INTER-AMERICAN TROPICAL TUNA COMMISSION

1ST WORKSHOP ON CAPACITY BUILDING:

INTRODUCTION TO THE METHODS USED IN THE TROPICAL TUNA STOCK ASSESSMENTS

Achotines (Panamá)
09-13 September 2024

REPORT

1. INTRODUCTION

The 1st Workshop on Capacity Building: Introduction to the Methods Used in the Tropical Tuna Stock Assessments took place from September 9–13, 2024, at the IATTC Achotines Laboratory in Panama. Organized by the Inter-American Tropical Tuna Commission (IATTC), this workshop was part of a broader initiative to enhance the scientific capacity of developing IATTC Member countries through targeted training in fishery stock assessment methodologies. The workshop was conducted in Spanish.

2. OBJECTIVES

Main objective:

- To increase participants' understanding of the methods used in IATTC tropical tuna assessments.

Specific Objectives:

- Introduce basic concepts of population dynamics used in fisheries stock evaluations.
- Explain mathematical models, especially age-structured models.
- Demonstrate statistical tools for fitting models to data.
- Present an overview of the Stock Synthesis 3 (SS3) platform.

3. PARTICIPANTS

The CPCs were asked to nominate three candidates that ideally met some technical requirements. The instructors then selected among the nominees. Priority was given to nationals from developing IATTC Member countries. Their selection was based on technical qualifications and space availability. The IATTC Capacity Building Fund covered all expenses (travel, accommodation, and food) for each participant.

Nominee Requirements:

- Fluency in Spanish, as the workshop was conducted in Spanish
- Basic knowledge of mathematics, statistics, and fisheries biology
- Proficiency in Excel
- Familiarity with R

A total of **12 participants** representing nine developing IATTC Member countries and two IATTC staff attended the workshop (Appendix A). One participant did not know Spanish; his participation

was nevertheless accommodated by providing explanations and guidance in English to the extent possible.

4. INSTRUCTORS

The workshop was conducted by three instructors from the IATTC scientific staff:

Dr. Carolina V. Minte-Vera – Senior Quantitative Fisheries Scientist, Stock Assessment Program
cminte@iattc.org
https://www.iattc.org/en-US/About/Staff/Detail/cminte

Dr. Dan Ovando – Senior Quantitative Scientist, Ecosystem and Bycatch Program
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https://www.iattc.org/en-US/About/Staff/Detail/dovando

Dr. Mark Maunder - Head of Stock Assessment Program
mmaunder@iattc.org
https://www.iattc.org/en-us/About/Staff/Detail/mmaunder

5. WORKSHOP STRUCTURE AND CONTENT

The workshop combined lectures, hands-on computer labs, discussion sessions, and individual projects to ensure a deep understanding of fishery assessment models.

Core topics covered:

- Population processes
- Age-structured population models (growth, mortality, recruitment)
- Model fitting using Excel and R
- Use of Stock Synthesis 3.0 (SS3)
- Interpretation of stock assessment outputs
- Statistical concepts (e.g., residuals, likelihood functions)
- Stock assessment model diagnostics
- Management reference points (MSY, FMSY)

Software Used:

- Microsoft Excel (with Solver add-in)
- R (with r4ss package)
- Stock Synthesis 3.0 (version 3.30.22.1)

Hardware Required:

- One laptop per participant
- Projector and whiteboard

6. DAILY AGENDA SUMMARY

The activities took place during the day and evenings. The full agenda is in Appendix 2. The key activities are in Table 2.

Table 2. Summary of the daily agenda of the 1st workshop on capacity building.

Day	Key Activities
Sunday, Sep 8	Arrival at Achotines
Monday, Sep 9	Opening ceremony, workshop introduction, fundamentals of population dynamics
Tuesday, Sep 10	Model fitting techniques, use of Excel Solver, recruitment and growth modeling
Wednesday, Sep 11	Multiple fishery, advanced SS3 modeling, spatial structure
Thursday, Sep 12	Integrated models in SS3, selectivity, reference points, output interpretation
Friday, Sep 13	Discussions, project work, final presentations, workshop closure

7. ADDITIONAL ACTIVITIES

- **Laboratory Tour**: Participants visited the Achotines Lab's facilities, including the captive yellowfin tuna population, and were given a thorough explanation of the research taken place in the laboratory by Dr. Dan Margulis.
- **Group dinner in town**: Provided cultural and networking opportunities.
- **Individual projects**: Application of concepts in simulated stock assessment scenarios.

8. PARTICIPANTS FEEDBACK

An anonymous survey[1] was conducted among the participants to gather feedback regarding the workshop. The participants' experience in fisheries range from 2 to 22 years and half had more than 10 years of experience. More than 90% of participants attend at least one type of meeting related to the commission work, and about half attend at least three types (commission meeting, SAC, working group meetings and preparatory meetings in their country) (Figure 1). About three quarters of the participants attend the SAC and more than half attend the commission meeting. The participants included country staff (about 35%), scientific advisors for the countries (35%), IATTC staff (20%) and commissioners (10%).

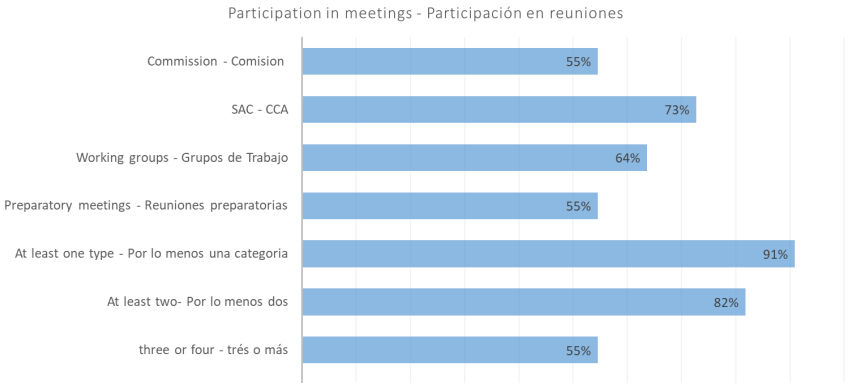

Figure 1. Characterization of the participants regarding their involvement in IATTC meetings

[1] 11 responses were received by August 8, 2025, and are used in this report. The full survey results can be visualized here

While all participants shared the opinion that stock assessments were an important tool for the sustainability of tuna fisheries, their knowledge of the tools used by the staff to do stock assessments and their preparedness to interpret the assessment results were moderate/limited/intermediate before the workshop. After the workshop, the participants considered that their knowledge improved and became good or very good in several aspects (Figure 2).

Most participants (90%) considered that they have a better understanding of how the scientific staff perform the stock assessments. All participants pointed out that they will use the acquired knowledge in their work.

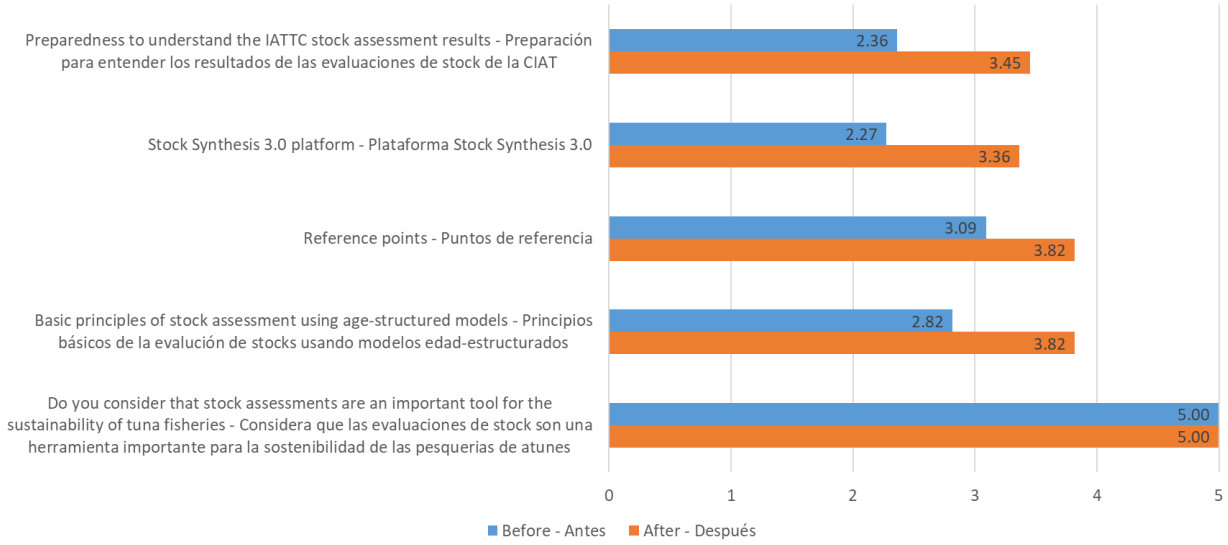

Figure 2. Knowledge before and after the workshop as perceived by the participants, on average (0 is none and 5 is excellent).

The participants felt that they had a better understanding of the different topics after the workshop. From 55% to 85% feel that their understanding of topics ranging from likelihood functions to yield-per-recruit analysis is better than before the workshop. All participants feel that all presentations and practice work on the computer were useful for their understanding of the topics. The amount of material covered in each of them was deemed enough for almost all topics for all participants, except for “process error” and “introduction to stock synthesis” which was not enough for 10% of the participants. Most participants feel that the material covered was at a level compatible with previous experience. However, for some topics, up to about 35% considered that the material was too complex. Those results indicate space for improvement in future workshops.

The participants were very pleased by the experience at the Achotines laboratory. The lodging in the Achotines laboratory was rated as excellent (4.45 out of 5). The meals had the same 4.45 rating, and the transportation (private bus from Panamá city) was rated at 4.73.

Overall, participants found the workshop material to be of high quality, with informative and illustrative presentations. The step-by-step instructions for implementing the models were particularly appreciated, as they clearly outlined the steps for and served as valuable reference material. Many participants recommended continuing to offer such materials on future workshops.

While the workshop met expectations for an introductory session on tuna stock assessment methods, several participants suggested improvements to enhance learning:

- Increase practice time and include more worked examples, ideally covering a wider range of fisheries.
- Extend the duration to allow deeper exploration of concepts and more time for exercises.
- Incorporate interpretation of results into each section for greater clarity.
- Consider offering a separate English-language session, as most of the workshop was in Spanish, which limited accessibility for non-Spanish speakers.

Participants acknowledged the complexity of the stock assessment models and expressed appreciation for the scientific staff's expertise and teaching approach. The methodology was generally seen as effective, and despite the challenges posed by the advanced concepts, the content was regarded as very useful.

The participants suggested topics for future workshops (Figure 3). The most requested topics were on the Stock Synthesis platform and data-poor stock assessment methods:

- Stock synthesis applications (more examples, forecast tools)
- Data-poor assessments (for example based on size data only) and interpretations
- Data standardization using spatiotemporal models
- Management strategy evaluation
- Data base management
- Biological sampling (standardization of methodology)
- Artificial intelligence applications
- [Assessment of] impacts on vulnerable and non-target species

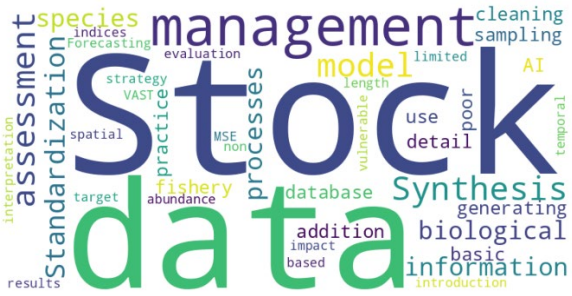

Figure 3. Word cloud of the topics suggested by the participants for future workshops.

9. CONCLUSIONS AND RECOMMENDATIONS

The 1st Workshop on Capacity Building marks a significant step in strengthening the technical capacity of IATTC Member countries. By investing in practical training on stock assessment methodologies, the IATTC supports sustainable tuna fisheries management in the Eastern Pacific Ocean.

The workshop proved to be a productive and valuable experience, both for the participants and the organizing team. The week-long workshop provided hands-on training in fisheries stock assessment methods and successfully built foundational knowledge for future capacity-building efforts. Based on feedback from the participants and reflections made by the instructors, several ideas emerged for improving future editions of the workshop:

1. Enhancing Lab Structure and Integration:

To improve the learning progression, future workshops should structure the laboratory exercises in a cumulative way, gradually increasing in complexity. In particular, the Stock Synthesis examples should be directly connected to earlier Excel-based labs to strengthen conceptual continuity. For example, implementing the most complex Excel model also in SS3, and then modifying that SS3 file (e.g., by adding a second fishery), would help participants draw clearer connections between simplified and integrated models.

2. Providing presentation materials in advance

Participants expressed interest in having access to presentation slides ahead of time. Making materials available before each session would allow them to print handouts or follow along more easily, helping with notetaking and retention, and serving as a reference during hands-on activities.

3. Refining the approach for teaching likelihood

The likelihood component of the workshop needs refinement, as it is a complex topic. The inclusion of equations may have confused participants, for next time the topic should be reached either by choosing a high-level, intuitive explanation or a more in-depth, methodical treatment. Also, using a data-generating process to explain the logic of likelihood concepts would help build intuition. Additionally, more clarity is needed in explaining the relationship between normal and lognormal distributions, which could be central to developing deeper understanding.

4. Location and logistics

The Achotines Laboratory proved to be an excellent location for the course. Its remote setting minimized distractions, while its proximity to local amenities allowed for meaningful social activities. The location helped foster focus during the day and connection among participants in the evenings.

5. Planning for future workshops

There is general agreement that one capacity-building workshop per year should be carried out by the staff. A return to the Achotines laboratory remains a strong option, but other venues could be explored.

6. Expanding workshop topics

The workshop sparked ideas for future themes. The participants were interested in continuing to address topics related to stock assessment, but also data generation, management and standardization. Ideally a series of thematic workshops should be built that can address the diverse needs across the region.

7. Including IATTC staff as participants

The decision to include some IATTC staff members as participants proved valuable. Their engagement added to the learning environment and promoted internal knowledge sharing. This practice should be continued in future workshops.

In summary, the 2024 capacity-building course was a strong step toward developing technical expertise in stock assessments among member countries. With thoughtful adjustments, future iterations can build on this success and offer even greater impact.

10. ACKNOWLEDGMENTS

The workshop was only possible due to the IATTC Capacity Fund and indication of candidates by the CPCs.

The success of the workshop was made possible thanks to the combined efforts of the following IATTC staff:

Scientific staff (Life history and captive yellowfin tuna population research):

- Dr. Dan Margulis

Achotines laboratory (technical and logistical support):

- M.Sc. Susana Cusatti
- Eblin Pereira

Panamá office (logistical support):

- Maylin Milagros Ruiz Chávez

La Jolla office (general support and social media):

- Dr. Arnulfo Franco
- Dr. Alexandre Aires-da-Silva
- Monica Galván
- Marisol G. Aguilar
- Barbara Cullingford
- Santiago Olivares

APPENDIX A

Table A1. Participants of the 1st workshop on capacity building.

Name	Country (Org.)	Email(s)
Charles Coc	Belize (BLZ)	charles.coc@bhsfu.gov.bz
Andres Ortiz	Colombia (COL)	andresortizas@gmail.com; andres.ortiz@aunap.gov.co
Alexander Salas	Costa Rica (CRI)	alexsaji@hotmail.com; a.salas@incopesca.go.cr
Carlos Tejeda	Guatemala (GTM)	ctejedadipesca2019@gmail.com
Martha Betancourt	Mexico (MEX)	marthaelena.betancourt@imbrsea.eu
Allan Gutierrez	Nicaragua (NIC)	agutierrez@inpesca.gob.ni
Yesuri Pino	Panama (PAN)	yesuripino@gmail.com; yesuri.pino@arap.gob.pa
Josymar Torrejon	Peru (PER)	ejosymart@gmail.com
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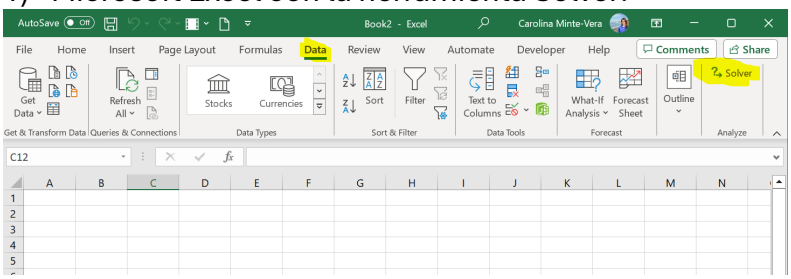
Henry Mero	Ecuador (ECU)	hmero@produccion.gob.ec
Salvador Siu	IATTC	ssiu@iattc.org
Miguel Perez	IATTC	mperez@iattc.org

Participants and IATTC staff: Susana Cusatti (IATTC), Dan Margulis (IATTC), Charles Coc (BLZ), Salvador Siu (IATTC), Martha Betancourt (MEX), Mark Maunder (IATTC), Yasuri Pino (PAN), Arnulfo Franco (IATTC), Dan Ovando (IATTC), Alexandre Aires-da-Silva (IATTC), Allan Gutierrez (NIC), Carolina Minte-Vera (IATTC), Andrés Ortiz (COL), Alexander Salas (CRI), Miguel Perez (IATTC), Henry Mero (ECU), Josymar Torrejón (PER), Carlos Tejeda (GTM), Guillermo Morán (TUNACONS). Not in the picture Eblin Pereira (IATTC), Maylin Milagros Ruiz Chávez (IATTC).

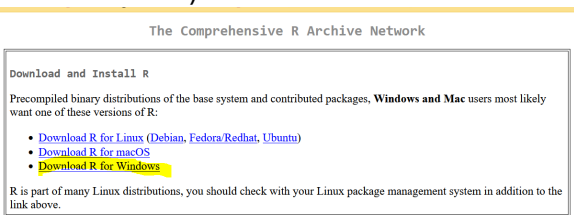
APPENDIX B: SOFTWARE INSTALLATION INSTRUCTIONS
Provided prior to the course (Excel Solver, R with r4ss, SS3)

1) Microsoft Excel con la herramienta Solver:



En este enlace puede encontrar las instrucciones de como instalar Solver:
https://support.microsoft.com/es-es/office/agregar-o-quitar-complementos-en-excel-0af570c4-5cf3-4fa9-9b88-403625a0b460

2) **Software R (**actualizado, por lo menos versión mayor que 4.0) que puede ser obtenido en este enlace:
https://cran.r-project.org/ (en amarilo para Windows, pero esta disponible para Linux y Mac también)



3) instalación de la librería "r4ss" en R.
https://github.com/r4ss/r4ss

La librería *r4ss* se puede instalar en R usando una de estas dos opciones:
Opción 1:

```
install.packages("pak")
pak::pkg_install("r4ss/r4ss")
```

Opción 2:

```
install.packages("remotes")
remotes::install_github("r4ss/r4ss")
```

4) Software Stock Synthesis 3.30 en su última versión, que se puede bajar de:
https://github.com/nmfs-ost/ss3-source-code/releases/tag/v3.30.22.1
La versión que vamos a usar es **ss3_opt**
Este es el enlace para la versión Windows:
https://github.com/nmfs-ost/ss3-source-code/releases/download/v3.30.22.1/ss3_opt_win.exe
Esta versión está disponible para otros sistemas operacionales también.