Report on the ICCAT bluefin tuna assessment meeting

ICCAT Headquarters, Madrid, Spain

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for

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Executive Summary

Atlantic bluefin tuna stocks are subject to international management by the International Commission for Conservation of Atlantic Tunas (ICCAT). ICCAT manages Atlantic bluefin tuna as two separate management units, the Western Atlantic and the Eastern Atlantic (including the Mediterranean Sea). Management of bluefin tuna, particularly for the Western Atlantic management unit, has been controversial for decades. The 2002 meeting of the ICCAT Atlantic bluefin tuna working group was held at the ICCAT Secretariat in Madrid from 22-30 July 2002. Three independent experts were appointed by the Center for Independent Experts (CIE) to attend the meeting as part of the US delegation. Their participation was aimed at adding expertise to the meeting, aiding in reaching a balanced consensus, and lending credibility to the outcome.

This report is concerned with two aspects of the assessment meeting: The conduct of the meeting and how it might be improved in the future, and the strengths and weaknesses in the analyses and advice resulting from the assessment meeting. It present the opinions of one CIE appointed expert and should be read in conjunction with the reports of the other CIE participants.

The 2002 bluefin tuna stock assessment meeting was successful. Eastern and western assessments were conducted using the VPA-2BOX software with no mixing between stocks. Mixing scenarios were also explored, by the Western Group, using VPA-2BOX with overlapping stocks.

The meeting was well planned and well run. The combined knowledge, experience, and skills of the participants was extensive and a high quality of work was achieved despite, what some would perceive as, a very abbreviated schedule for conducting a stock assessment.

The main recommendations of this report are for:

- Further investigations of the estimation properties of the current assessment methods.
- A concerted effort to move towards data-appropriate estimation methods, while maintaining the continuity of consistent management advice.
- An effort to move towards conducting a single *assessment* of the two stocks rather than separate eastern and western assessments (Note, this says nothing about the *management* of the two stocks).
- From time to time, the funding of a small team of scientists to conduct an independent assessment of Atlantic bluefin tuna stocks (to aid in the introduction of new estimation methods and the move to a single assessment).
- The development of complex and biologically realistic "operating models" for use in simulation studies to investigate the properties of estimation models, and to evaluate management strategies.

Background

The 2002 meeting of the ICCAT Atlantic bluefin tuna working group was held at the ICCAT Secretariat in Madrid from 22-30 July 2002. I was one of three independent experts appointed by the Center for Independent Experts (CIE) to the US delegation. Our participation was aimed at adding expertise to the meeting, to aid in reaching a balanced consensus, and to lend credibility to the outcome (see Appendix 2: Statement of Work). For background information on the fishery and its management, also see Appendix 2.

The main objective of the meeting was to update the assessments for the eastern and western stocks of Atlantic bluefin tuna (previous assessments being in 1998 and 2000 respectively). Also, consideration was to be given to three assessment options identified in the 2001 BFT-Mixing report for dealing with the Central Atlantic region. There is some concern that the current management boundary is not appropriate given the observed levels of migration of bluefin tuna across the management boundary (i.e., from tagging data, where fish tagged in the western management area are captured in the eastern management area and vice versa).

This report is concerned with the first two bullet points in the fourth specific task in the Statement of Work: the conduct of the meeting and how it might be improved in the future, and the strengths and weaknesses in the analyses and advice resulting from the assessment meeting. Note, as the meeting reached a consensus view on the status of the stocks and appropriate management units, the third bullet point in the fourth specific task of the Statement of Work is not applicable.

Review Activities

Meeting Preparation

Prior to the meeting the supplied background material (Appendix 1) was read and other relevant documents and literature, which were available (at short notice), were consulted. Papers presented at the meeting (Appendix 1) were reviewed during the meeting and whilst on site in Madrid.

Meeting Attendance

A brief narrative of the meeting is given below. Fuller details of the findings of the meeting are available in the Executive Summary and Detailed Report of the meeting.

22 July

The meeting was opened, with Dr. Joe Powers serving as overall meeting coordinator. The meeting was structured with Plenary sessions, where all participants met and with group sessions, where participants split into eastern and western groups. Dr Jean-Marc Fromentin was chairman for the Eastern Group, and Dr Mike Sissenwine was chairman for the Western Group. The CIE participants consulted with Dr Sissenwine, and it was agreed that two of us (Dr. Robert Mohn and I) would join the Western Group, and the third (Dr Ding Chen) would work with the Eastern Group.

The first day consisted of a Plenary session. The Agenda was adopted, the Sixth GFCM-ICCAT Joint Working Group Meeting was briefly reviewed, and each of the submitted papers which were relevant to both groups were briefly presented and discussed. These papers included updated catches and abundance indices, as well as three methods papers (SCRS/02/086, SCRS/02/087, SCRS/02/088).

July 23

The day started with a discussion on generic aspects of CPUE analysis at a Plenary session. There was a some concern at the variety and standard of some of the CPUE analyses that were being done. The meeting decided that some recommendations would be put forward to address these concerns.

The meeting then split into Eastern and Western groups. This was to be the typical pattern, with a Plenary session in the morning where group progress was reported and then a split back into the individual groups. Since I worked with the Western Group, this narrative is restricted to that group and the Plenary sessions.

The Western Group began the detailed work of the assessment, keeping firmly in mind the Rebuilding Plan (to rebuild to MSY by 2018), and the 2002 Workplan (which calls for consideration of alternative boundaries for assessment purposes). The group worked through the appendix in document SRCS/02/086 as it detailed all of the decisions which needed to be made to specify a run (using the catalogued VPA-2BOX software). The method for deciding on the basecase run was agreed. It was very similar to that in 2000. The run was fully defined except for the "weighting method" (the method of estimating and/or specifying variances for each of the abundance indices). Diagnostics are to be calculated and compared before deciding which of the runs will be used as the basecase.

July 24 to July 27

Updates were given each morning at Plenary sessions. The Eastern Group worked through the catch and length data in detail considering all of the substitutions that had been made (for missing length data). They also constructed a catch scenario, in addition to the official one, which accounted for the suspected over-reporting of catches in years that affected future quotas and under-reporting in subsequent years (when quotas were in force). Validation and continuity VPA runs had been done to check the updated software and the effect of changes in catch at age and abundance indices.

In the Western Group, specifications for various runs were agreed upon, and discussion centered on which "mixing" runs to do. These fell into two groups: Extensions of the management boundary to the east (thus including more catch as "western" fish); and runs of VPA-2BOX with overlapping stocks (a proportion of eastern fish in the western area and vice versa). It was agreed that treating the Central Atlantic as a separate stock for assessment purposes is not sensible; as a response to the possibility of treating it as a separate management unit, it was agreed to provide a qualitative assessment of annual changes in CPUE and size structure.

There was also a great deal of discussion on the need to include advice with regard to the consequences of management options which are based on incorrect "mixing" assumptions. For example, what biases would be expected in the basecase assessment results if much of the catch in the western management area is from eastern fish, or alternatively if much of the catch in the Central Atlantic is from western fish? It was agreed that a contingency table would be constructed for inclusion in the Detailed Report.

The basecase run was chosen on the basis of the AIC values for four alternative weighting schemes. The AIC values indicate that there is no reason to move from the "equal weighting" scheme (where all indices are assumed to have the same variance) which was used in the 2000 assessment. The calculated p-values for chi-squared deviances (Gelman et al. 1995) are all very low, indicating that the distributional assumptions are violated for each run. This is of concern but, from a pragmatic point of view, one of the runs must be chosen as a basecase.

Sensitivity runs were also discussed and results show that estimates are very sensitive to "F-ratio" assumptions (the ratio of estimated F for the plus group at age 10 to the F on age 9 fish). These sensitivities have been seen in previous assessments, but it is still of concern that "sensible" results can only be obtained when the VPA is highly constrained.

July 28 to July 29

The Western Group met on Sunday evening (July 28) to review results in case some further runs/projections needed to be done overnight. A sensitivity run and some retrospective runs were agreed upon. It was discovered that the chi-squared deviances were wrongly calculated by the catalogued software; when calculated correctly all of the four initial model runs had acceptable p-values. From mid-afternoon on July 29 the draft text was reviewed for the detailed report. There were no Plenary sessions during these two days.

July 30

For most of the day there were separate group meetings to review the relevant text of the Executive Summary. The Plenary session considered the combined Executive Summary; it began at 10pm and continued until 1am the next morning. The Plenary did not recommend any changes to the current quotas or management boundaries.

Conduct of the Meeting

There were problems in the 2002 stock assessment *process* for Atlantic bluefin tuna. However, it is far from obvious how the process could realistically have been improved. I would like to stress that the criticisms I have of the *process* have nothing whatsoever to do with the participants at the meeting or the organization of the meeting. I believe that there are structural problems with the process, but I also appreciate that there are no easy solutions.

Key features of the 2002 stock assessment meeting were:

1. Relevant catch and catch-at-size data were, in theory, obtained by the Secretariat from National Scientists prior to the meeting.
2. Updated abundance indices and other relevant biological data were presented at the meeting.
3. The main analyses to be performed at the meeting were agreed to in advance and were to be done using catalogued software.
4. Separate eastern and western assessments were to be done by separate assessment groups; common issues were to be discussed in Plenary sessions of all participants.
5. The meeting was to produce an Atlantic bluefin tuna Detailed Report (including general recommendations and recommendations for future research) and an associated Executive Summary.

The meeting was scheduled for 9 days in July in Madrid at ICCAT Headquarters. In theory, the process has much to recommend it. It is advantageous that as much as possible should be done before the meeting: collation and checking of data; production of abundance indices; agreeing on stock assessment methods; implementation of the methods in software and the testing and documentation of the software. Also, it is clearly desirable that the meeting produce detailed documentation of its assessment results and management advice. However, in practice there were several problems:

1. Not all requested data were available and there were doubts as to the authenticity of some of the data (this applies to previously supplied data as well).
2. Many of the previous general and research recommendations had not been followed.
3. The quality and application of the methods used to standardize CPUE indices was highly variable.
4. Some of the details of the agreed assessment method had been mis-specified and/or incorrectly implemented in the catalogued software.
5. Many analyses were done in the meeting room while the meeting was in session.
6. The notion of completely separate eastern and western stocks was ingrained by the structure of the meeting; "mixing" scenarios were an "add-on" to the Western Group.
7. The large number of participants and the relatively short time frame led to a somewhat harried "assessment by committee".

8. The work environment for participants was hot and uncomfortable and the meeting rooms were unsuitable for visual presentations (i.e., overheads and/or Powerpoint).

Many of these practical problems are somewhat intractable given the large number of countries (and people) involved in the process. The international management of the resource also means that there are inherent political considerations that have and will continue to shape the assessment process. However, I have some suggestions with regard to some of the problems.

The first two problems may not have short term or even long term solutions. Countries need the will and the resources to collect and supply accurate fisheries data, and there is presumably limited scope for ICCAT to provide them with appropriate incentives to do so for bluefin tuna. Similar comments apply to the recommendations. However, rather than having a lot of recommendations, it may be more productive to identify a small number of important recommendations and state them more strongly.

With regard to the analysis of CPUE indices, there are relevant recommendations from the current meeting, and the ICCAT Methods Working Group may well meet and seek to standardize the methods used. Ideally, the raw data would be made freely available and all indices would be produced by suitably skilled analysts using the most appropriate methods in each case. For political and commercial reasons this will not happen even if the resources were available. I think that the way forward here is for the Methods Group to work towards providing "catalogued methods" with supporting software and documentation so that National Scientists can provide a more uniform quality in the production of standardized CPUE indices.

I have noted that despite the cataloging of the VPA-2BOX software used in the assessment it produced some incorrect outputs (due to mis-specification of methods and/or errors in implementation). This does *not* reflect badly on the personnel involved, rather it points to the extreme difficulty of establishing fully functional and correct assessment software. There is perhaps no solution to this. Managers need to be aware of the difficulty of achieving this objective and of the need to budget appropriate resources. I am fully supportive of the ICCAT Methods Working Group recommendation to build and maintain a catalog for all assessment software used by ICCAT (Anon. Draft).

It is expected that participants at these type of meetings will perform many minor analyses to assist the meeting with diagnostics and graphical representations of data and results. However, given that they work while the meeting is in progress, perhaps even joining in the discussion while coding a job, it is inevitable that mistakes will be made. Preferably, people performing any analyses (including setting up assessment runs) should do so when the meeting is not actually in session, or they should use a suitable workspace outside of the meeting room.

The problem with having separate eastern and western groups is related to assessment methods, but it is also ingrained in the process. I understand that it is probably necessary within the context of the current process, but it does create a problem in that there is no real scope for conducting a "single assessment" (which would seem sensible given the large level of mixing across the management boundary). The Western Group did explore "mixing scenarios", but these were never considered as assessments because they could not be seen to be competing with the Eastern Group's assessment. There was also a great deal of reluctance for members of each group to comment on the other group's assessment results when going through the Executive Summary. This was for two reasons: they had not been present at the other group's discussions; and, it was perceived to be outside of their brief, in that they were a member of the other group.

A harried "assessment by committee" would seem to be an inevitable consequence of the number of countries involved, together with the large number of participants and the need to complete the assessment at a single meeting. A contrasting process would see an assessment conducted by a small team of scientists working over an extended period. They would have time to fully explore the data, experiment with alternative assessment methods and model assumptions, and explore a full range of sensitivities. It may be, if funding were available, that such an approach could be used to complement the current process. Direct funding of an independent assessment, from time to time, could also help facilitate the introduction of new assessment methods (see below).

The main meeting room (where the Western Group meet, and the Plenary sessions were held) was at times very uncomfortable due to the July heat in Madrid. People do not do their best work in such an environment. Also, the room did not appear suitable for presentations using Powerpoint or even an overhead projector. Most participants were perhaps aware of this as there was only one visual presentation. Methods, data, and results can all be better understood if they are properly presented. An upgrade and modernization of the ICCAT meeting room could be money well spent.

Strengths and Weaknesses in Assessment Methods and Advice

At some time in the history of ICCAT it appears that a decision was made that bluefin tuna assessments would be done using VPA based methods. This has lead to a process which requires National Scientists to deliver as complete as possible histories of catch and catch-at-size to the Secretariat. The Secretariat after making numerous substitutions for catches which do not have corresponding size data, produces catch-at-age matrices using estimated growth curves (cohort slicing). Although, in the past there has been exploration of alternative assessment methods, the traditional VPA approach was nevertheless used in the 2002 assessments. The strength of this approach is that it provides a means of delivering relatively consistent management advice from assessment to assessment. That is, there is a continuity of management advice because assessment results do not differ too much from year to year (the exception is in the projection results, but this is probably unavoidable with any assessment method, as the projection results depend on recent cohorts which will always be poorly estimated).

An often-repeated phrase in some stock assessment meetings is that of the "bias variance tradeoff". With some assessment methods one can produce relatively definitive results that lead to straightforward management advice, if one ignores the bias implicit in the methodology. Alternatively, other methods with less bias will yield such great uncertainty that it is difficult to articulate any useful management advice. I believe that the current VPA based methods are well towards the "biased" end of this tradeoff. However, if more modern data-appropriate methods were used, one could well end up at the high variance end of the trade-off. Participants at the meeting are aware of the need to move towards so called "statistical based" methods (e.g., Fournier et al. 1998) as recommended by the ICCAT Methods Working Group (Anon. Draft). It is also appreciated that such a move should be phased in relatively slowly to ensure the continuity of consistent management advice.

While moving towards more data appropriate estimators (which accept that accurate catch-at-age data are not available), it is important to gain a thorough understanding of their estimation properties. To do this it will be necessary to develop a new generation of models that can be used as "operating models" (models of reality) in simulation studies. Ultimately, these models could be used in formal management strategy evaluation to determine management strategies that are robust to a wide range of uncertainties (e.g., Polacheck et al. 1999).

One of the weaknesses of the current estimation method is that its biases have not been explored for a wide range of alternative states of nature, including alternative stock hypotheses (though some work has been done on this: Butterworth and Geromont 2000). In some ways, the use of the current estimation methods has also limited the range of alternative hypotheses that are considered. For instance, it seems widely accepted that the eastern stock is an order of magnitude greater in size than the western stock. The belief is driven primarily by the assessment results, which to a certain extent define a small western stock by the definitions of what are western catches and what are eastern catches. However, there does not appear to be any data that would rule out western stock sizes of a smaller, but similar magnitude to the eastern stock.

All meeting participants agree that better data are required to provide more reliable stock assessments. There is an obvious need for more fishery independent abundance indices. One possibility that remains to be fully explored is the use of acoustic methods that have had some limited application on other tuna species (Bertrand et al. 1999, Betrand and Josse 2000). Acoustic surveys of spawning biomass may be feasible. An alternative could be to use fixed counting devices in entry points to the Mediterranean and the Gulf of Mexico (these could potentially provide data for a variety of species). Additional tagging data would be useful for understanding migration patterns, but there will always be interpretation problems with

regard to stock structure, as the natal origin of the tagged animals is not known. The development of a natal origin indicator (e.g. through an elemental constituent analysis of the nucleus of the otolith) would be of enormous benefit in understanding stock structure and population dynamics.

Summary of Findings

This heading is too grand for what follows, in that these are my impressions from attending a single bluefin tuna stock assessment meeting. I have the advantage of bringing new eyes to the process but I lack the experience gained by those who have been attending these meetings for perhaps a decade or two.
With regard to the conduct of the meeting and the stock assessment process:

- The process is largely appropriate given the political requirements of assessing an international fishery.
- Practical problems are mainly a consequence of the sheer number of countries and participants involved.
- The 2002 meeting was well planned and conducted:
    – The meeting was skillfully chaired and coordinated,
    – Participants knew the required outputs of the meeting and worked efficiently towards delivering them.
- The division of the meeting into separate eastern and western assessment groups is logical given the current management strategy, but is illogical from a pure stock assessment perspective.
- There is a need for some evolution in the process; this will be hard to achieve and will only happen slowly.

With regard to the assessment methods and the advice resulting from the meeting:

- The assessment method provides a reasonable approach to ensure the continuity of consistent management advice.
- There is an acknowledged need to move towards more data-appropriate estimation methods, but this must be done in a measured fashion.

Conclusions and Recommendations

The 2002 bluefin tuna stock assessment meeting was successful. Eastern and western assessments were conducted using the VPA-2BOX software with no mixing between stocks. Mixing scenarios were also explored, by the Western Group, using VPA-2BOX with overlapping stocks. The meeting included many recommendations in its draft Detailed Report, including some related to the need to apply more data-appropriate estimation methods in the future.

The meeting was well planned and well run. The combined knowledge, experience, and skills of the participants was extensive and a high quality of work was achieved despite, what some would perceive as, a very abbreviated schedule for conducting a stock assessment.

My recommendations are as follows.

In the short to medium term:

- Further investigations of the estimation properties of the current assessment methods, in particular looking at F-ratio assumptions, and what drives the estimated size disparity between the eastern and western stocks.

- A concerted effort to move towards data-appropriate estimation methods, while maintaining the continuity of management advice.

- An effort to move towards conducting a single *assessment* of the two stocks rather than separate eastern and western assessments. (Note, this says nothing about the *management* of the stocks.)

- To aid in the introduction of new estimation methods and the move to a single assessment it may be worthwhile, from time to time, to fund a small team of scientists to conduct an independent assessment of Atlantic bluefin tuna stocks (giving them ample time to explore the data and alternative model assumptions).

In the medium to long term:

- Development of complex and biologically realistic "operating models" for use in simulation studies to investigate the properties of estimation models, and to evaluate management strategies.

References

Anon. (draft). Report of the ICCAT Working Group on assessment methods. Meeting held at the ICCAT Secretariat, Madrid, Spain, 11-15 June 2001.

Bertrand, A. and Josse, E. 2000. Acoustic estimation of longline tuna abundance. ICES J. Mar. Sci. 57: 919-926.

Bertrand, A., Josse, E., and Masse, J. 1999. In situ acoustic target-strength measurement of bigeye (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) by coupling split-beam echosounder observations and sonic tracking. ICES J. Mar. Sci. 56: 51-60.

Butterworth, D.S. and Geromont, H.F. 2000. Simulation testing as an approach to evaluate the reliability of assessment methods: an example involving initial consideration of the one/two stock hypotheses for North Atlantic bluefin tuna. SCRS/00/105 (and Addendum).

Fournier, D.A., Hampton, J., and Sibert, J.R. 1998. MULTIFAN-CL: a length-based, age-structured model for fisheries stock assessment, with application to South Pacific albacore, *Thunnus alalunga.* Can. J. Fish. Aquat. Sci. 55: 2105-2116.

Gelman, A., Carlin, J., Stern, H., and Rubin, D. 1995. Bayesian data analysis. Chapman and Hall. 552 p.

Polacheck, T., Klaer, N.L., Millar, C., and Preece, A.L. 1999. An initial evaluation of management strategies for the southern bluefin tuna fishery. ICES J. Mar. Sci. 56: 811-826.

Appendix 1: Material provided

Documents provided before the meeting:

Executive summary of species status for Atlantic bluefin tuna. *In* ICCAT report 2000-2001: 54–68.

Report of the ICCAT SCRS west Atlantic bluefin tuna stock assessment session (Madrid, Spain, September 18-22, 2000), west Atlantic bluefin tuna - detailed report. SCRS/00/24. 63 p.

ICCAT workshop on bluefin mixing (Madrid, Spain, September 3-7, 2001). SCRS/01/020. 32 p.

Bluefin tuna workplan: year 2002. 3 p.

Documents submitted to the meeting:

SCRS/02/010	GFCM-ICCAT Meeting Report. Anon.
SCRS/02/036	General review of bluefin tuna farming in the Mediterranean area. Miyake, P.M., J.M. de la Serna, A. di Natale, A. Farrugia, N. Miyabe, V. Ticina.
SCRS/02/081	Updated standardized CPUE indices for Canadian bluefin tuna fisheries based on commercial catch rates. Porter, J.M., M. Ortiz, and S.D. Paul.
SCRS/02/085	Preliminary results of aerial surveys of bluefin tuna in the western Mediterranean sea. Jean-Marc Fromentin, Henri Farrugio, Michele Deflorio and Gregorio De Metrio.
SCRS/02/086	Specifications and clarifications regarding the ADAPT VPA assessment projection computations carried out during the September 2000 ICCAT west Atlantic bluefin tuna stock assessment session. Punt, A.E. and D.S. Butterworth.
SCRS/02/087	An initial application of the spatial structure framework for North Atlantic bluefin developed at the September 2001 bluefin mixing workshop using simple age-aggregated models. Punt, A.E. and D.S. Butterworth.
SCRS/02/088	A scenario-based framework for the stock assessment of North Atlantic bluefin tuna taking into account trans-Atlantic movement, stock mixing and multiple fleets. Apostolaki P., E.A. Babcock and M. McAllister.
SCRS/02/089	Standardized catch rates of bluefin tuna, thunnus thynnus, from the rod and reel/handline fishery off the northeast United States during 1980-2001. Brown, C.
SCRS/02/090	Standardized catch rates for large bluefin tuna, thunnus thynnus, from the U.S. pelagic longline fishery in the gulf of Mexico and off the Florida east coast. Cramer, J.
SCRS/02/091	Updated index of bluefin tuna (thunnus thynnus) spawning biomass From Gulf of Mexico ichthyoplankton surveys. Scott, G., and S.C. Turner.
SCRS/02/092	Distribution of western-tagged Atlantic bluefin tuna determined from implantable archival and pop-up satellite archival tags. Block, B., et al.
SCRS/02/093	Atlantic bluefin tuna: additional considerations on mixing on the feeding grounds. Hester, F.

SCRS/02/094   Sex-ratio by length-class of bluefin tuna (Thunnus thynnus L.) caught by Maltese longliners. Farrugia, A.

SCRS/02/095   Description of Maltese bluefin tuna (Thunnus thynnus L.) fisheries. Farrugia, A.

SCRS/02/096   Revision of historical catches of bluefin tuna made by Maltese longliners. Farrugia, A.

SCRS/02/097   Historical catch of bluefin tuna (Thunnus Thynnus) and little tuna (E. Alletteratus) from a Libyan trap net. Tawil, M.Y.

SCRS/02/101   Update of bluefin tuna catch-at-size database. Kebe, P., C Palma, J Cheatle. Version #0, Version #1, Version #2

SCRS/02/102   Catch, effort and standardized catch per unit effort for the eastern Mediterranean bluefin tuna stock caught by Taiwanese longline fishery up to 2001. Hsu, C. and H. Lee.

SCRS/02/103   Standardized bluefin CPUE from the Japanese longline fishery in the Atlantic including those for mixing studies. Miyabe, N. and Y. Takeuchi.

SCRS/02/104   Long term fluctuations in bluefin tuna trap catches: Are they environmentally driven? Ravier-Mailly, C. and J.M. Fromentin.

SCRS/02/107   New tendencies in the Turkish bluefin tuna fishery in 2001 and 2002. Oray,I.K. and F.S. Karakulak.

SCRS/02/109   Updated Standardized Catch Rates for bluefin tuna from the trap fishery in the straits of Gibraltar. Ortiz de Urbina, J. and J.M. de la Serna.

Appendix 2: Statement of Work

STATEMENT OF WORK

Subcontract between the University of Miami and Innovative Solutions, LTD.

Background

Atlantic bluefin tunas are a valuable commercial and recreational fishery resource. The fishery takes place throughout the North Atlantic Ocean and the Mediterranean Sea. Many countries from Europe, North America, Asia, Africa, South America and the Caribbean participate in the fishery.

The fishery is subject to international management by the International Commission for Conservation of Atlantic Tunas (ICCAT). The ICCAT convention establishes Maximum Sustainable Yield as the objective for management. Scientific advice for fisheries management is prepared by ICCAT's Scientific Committee on Research and Statistics (SCRS). ICCAT manages Atlantic bluefin tuna as two separate management units for the Western Atlantic and Eastern Atlantic (including the Mediterranean Sea). The Western Atlantic bluefin tuna population has been sharply reduced in abundance from the 1970s. ICCAT adopted a rebuilding plan for the Western Atlantic fishery in 1998, which is still in force. Overfishing is now occurring in the Eastern Atlantic, with the catch far exceeding estimates of the yield that can be sustained.

Management of bluefin tuna, particularly for the Western Atlantic management unit, has been controversial for decades. The fishing industries (both commercial and recreational) believe the stock has not declines as seriously as indicated by ICCAT assessments, and that more recover has occurred in recent years. Environmentalists have argued that the Western Atlantic bluefin tuna fishery is an extreme example of overfishing, and that the rebuilding process has just begun, at best. Part of the controversy over bluefin tuna is related to ICCAT's use of two management units. It has always been known that there is some migration across the management unit boundary, but recent evidence indicates the mixing between Western and Eastern Atlantic management units could be quite important from a management perspective.

More detailed background can be found on the ICCAT web site at www.iccat.es by clicking on "Download Reports, Regulations, etc.", and then clicking on:

"Executive Summaries of Species Status, Oct. 2001- Bluefin": For the most recent management advice;

"Last Detailed Species Assessment Report-Bluefin": For details on the most recent assessment which was conducted in 2000;

"Other Reports of 2001- Bluefin Mixing Meeting": For a description of recent information on mixing and its implications; and

"Work plans for Species Working Groups- Bluefin": For the work plan for the 2002 assessment meeting for bluefin.

These four documents will also be sent electronically (see Appendix I for a tentative list of submissions to the ICCAT bluefin tuna session).

Role of the Consultant

The consultant is to participate as an objective scientific expert member of the US Delegation to the ICCAT bluefin tuna assessment meeting, 22-30 July 2002 at ICCAT Headquarters in Madrid. The US Delegation will be composed of scientists funded by the fishing industry and environmental interests, as well as US government scientists. In the past, the diversity of perspectives of the scientists within the US delegation has made it difficult to reach consensus on assessment results and management advice. The participation of independent experts from the Center for Independent Experts (CIE) is intended to add expertise, help reach a balanced consensus, and lend credibility to the outcome.

The last "bulleted" document (work plan) above gives a description of the work to be carried out during the assessment meeting. The second "bulleted" document (Detailed Assessment) describes the statistical methods used to calculate abundance indices (i.e., general linear models), preparation of catch at age matrices (by cohort slicing), the assessment methodology (a version of ADAPT), and other models (e.g., Age Structured Production Models). The consultants must have the expertise and experience to understand these methods and models and to help guide the assessment meeting to use them properly from a scientific perspective.

In addition to participating in the ICCAT meeting for nine days, the consultant will be expected to spend five days preparing for the meeting (reviewing past assessments and documents submitted to the current meeting), and two days following the meeting preparing a report. The consultant's duties will not exceed a total of 22 days.

Specific Responsibilities of the Consultant

Specific tasks and timings are itemized below:

1. Read and become familiar with the four documents noted above listed in the Background session of this SOW, SCRS documents submission to the assessment meeting provided to the consultants in advance of the meeting (a list of expected submissions is attached), and other relevant documents;

2. Participate in the entire ICCAT assessment meeting of 22-30 July 2002;

3. As a participant in the meeting, conduct analyses and prepare portions of the meeting report as assigned by the head of the US Delegation for the Western Atlantic bluefin tuna assessment;

4. Prepare a report addressing the following points:

   o Highlighting impressions of the conduct of the meeting and how it might be improved in the future;

   o Discussing strengths and weaknesses in the analyses and advice resulting from the assessment meeting; and

   o If, and only if, the assessment meeting fails to provide unambiguous advice by consensus, the individual consultants will provide their own expert advice within the context of work plan and requirements of the ICCAT rebuilding plan for Western Atlantic bluefin tuna. Specifically, they should advise on the appropriate total allowable catch level consistent with the rebuilding plan, and on management units (i.e., should ICCAT change from its current two management units, and if so, how?).

5. No later than August 9, 2002, submit the written report[1] (see Appendix II) addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Die, via email to ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu.

NAME_____   DATE_____

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[1] The written report will undergo an internal CIE review before it is considered final. After completion, the CIE will create a PDF version of the written report that will be submitted to NMFS and the consultant.

**ANNEX I: TENTATIVE LIST OF SUBMISSIONS FOR THE
ICCAT BLUEFIN TUNA SESSION**

Specifications and clarifications regarding the ADAPT VPA assessment/projection computations carried out during the September 2000 ICCAT West Atlantic bluefin tuna stock assessment session - Punt, A E and Butterworth, D S - SCRS/02/086

An initial application of the spatial structure framework for North Atlantic bluefin developed at the September 2001 bluefin mixing workshop using simple age-aggregated models - Punt, A E and Butterworth, D S - SCRS/02/087

A scenario-based framework for the stock assessment of North Atlantic bluefin tuna taking into account trans-Atlantic movement, stock mixing and multiple fleets - P. Apostolaki , M. McAllister and E. A. Babcock - SCRS/02/088

Standardized catch rates of bluefin tuna, thunnus thynnus, from the rod and reel/handline fishery off the northeast United States during 1980-2001 - Craig A. Brown - SCRS/02/089

Standardized catch rates for large bluefin tuna, thunnus thynnus, from the U.S. pelagic longline fishery in the gulf of Mexico and off the florida east coast. - Jean Cramer - SCRS/02/090

Updated index of bluefin tuna (thunnus thynnus) spawning biomass From Gulf of Mexico ichthyoplankton surveys - Gerald P. Scott and Stephen C. Turner - SCRS/02/091

Updated information on electronic tag results from bluefin tuna tagged in the western Atlantic Ocean - Barbara A. Block and Andre Boustany - SCRS/02/092

Atlantic bluefin tuna: additional considerations on mixing on the feeding grounds - Frank Hester - SCRS/02/093

ANNEX II: REPORT GENERATION AND PROCEDURAL ITEMS

1. The report should be prefaced with an executive summary of findings and/or recommendations.

2. The main body of the report should consist of a background, description of review activities, summary of findings, conclusions/recommendations, and references

3. The report should also include as separate appendices the bibliography of all materials provided and a copy of the statement of work.