers (tom@bluematterscience.com)</p> <p>2023-07-20</p> <p>1 Introduction to Exceptional Circumstances Protocols</p> <p>A principal motivation behind management strategy evaluation (MSE) and the management procedure (MP) approach was originally to lessen the need for frequent use of more complex and comprehensive stock assessment processes (and associated 'linking', Butterworth 2008). It follows that in most settings, MPs are adopted for an agreed period of time after which a formal review of the MP is scheduled (e.g., the 5-year interval for reviews of MP implementation by the International Whaling Commission, IWC 1999; the 6-year interval for reviews of the MP adopted by ICCAT (2022)).</p> <p>It is however considered best practice to establish protocols for detecting situations where the observed system dynamics are not consistent with the range of simulations specified in the operating model, over which the adopted MP was demonstrated to be robust (Butterworth 2008). Exceptional circumstances (EC) protocols typically compare new, updated observations of the data used by the MP with the simulated values from the MSE projections ('posterior predicted data'). They can also involve a check of the assumptions used to condition the models or characterize the axes of uncertainty. It is also prudent to consider which robustness OMs the MP was particularly vulnerable to as this will highlight which conditions will cause the MP to provide bad advice.</p> <p>2 Objective of this document</p> <p>This document is intended to guide the reader (an experience R programmer and MSE technical specialist) through how to organize posterior predicted data and real observations into an ECP object that can be uploaded to the ECP App.</p>

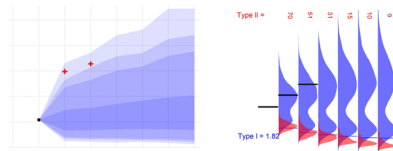
2. Stock Composition exploration
3. E-tag exploration



4. ECP investigation and presentation

Developing Exceptional Circumstances Provisions for Atlantic Bluefin Tuna

MODELLING APPROACHES: SUPPORT TO BLUEFIN TUNA STOCK ASSESSMENT. Phase 12.2 (ICCAT GBYP 03/2023)



Bluefin Tuna MSE working group
23 June 2023
Tom Carruthers

5. Draft SCRS paper

SCRS/2023/XXX

EXCEPTIONAL CIRCUMSTANCES PROVISIONS FOR THE ATLANTIC BLUEFIN TUNA MANAGEMENT PROCEDURE

T. R. Carruthers¹, J. Walter², A.R. Hordyk¹, A. Hanke³, K. Gillespie³, N. Duprey⁴, D.S. Butterworth⁵

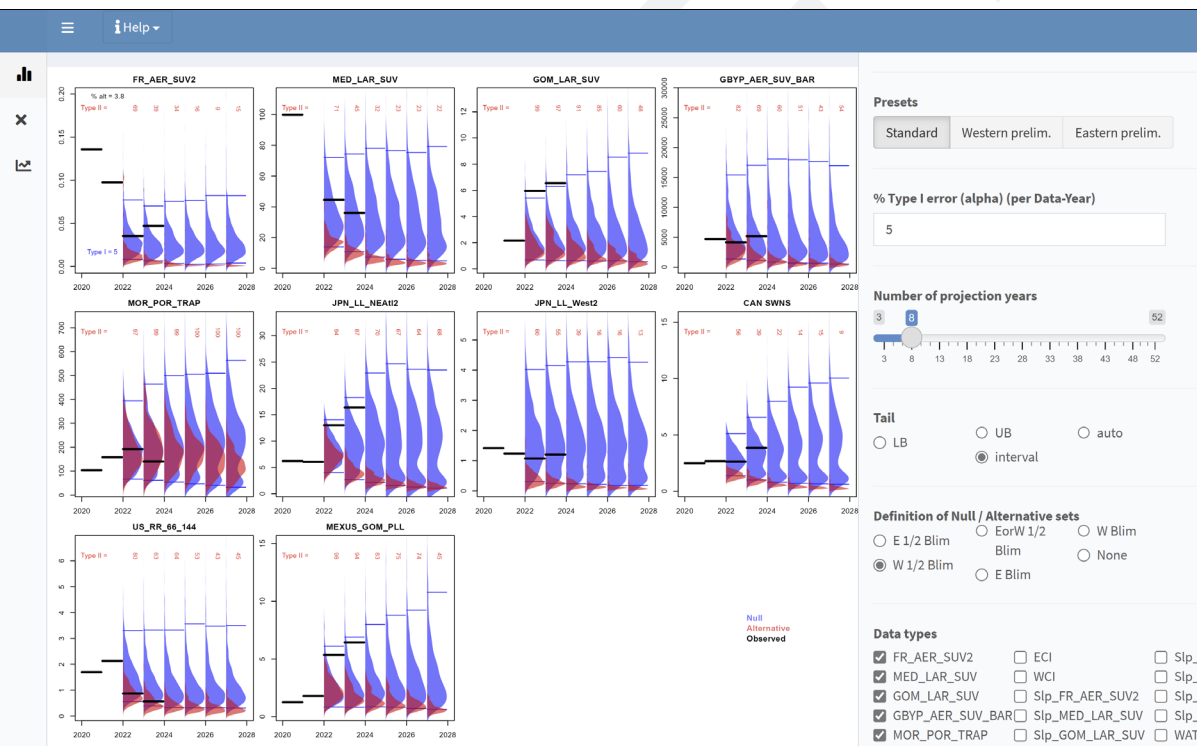
SUMMARY

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KEYWORDS

Management strategy evaluation, bluefin tuna, operating model, management procedure.

6. App / Preliminary investigation of exceptional circumstances protocols / indicator systems



2 Progress with respect to tasks and deliverables

All contracted tasks (Table 2 and deliverables Table 3) were completed on time. Outstanding is simply adding new observations of data as they are provided which is relatively trivial.

Table 2. Status of 2023 contract tasks/activities. Green denotes a completed task.

Task / activity	Status
July 20:	
1. Documenting processes to run MSE and ECP (exceptional circumstances protocols) and update the ABTMSE GitHub repo.	Appendices A and B
2. Stock Composition exploration	Included in App Appendix C
3. Electronic tag exploration	Included in App Appendix C
4. ECP investigation, coding and presentation	Appendices D and E
5. Draft ECP proposal (SCRS draft paper, app).	Appendices D and E
6. Code checking of the adopted management procedure	
7. Miscellaneous	

Acknowledgments

Many thanks in particular to Alex Hanke and Kyle Gillespie for helping to brainstorm ECP visualization and diagnostics. Thank again to Francisco Alemany for directing the project, and to Doug Butterworth for organizing all aspects of MSE framework development.

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3 Appendices

Appendix A – Technical Guide to constructing the ABTMSE R package
Appendix B – Technical Guide to formatting data for use in the ECP app
Appendix C – ECP R package
Appendix D – SCRS presentation on ECP exploration
Appendix E – SCRS paper on ECP background, bluefin ECP options.