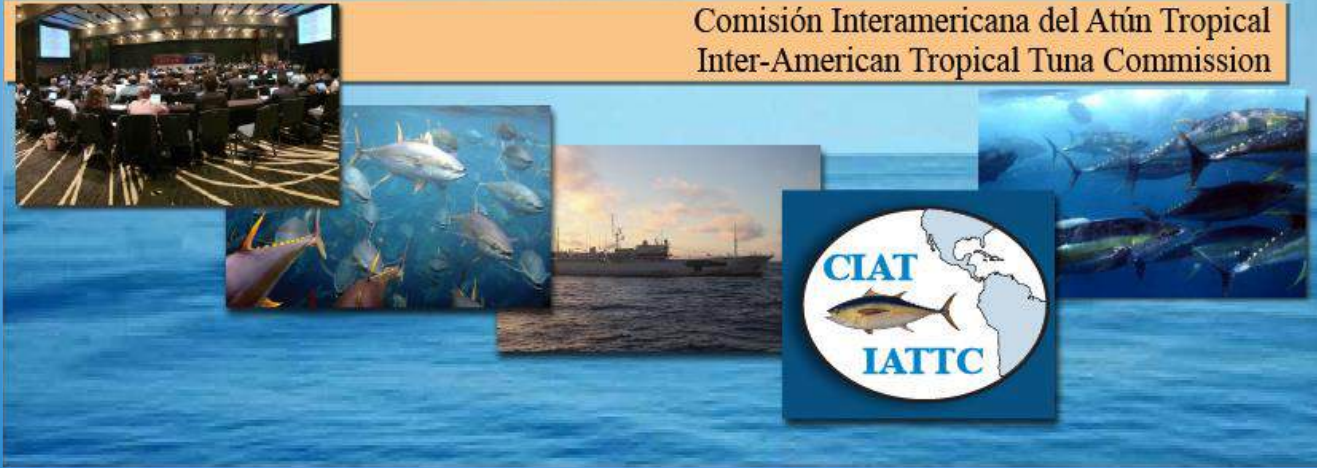


Comisión Interamericana del Atún Tropical  
Inter-American Tropical Tuna Commission



## Update on IATTC climate change work

IATTC Staff

1<sup>st</sup> Climate Change Workshop – 23-26 February 2025  
virtual conference.



## INTER-AMERICAN TROPICAL TUNA COMMISSION

### 101<sup>st</sup> MEETING

Victoria, B.C., Canada  
7-11 August 2023

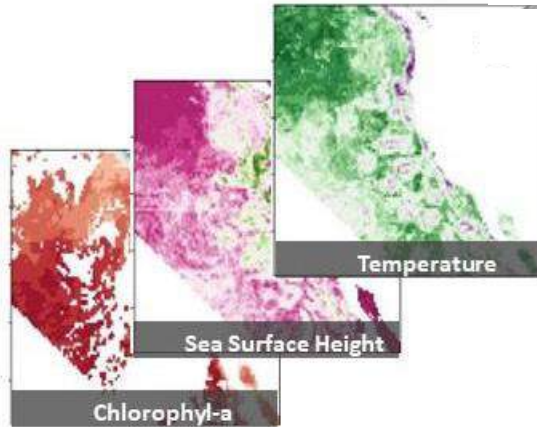
## RESOLUTION C-23-10

## ON CLIMATE CHANGE

1. The IATTC scientific staff will *highlight and consider the best scientific information available on the relationships between climate change, target stocks, non-target species, and species belonging to the same ecosystem or associated with the target stocks.*
2. The scientific staff shall incorporate in the next edition of the science strategic plan the issue of climate change and its impact on target species, non-target species, and the EPO ecosystem in general.
3. The Commission in 2024 and annually thereafter shall include climate change as an agenda item at the ordinary annual meeting of the IATTC.

# IATTC climate change/environmental work

## Environmental Database



**~10,000 daily layers: Jan 01, 1995 – Dec 31, 2023**  
**(spatial resolution 0.10 – 0.25°)**

## 14 Dynamic Variables

### Surface

- SST
- SST gradient
- Surface salinity
- Current speed
- Current direction
- Eddy kinetic energy
- Finite size Lyapunov exponent (FSLE)
- Front index
- Chlorophyll
- Chlorophyll gradient

### Subsurface

- Temp 100 meters
- Mixed layer depth
- Bulk frequency
- Isothermal layer depth



Copernicus  
Marine Service



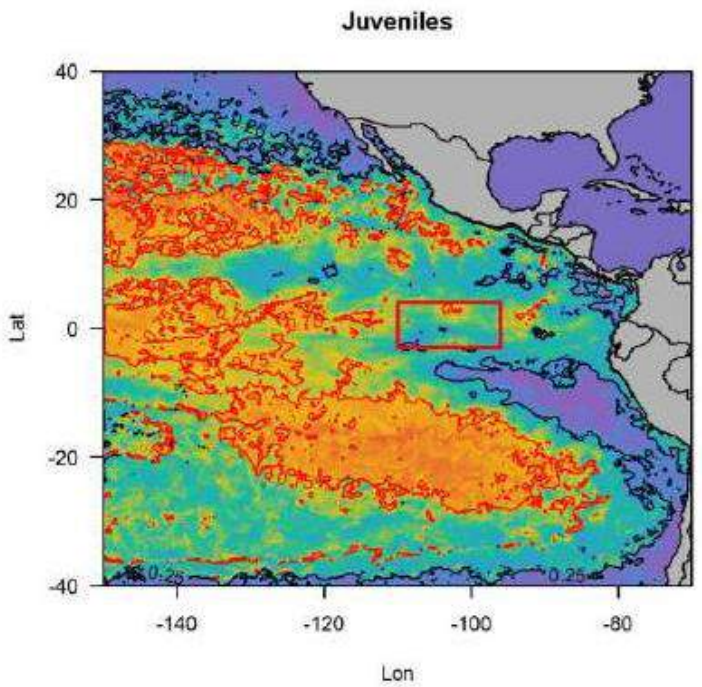
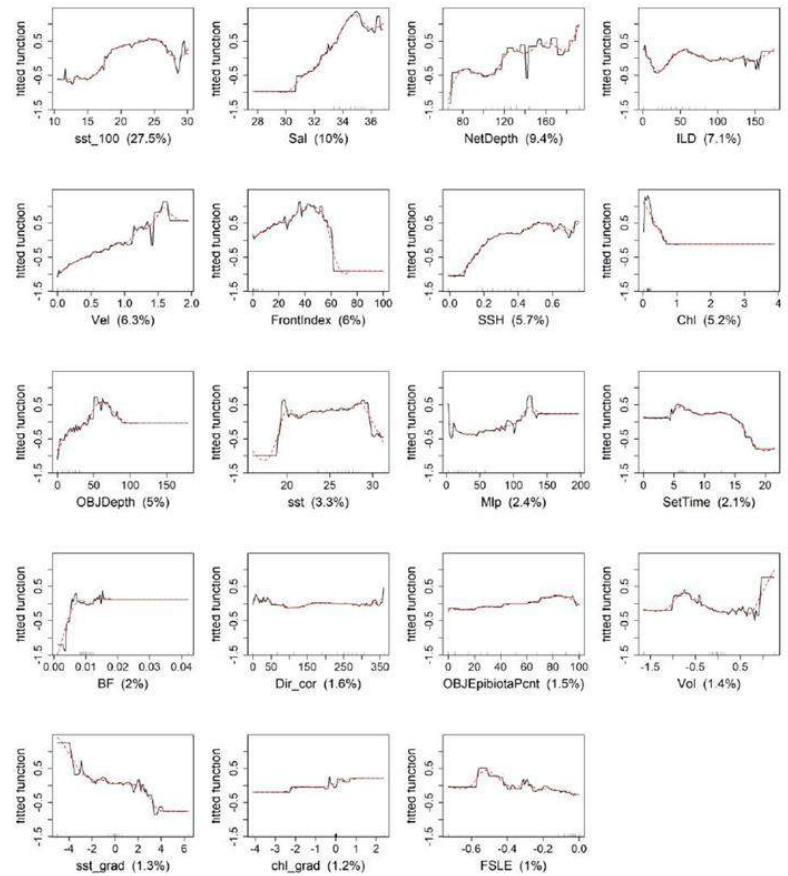
Copernicus  
Europe's eyes on Earth

Implemented by  
MERCATOR OCEAN  
INTERNATIONAL





# IATTC climate change/environmental work



- Species
- Yellowfin
  - Bigeye
  - Skipjack

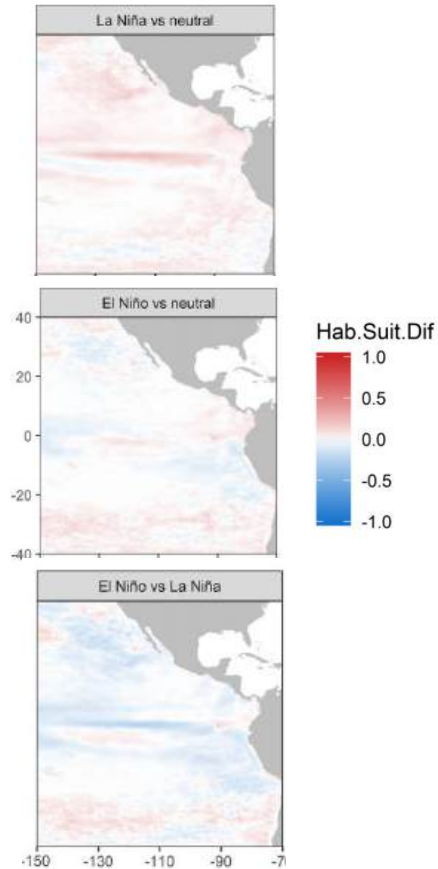
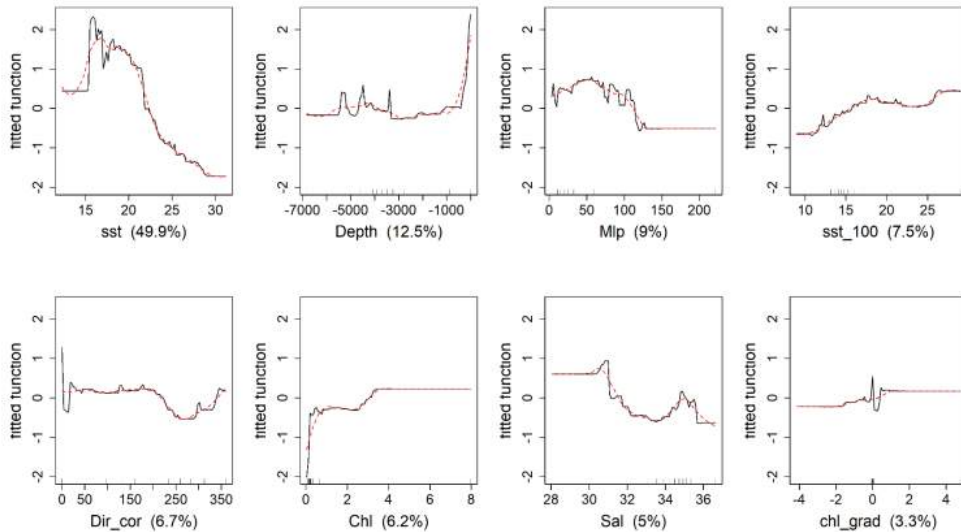
- Size classes
- Small
  - Juvenile
  - Large

Daily Predictions

- 2002-2023



# IATTC climate change/environmental work



# Early Life History Program: Published Studies on Climate Change Effects on Tunas

Since 2011, the Early Life History Group of the IATTC has conducted studies of the effects of climate change on the pre-recruit life stages of YFT.

This research has utilized a combination of experimental and modeling studies conducted mostly at the Achotines Laboratory, and is focused on the effects of ocean warming, ocean acidification, hypoxia, and wind-induced microturbulence on the survival, growth, physiology and behavior of egg and larval stages of YFT.

## Publications resulting from this research include:

Heuer, R.M., Y. Wang, C. Pasparakis, W. Zhang, V. Scholey, D. Margulies and M. Grosell. 2023. **Effects of elevated CO<sub>2</sub> on metabolic rate and nitrogenous waste handling in the early life stages of yellowfin tuna (*Thunnus albacares*)**. Comparative Biochemistry and Physiology, Part A 280: 111398. <https://doi.org/10.1016/j.cbpa.2023.111398>

Wexler, J.B., D. Margulies, V. Scholey, C. E. Lennert-Cody, D. Bromhead, S. Nicol, S. D. Hoyle, M. Stein, J. E. Williamson, J. Havenhand 2023. **The effect of ocean acidification on otolith morphology in larvae of a tropical, epipelagic fish species, yellowfin tuna (*Thunnus albacares*)**. Journal of Experimental Marine Biology and Ecology 10.1016. <https://doi.org/10.1016/j.jembe.2023.151949>

Nicol, S., P. Lehodey, I. Senina, D. Bromhead, A. Frommel, J. Hampton, J. Havenhand, D. Margulies, P. Munday, V. Scholey, J. Williamson, and N. Smith. 2022. **Ocean futures for the world's largest yellowfin tuna population under the combined effects of ocean warming and acidification**. Frontiers in Marine Science 9: 816772. <https://doi.org/10.3389/fmars.2022.816772>

Heuer, R.M., Y. Wang, C. Pasparakis, V. Scholey, D. Margulies and M. Grosell. 2020. **Effects of elevated CO<sub>2</sub> on yellowfin tuna (*Thunnus albacares*) early life stage respiration and ammonia excretion**. Journal of the Federation of American Societies for Experimental Biology 34(S1): 1-1. <https://doi.org/10.1096/fasebj.2020.34.s1.09653>

Frommel, A.Y., D. Margulies, J.B. Wexler, M.S. Stein, V.P. Scholey, J.E. Williamson, D. Bromhead, S. Nicol, and J. Havenhand. 2016. **Ocean acidification has lethal and sub-lethal effects on larval development of yellowfin tuna, *Thunnus albacares***. J. Exp. Mar. Biol. Ecol. 482: 18-24. <https://doi.org/10.1016/j.jembe.2016.04.008>

Margulies, D., V. P. Scholey, J. B. Wexler, and M. S. Stein. 2016. **Research on the reproductive biology and early life history of yellowfin tuna *Thunnus albacares* in Panama**. Pages 77-144 In: Advances in Tuna Aquaculture, D. Benetti, G. Partridge, and A. Buentello (editors), Elsevier-Academic Press.

Bromhead, D., V. Scholey, S. Nicol, D. Margulies, J. Wexler, M. Stein, S. Hoyle, C. Lennert-Cody, J. Williamson, J. Havenhand, T. Ilyina, and P. Lehodey. 2015. **The potential impact of ocean acidification upon eggs and larvae of yellowfin tuna (*Thunnus albacares*)**. Deep Sea Res. Part II, Top. Stud. Oceanogr. 113: 268-279. <https://doi.org/10.1016/j.dsr2.2014.03.019>

Scholey, V., D. Bromhead, D. Margulies, S. Nicol, J. Wexler, M. Santiago, J.E. Williamson, S. Hoyle, P. Schlegel, J. Havenhand, T. Ilyina, and P. Lehodey. 2012. **Novel research into the impacts of ocean acidification upon tropical tuna**. Pelagic Fisheries Research Program Newsletter 16(1): 1-8.

Wexler, J.B., D. Margulies, and V.P. Scholey. 2011. **Temperature and dissolved oxygen requirements for survival of yellowfin tuna, *Thunnus albacares*, larvae**. J. Exp. Mar. Biol. Ecol. 404: 63-72

Kimura, S., H. Nakata, D. Margulies, J. M. Suter, and S. L. Hunt. 2004. Effect of oceanic turbulence on the survival of yellowfin tuna larvae. Nippon Suisan Gakkaishi, 70: 175-178.



# Early Life History Program: Future Research Related to Climate Change Effects on Tunas

The IATTC Early Life History Group, in collaboration with the Ecosystem and Bycatch, and Stock Assessment Groups, is developing a long-term research plan to investigate the effects of climate change on tunas. This research is ongoing and will be conducted mostly at the Achotines Laboratory in collaboration with La Jolla-based staff.

The studies are investigating the effects of climate change on the survival, growth, physiology, behavior and genetics of pre-recruit, juvenile and adult stages of tunas. Experimental results will be used to inform physical-biological interaction models to describe the effects of climate change on tunas.

## Specific Topics of Study:

### Effects of Ocean Warming on Larval YFT and PBF

- Ongoing studies, initiated in 2024, of the effects of thermally-limiting water temperatures ( $> 28^{\circ}\text{C}$ ) on the larvae of YFT and PBF (in collaboration with Kindai U)
- Possible interactive studies of the effects of ocean warming and ocean acidification on pre-recruit life stages of YFT (extending the experimental and modeling work of Nicol et al. 2022)

### Effects of Ocean Acidification on Pre-Recruit Life Stages of YFT

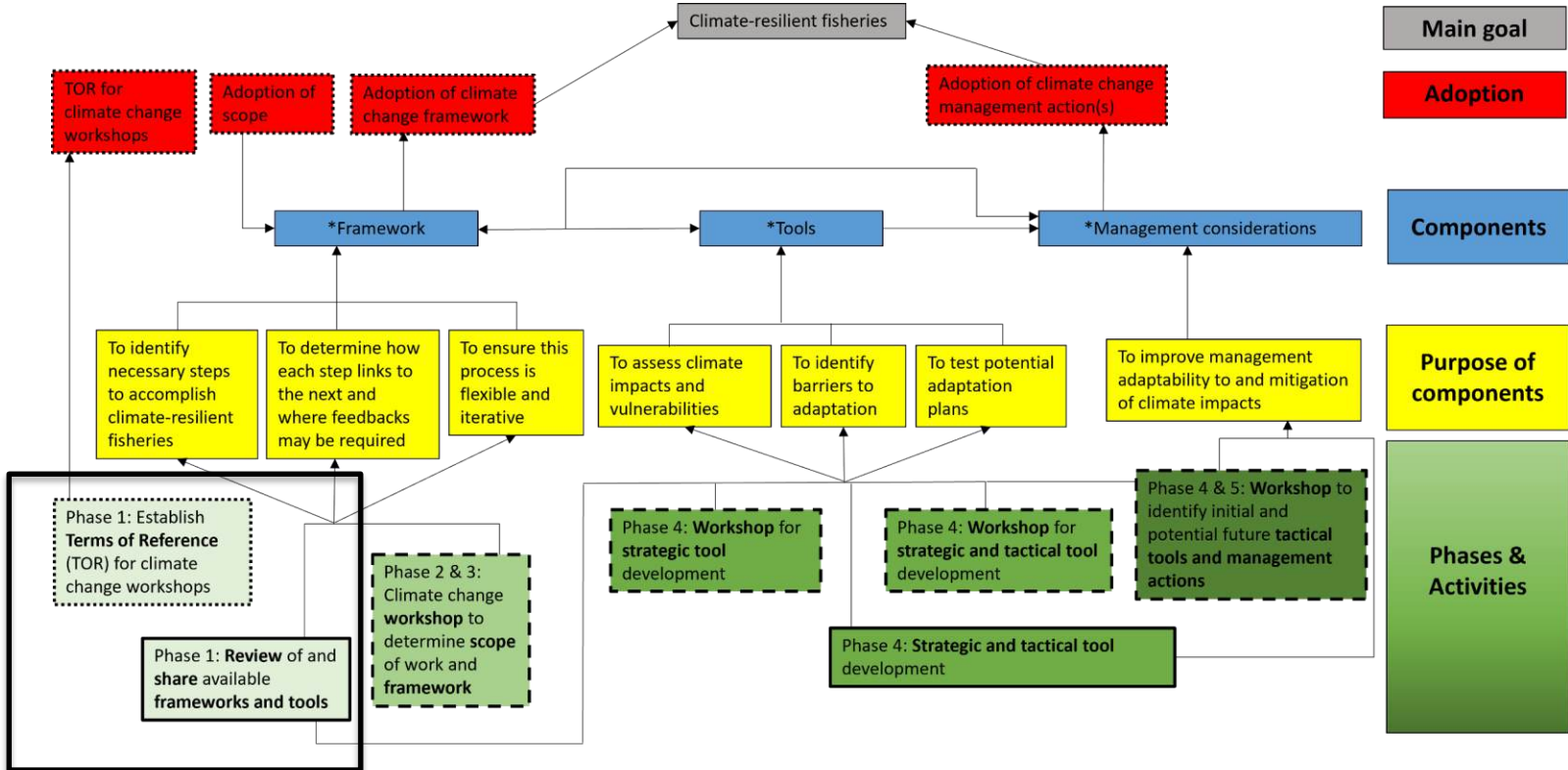
- Extending the published work of the IATTC, in collaboration with academic colleagues, to investigate more-specific effects of ocean acidification on the survival, growth, physiology and genetics of late-larval and early-juvenile YFT
- Utilizing these experimental results to parameterize physical-biological interaction models for ocean acidification effects

### Effects of Hypoxia on Larval and Early-Juvenile Stages of YFT

- Extending published work of the IATTC to investigate the effects of hypoxia (which usually accompanies ocean warming and acidification) on the larval and early-juvenile stages of YFT



# Climate change proposed workplan



Legend: box boundary definitions

- Involving the IATTC scientific staff
- Involving the IATTC scientific staff, Commission, and stakeholders
- Involving the Commission



# Climate change workshop TORs

**INTER-AMERICAN TROPICAL TUNA COMMISSION**

**102<sup>nd</sup> MEETING**

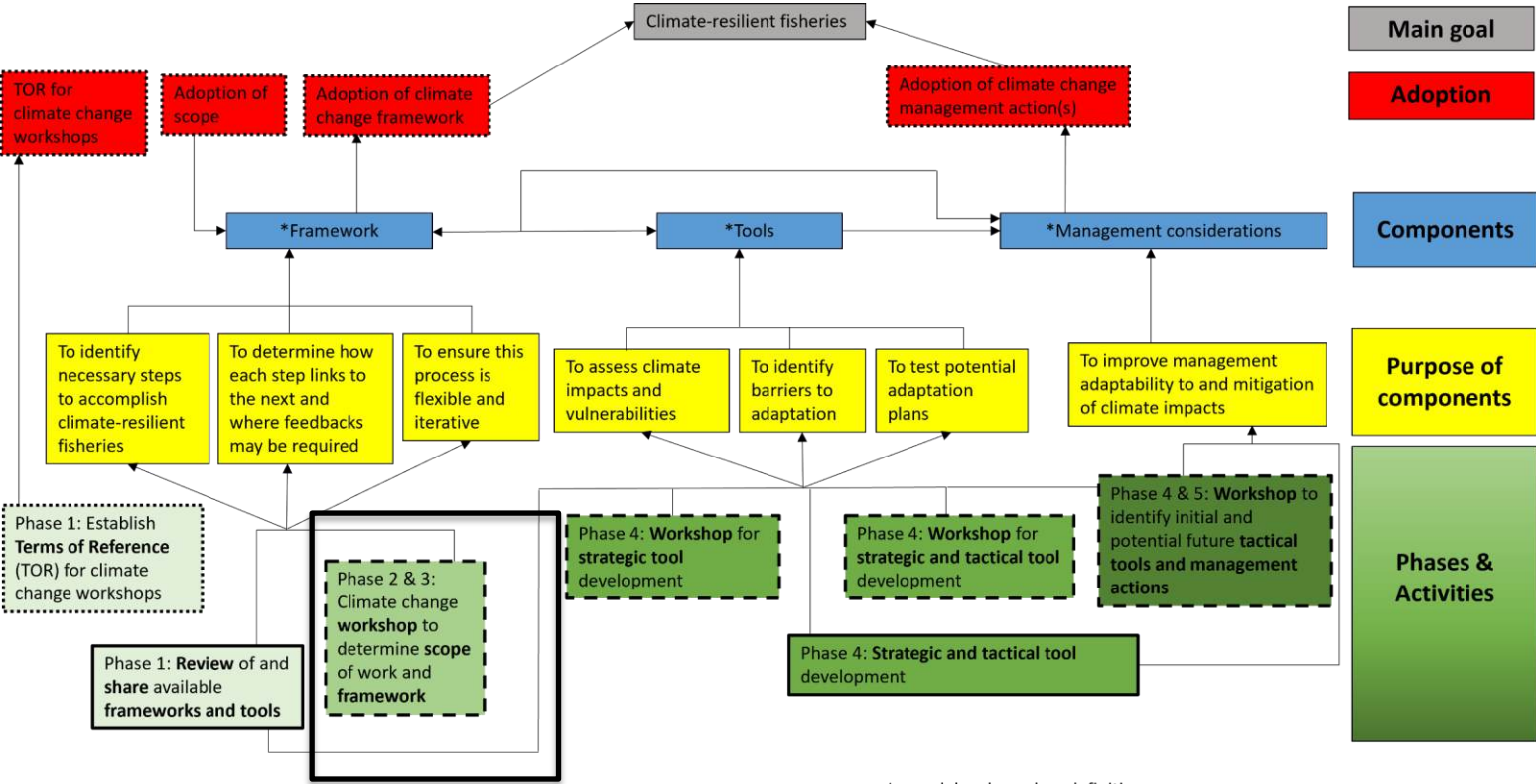
Panama, Panama  
02-06 September 2024

**IATTC-102 INF-B**

## **TERMS OF REFERENCE FOR CLIMATE CHANGE WORKSHOPS**

- TORs described in IATTC-102 INF-B
- Briefly presented at 102<sup>nd</sup> Meeting in Panama City at its request
- Was not discussed in detail or submitted as a proposal and thus not endorsed at the 102<sup>nd</sup> Meeting
- To start the workshop series we are following the principles and guidelines from the proposed TORs

# Climate change proposed workplan



Legend: box boundary definitions

- Involving the IATTC scientific staff
- Involving the IATTC scientific staff, Commission, and stakeholders
- Involving the Commission



# Proposed Timeline

Phase	Activities	2024				2025				2026				2027				2028				2029			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1) Planning	Review of and share available frameworks and tools																								
	Develop white paper of review and workplan proposal																								
	SAC/Comission Meeting: Share climate change resources and proposal with members																								
	Establish Terms of Reference (TOR) for climate change workshops																								
2) Decide on main goal and scope	Workshop to develop main goal and scope																								
	SAC/Comission Meeting: Share/adopt main goal and scope																								
3) Develop framework	Workshop to develop framework																								
	SAC/Comission Meeting: Share/adopt framework																								
4) Creating tools	Strategic tool development																								
	Workshop for sharing and developing strategic tools																								
	Tactical tool development																								
	SAC/Comission Meeting: Share newly developed strategic tools																								
	Workshop for sharing and developing strategic and tactical tools																								
	SAC/Comission Meeting: Share newly developed strategic and tactical tools																								
	Workshop to identify tactical tools and management action																								
Tool Implentation & Action <sup>12</sup>	SAC/Comission Meeting: Recommend tool implementation/ management action																								
	Implementation																								



# Discussions for the workshop

1. Main Goal (Feb 24<sup>th</sup>)
  - External Speaker
  - [CC-01-01](#)
  - Preliminary Recommendation
2. Scoping (Feb 25<sup>th</sup>)
  - External Speaker
  - [CC-01-01](#)
  - Preliminary Recommendations
3. Framework (Feb 26<sup>th</sup>)
  - External Speaker
  - [CC-01-02](#)
  - Example frameworks
  - Preliminary Recommendation



**DOCUMENT CC-01-01**  
GOALS AND SCOPE OF THE IATTC CLIMATE CHANGE WORKPLAN



**DOCUMENT CC-01-02**  
A PROPOSED FRAMEWORK FOR IATTC'S CLIMATE CHANGE WORKPLAN

# Preguntas – Questions?

