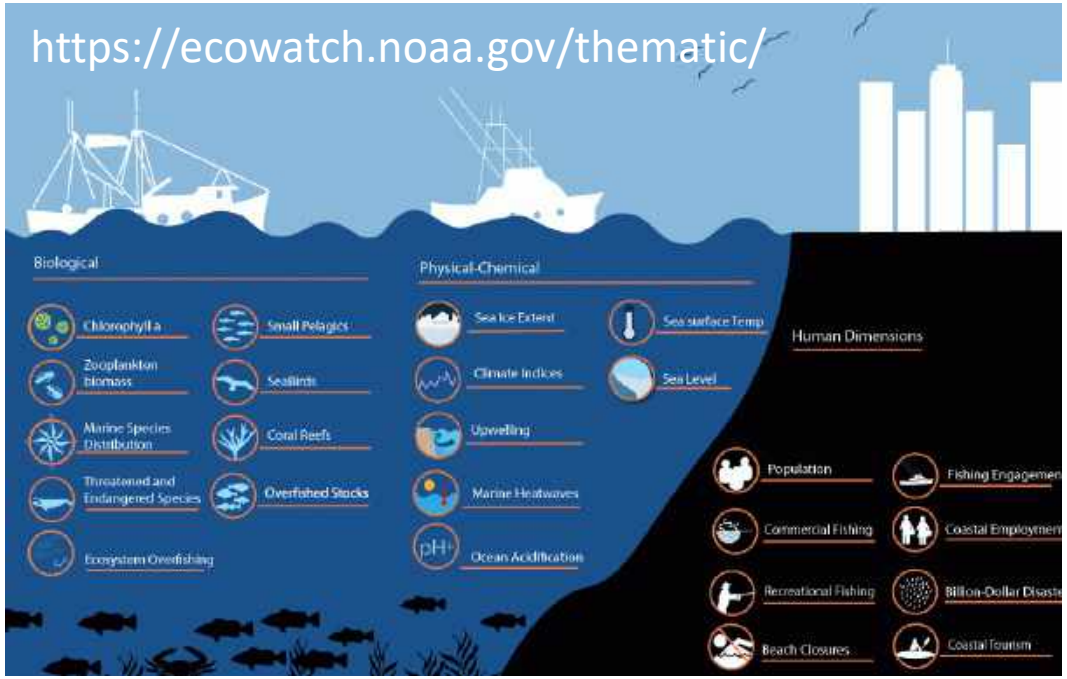
Review of t-RFMO Ecosystem Research to Inform a Workplan on EcoCards for the EPO (EB-02-02)

Leanne Fuller, Jon Lopez, Shane Griffiths, Dan Crear, Alexandre Aires-da-Silva and external collaborators Maria Jose Juan-Jorda, Valerie Allain, Hilario Murua

2a Reunión del Grupo de Trabajo sobre Ecosistema y Captura Incidental - 5-6 de junio de 2024
2nd Meeting of the Permanent Working Group on Ecosystem and Bycatch, 05-06 June 2024

Outline

- Objectives of EB-02-02
- Background on needs for improved communication of ecosystem status
- Harmonizing reporting with other t-RFMOs
- Proposed workplan to support implementation of EAFM
  - development of "*EcoCards*" and "*Ecosystem Status Assessments*"



Objectives of EB-02-02

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  - Review and summarize available information on ecosystem research by each t-RFMO
  - Examine tools that may be considered in developing an *EcoCard*
    - (e.g., indicators, ecosystem models, and spatial units: "*ecoregions*")
  - To consider this information to propose an IATTC workplan aimed at supporting decision making
    - (to ultimately restructure the EC report)
  - Overarching goal:
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- In t-RFMOs, the *EcoCard* concept is in its infancy
  - Candidate indicators have been identified by other t-RFMOs
  - *EcoCard* initiatives have commenced in other t-RFMOs
  - Specific indicators, *EcoCards*, and their spatial extent ("*ecoregions*") have not yet been developed or adopted by the Commissions
  - Timely to harmonize efforts to adapt and standardize tools & ecosystem-advice products

Background: Expansion of ecological research (IATTC mandates)

- Under the Antigua convention, the IATTC is responsible for ensuring the "*long-term conservation and sustainable use of the stocks of tunas and tuna-like species and other associated species of fish taken by vessels fishing for tunas and tuna-like species in the eastern Pacific Ocean (EPO)*"
- Article IV. "*Where the status of target stocks or non-target or associated or dependent species is of concern, the members of the Commission shall subject such stocks and species to enhanced monitoring in order to review their status and the efficacy of conservation and management measures. They shall revise those measures regularly in the light of new scientific information available.*"
- Article VII. "*adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing for, or dependent on or associated with, the fish stocks covered by this Convention, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened*"

Background: Expansion of ecological research (IATTC's SSP)

Recolección de datos en apoyo científico de la ordenación

-

Data collection for scientific support of management

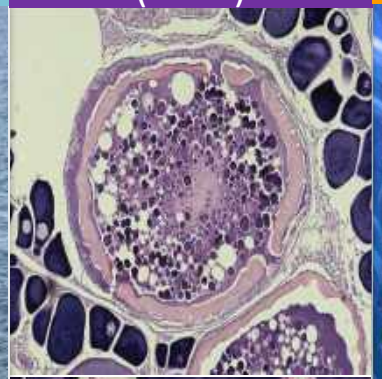
(n=13)

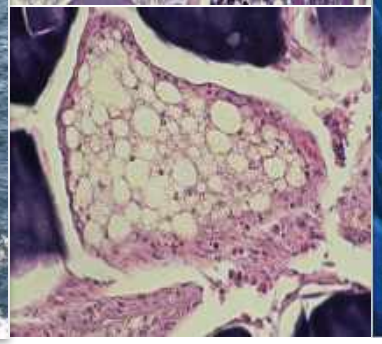
Estudios del ciclo vital en apoyo científico de la ordenación

-

Life-history studies for scientific support of management

(n=12)





Pesquerías sostenibles

-

Sustainable fisheries

(n=33)

Impactos ecológicos de la pesca: evaluación y mitigación

-

Ecological impacts of fisheries: assessment and mitigation

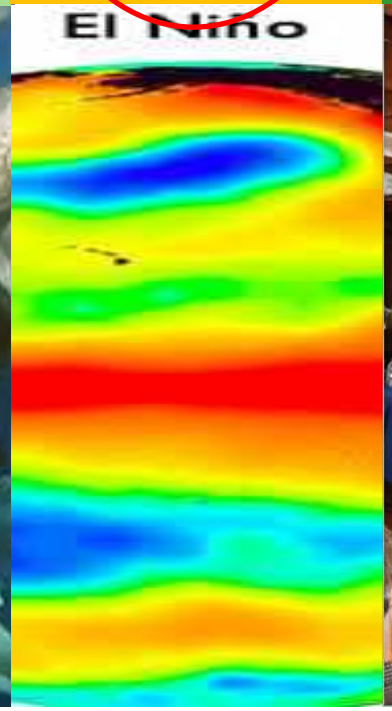
(n=23)**

Interacciones entre el medio ambiente, el ecosistema, y la pesca

-

Interactions among the environment, the ecosystem and fisheries

(n=13)**



Transferencia de conocimientos y fomento de capacidad

-

Knowledge transfer and capacity building

(n=5)

Excelencia científica

-

Scientific excellence

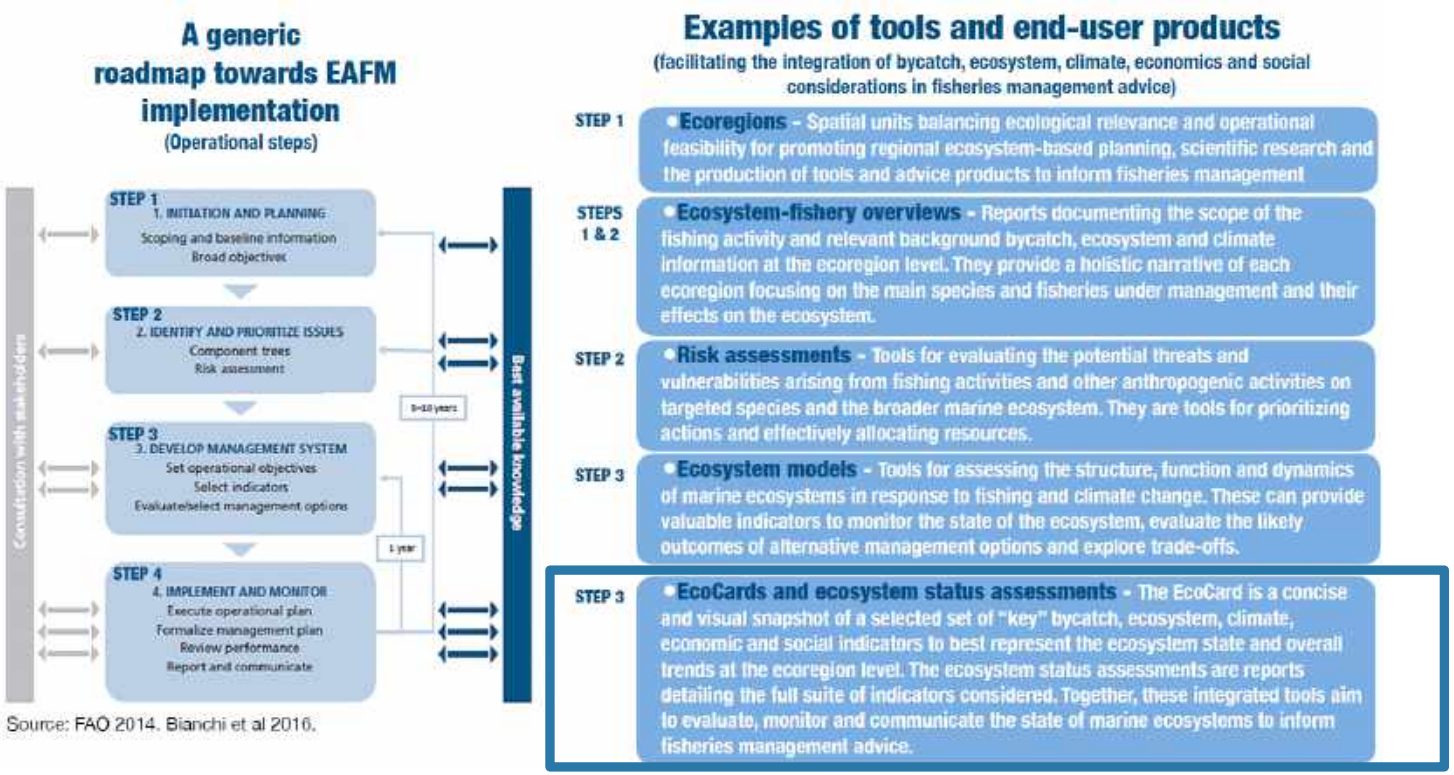
(n=4)

Background: Need for improved communication

- Purpose of *Ecosystem Considerations* (EC) report:
  - Broadly describe fisheries impacts on the EPO ecosystem
  - Support EAFM and the decision-making process
- Consequences of research expansion:
  - The EC report has increased in length and complexity
  - Report is not optimal for communicating ecosystem status
- Possible transition to shortened agendas (14th SAC)
  - Scientific meetings focused on effectively responding to Commission needs
  - Background work related to staff's recommendations for management
  - New meeting format reduces opportunities for detailed presentations
- Restructure the EC report to improve communication (ecosystem-advice products)
  - Indicator-based Ecosystem Report Card or "*EcoCard*"
  - *Ecosystem Status Assessment*

Background: The "*EcoCard*" concept

- What is an "*EcoCard*"?
  - Visual tool to support implementation of EAFM
  - Summarized indicator-based "Ecosystem Report Card" to convey a suite of relevant bycatch, ecosystem, and climate indicators, among others, chosen to 'best' represent ecosystem status
  - Goal: to visually and succinctly represent ecosystem status and overall trends



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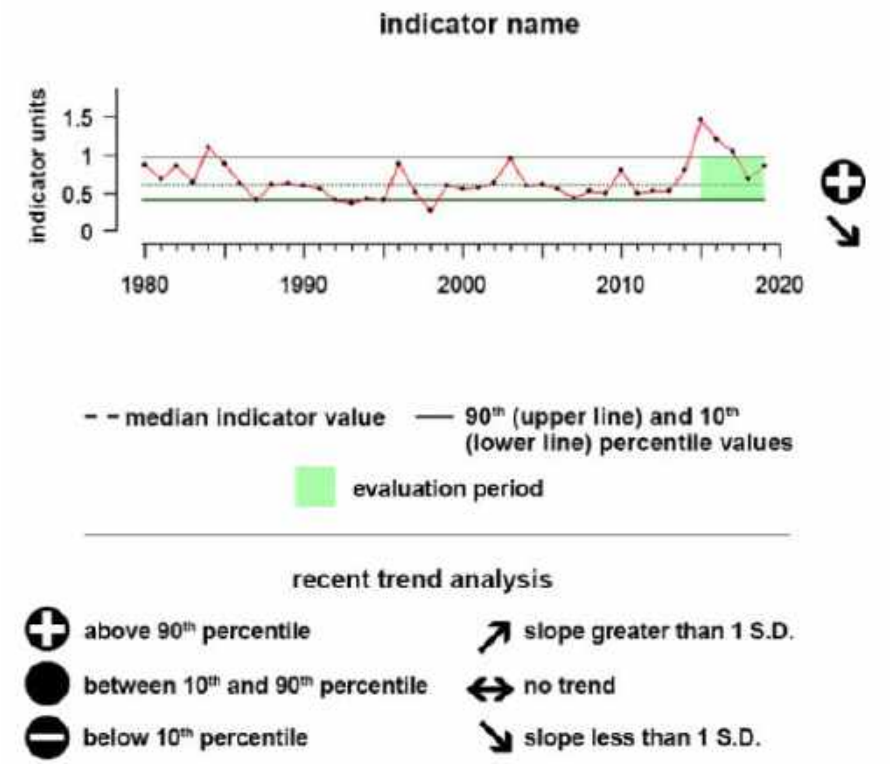
- SST example https://ecowatch.noaa.gov/thematic/sea-surface-temperature



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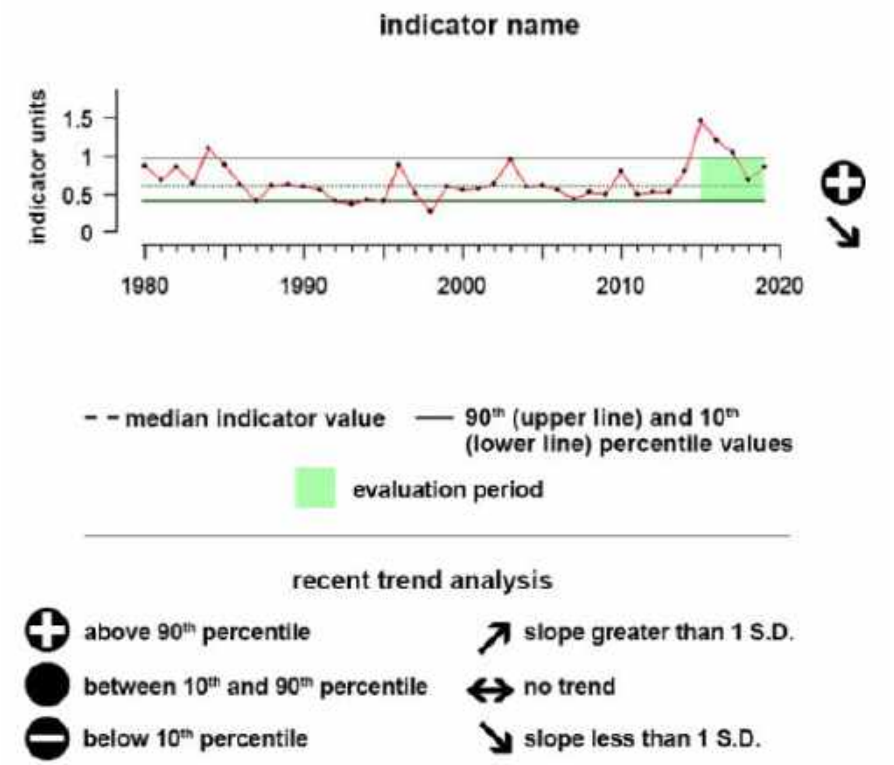
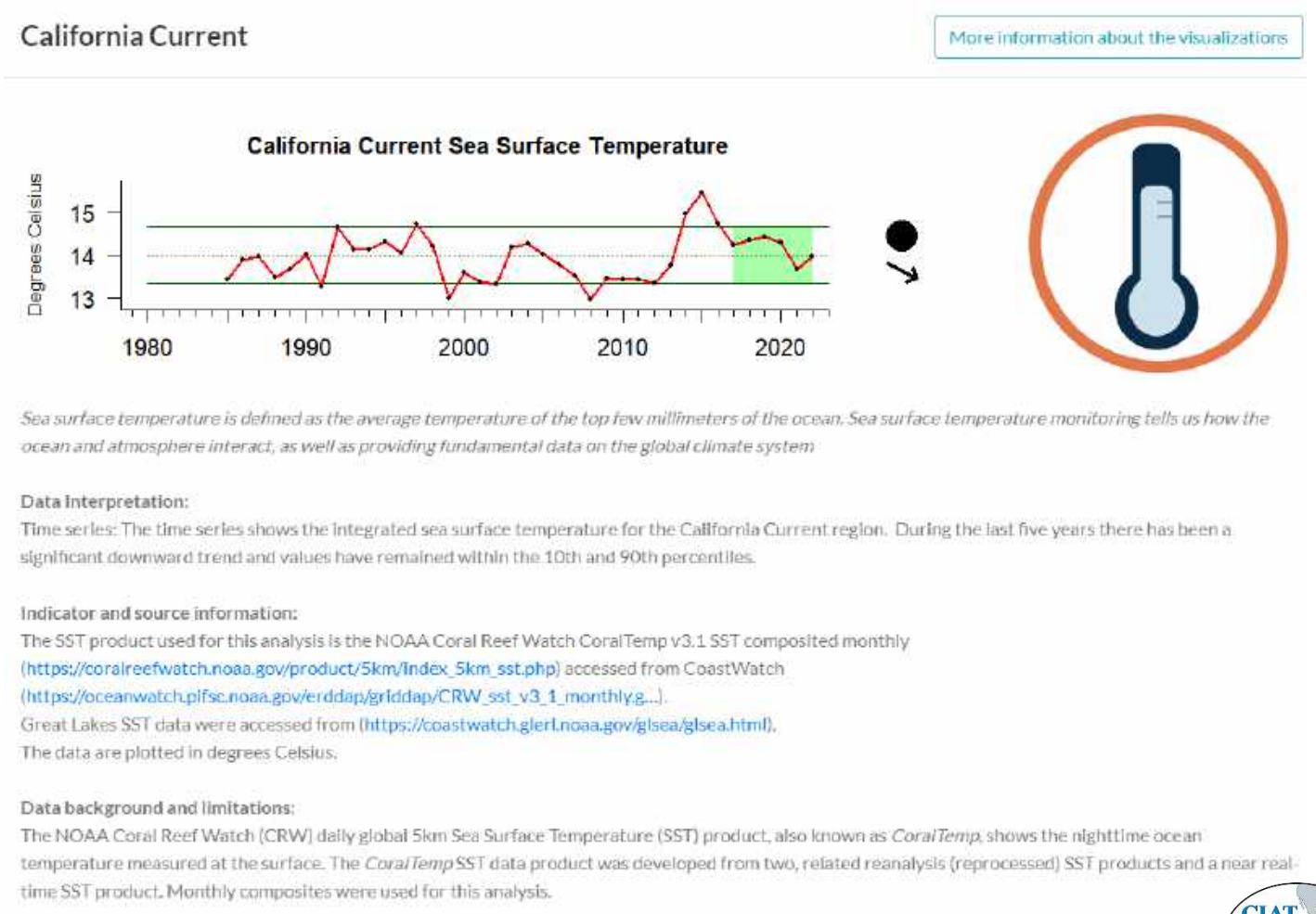
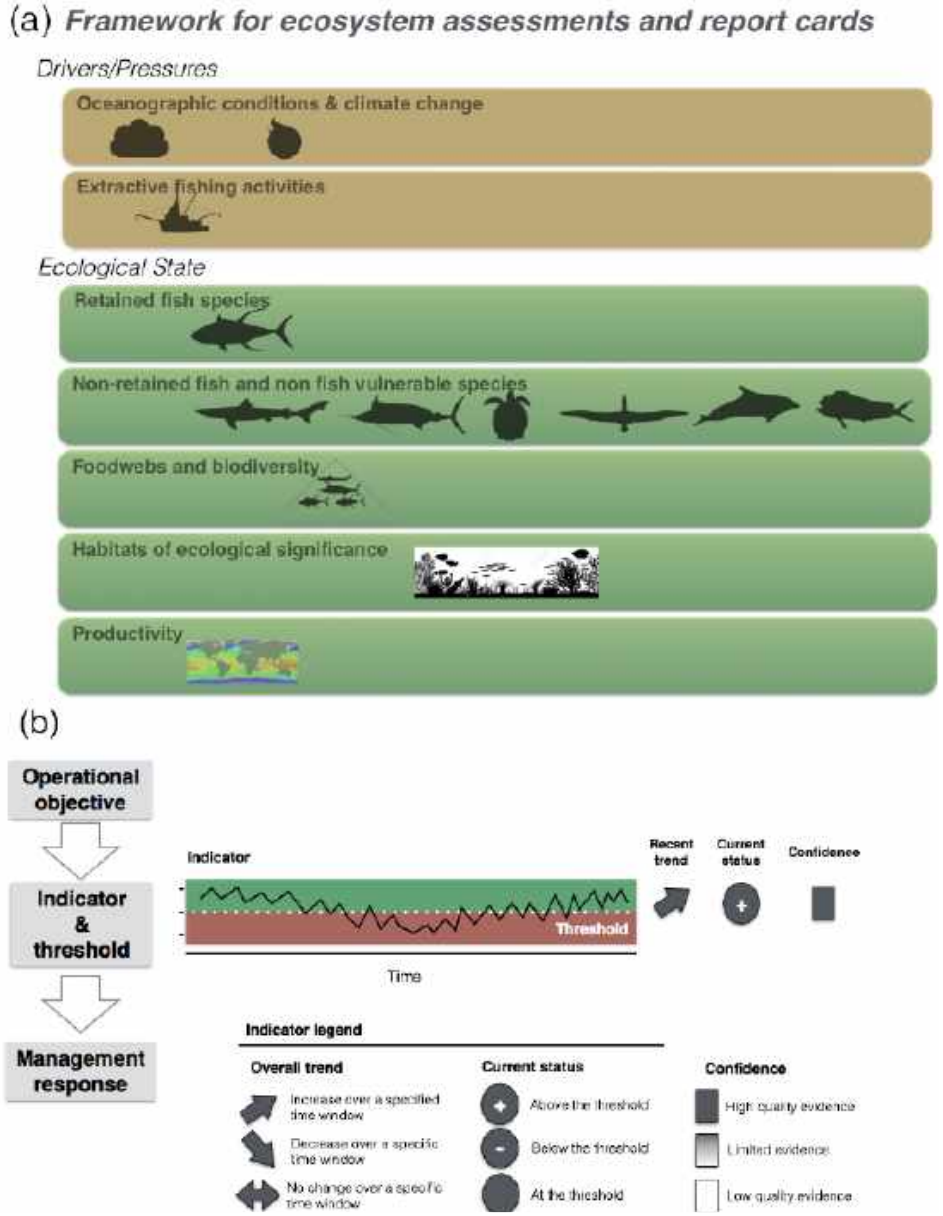




Background: The "*EcoCard*" concept

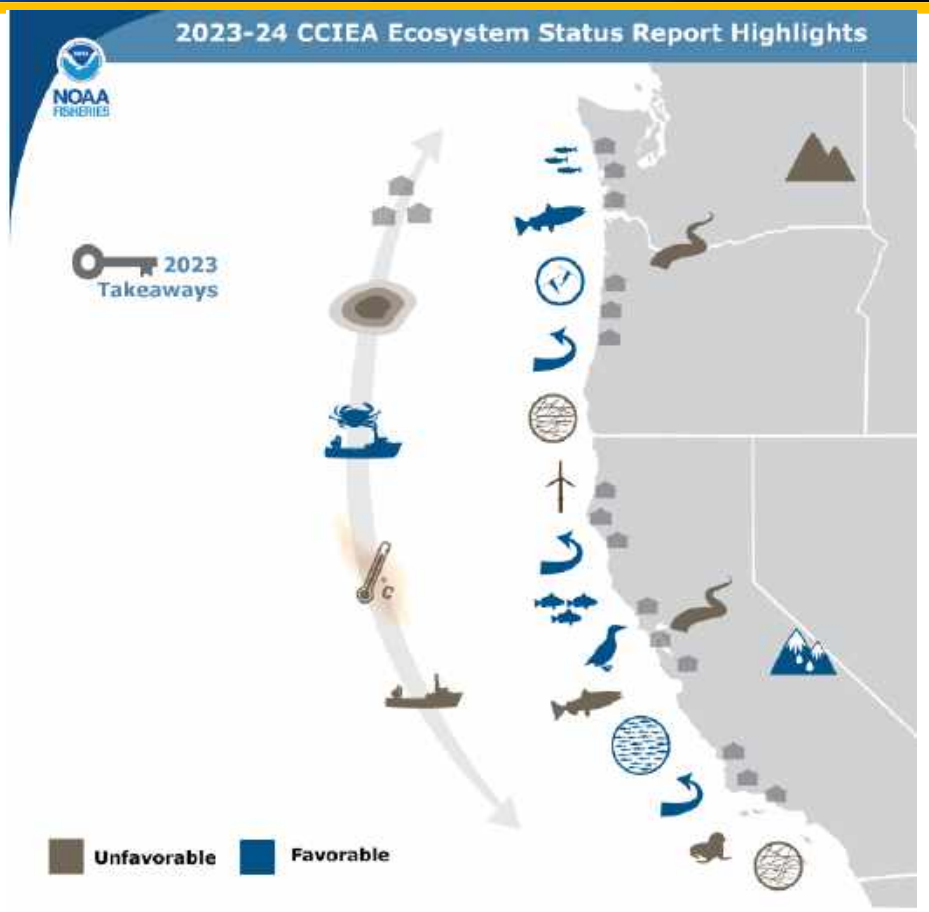
- Example of IOTC's framework
  - Potential drivers, pressures and ecological states to monitor
  - Depiction of indicator trends is similar to NOAA's ecowatch
  - Note the operational objective, indicator threshold, management response and confidence



Juan-Jordá, M.J., H. Murua, and E. Andonegi. 2018a. An indicator based ecosystem report card for IOTC - An evolving process. IOTC-2018-WPEB14-20. 17 pp.

Background: *Ecosystem Status Assessment*

- What is an "*Ecosystem Status Assessment*"?
  - Complementary to the *EcoCard*
  - Extensive description of a suite of indicators to describe annual status of marine ecosystems
  - Report primarily used for consultation to support the *EcoCard*
  - Along with the *EcoCard*, aims to evaluate, monitor, and communicate the state of the ecosystem to inform management advice



Highlights of the 2023 Ecosystem Status Report indicating major trends and takeaways. Credit: Su Kim, NOAA

El Niño's Past Impacts

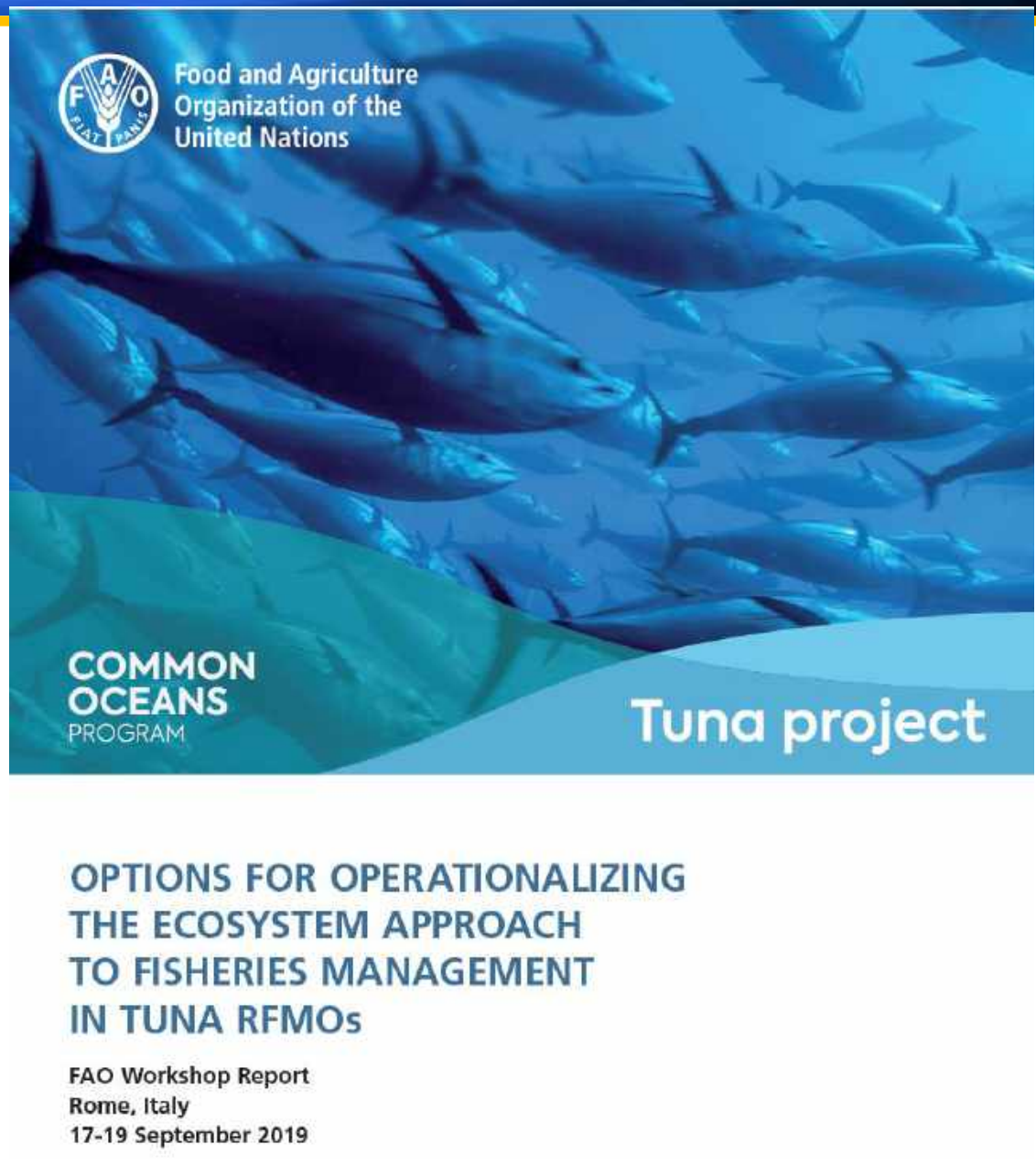
During 2023, Pacific Ocean temperatures around the equator shifted from cool La Niña conditions into warm "strong" El Niño conditions by the autumn and winter months. These changes in Pacific Ocean temperatures impact regional and local conditions across multiple countries, including the United States.

The last strong El Niño, in 2015, coincided with the tail end of a massive marine heatwave that had already weakened the ecosystem. This "double whammy" led to cascading effects, harming numerous species. For example, starving sea lion pups arrived on Southern California beaches while their

https://www.fisheries.noaa.gov/feature-story/california-current-ecosystem-shows-resilience-strong-el-nino

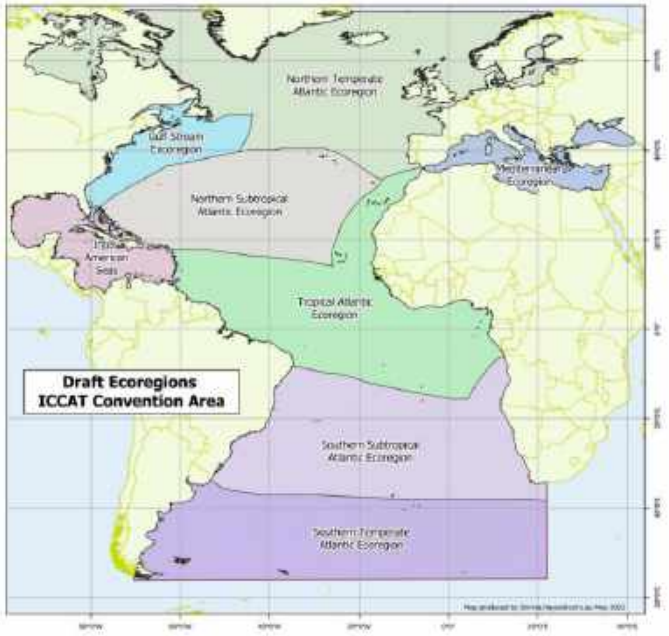
Ongoing efforts to develop tools & products to support EAFM

- t-RFMOs have long recognized the need for and importance of implementing EAFM
  - Tangible progress has been limited
  - Lack of long-term plan for operationalizing EAFM
  - Complexity of monitoring climate and ecosystem dynamics (e.g., what elements to include)



Ongoing efforts to develop tools & products to support EAFM

- Emergence of **tools** to support EAFM implementation
  - Development of “ecoregions” (ecologically meaningful and practical, spatial units) (ICCAT, IOTC)
    - To incentivize ecosystem planning, science and the development of advice products



ICCAT SCRS-2022-107

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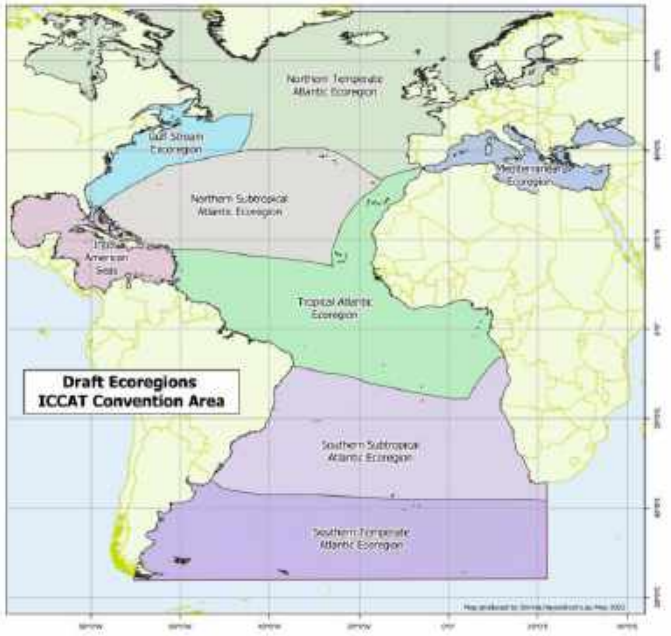
    - To identify and prioritize species most vulnerable to impacts by tuna fisheries



ICCAT SCRS-2022-107

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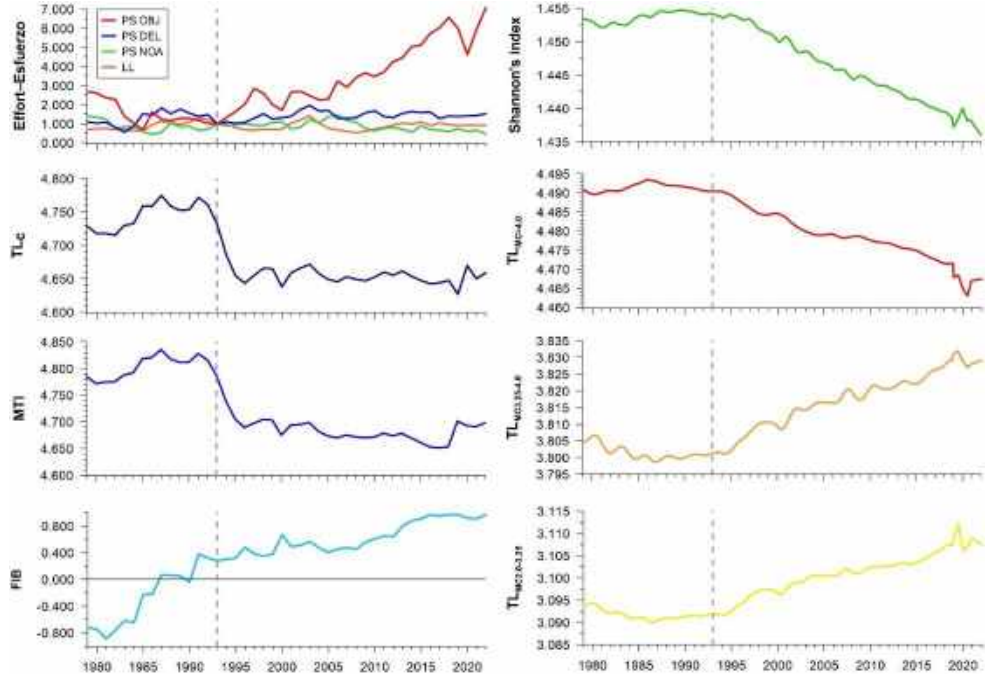
    - To identify and prioritize species most vulnerable to impacts by tuna fisheries
  - Development of ecosystem models and ecological indicators (IATTC, WCPFC, planned for ICCAT, IOTC)
    - To understand and evaluate effects of fishing and climate on ecosystem structure and function

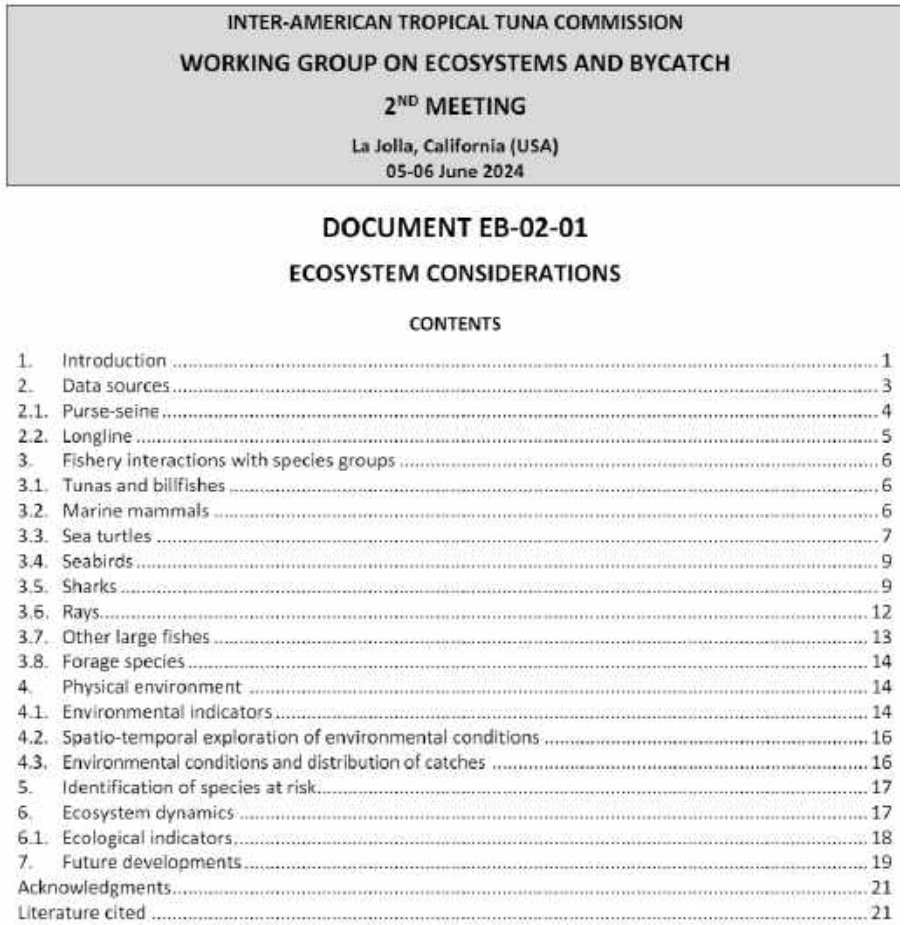
ICCAT SCRS-2022-107

EASI-Fish
ECOLOGICAL ASSESSMENT for the SUSTAINABLE IMPACTS of FISHERIES



Ongoing efforts to develop tools & products to support EAFM

- Emergence of **products** to support EAFM implementation
  - Development of *Ecosystem Considerations* reports (like in IATTC e.g., EB-02-01) & *Ecosystem-fishery* overviews (like those under development by ICCAT)
    - Document the scope of the fishery & its dynamics with the ecosystems



INTER-AMERICAN TROPICAL TUNA COMMISSION

WORKING GROUP ON ECOSYSTEMS AND BYCATCH

2ND MEETING

La Jolla, California (USA)
05-06 June 2024

DOCUMENT EB-02-01

ECOSYSTEM CONSIDERATIONS

CONTENTS

Ongoing efforts to develop tools & products to support EAFM

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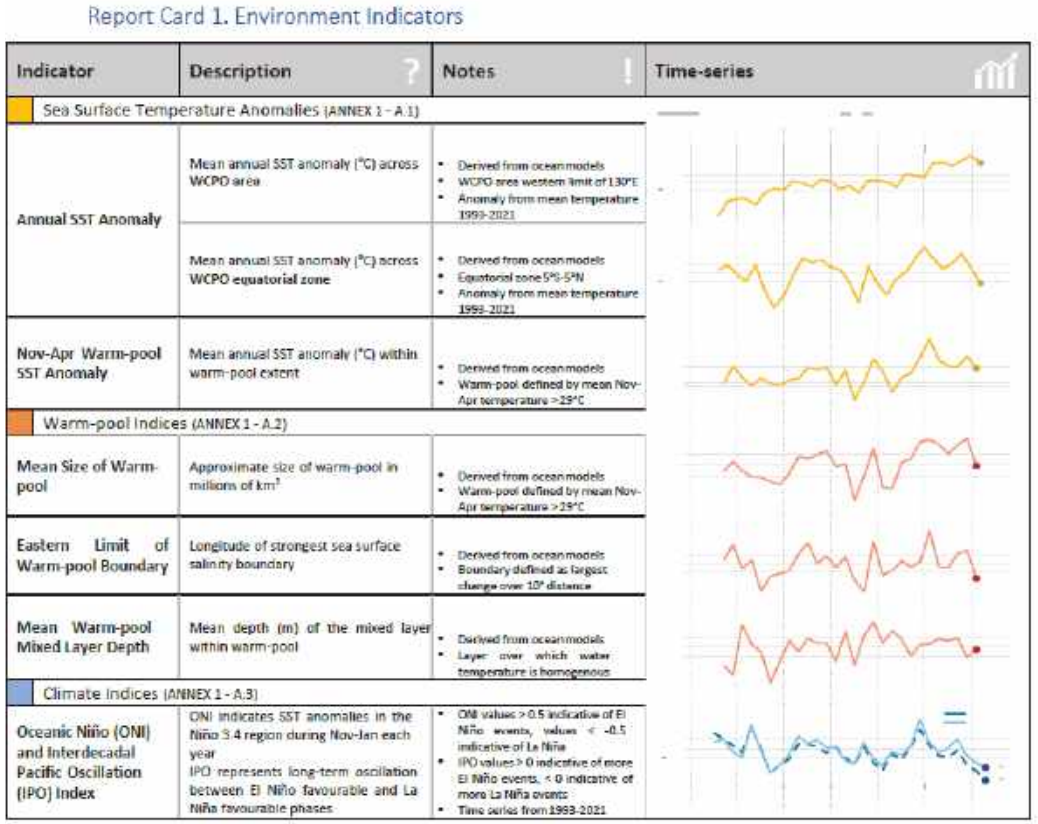
    - Document the scope of the fishery & its dynamics with the ecosystems
  - Development of indicator-based *EcoCards* and associated *Ecosystem Status Assessments* (like those under development by SPC-WCPFC)
    - Provide a succinct state of the ecosystem using indicator trends

    (WCPFC-SC19-2023/EB-WP-01)

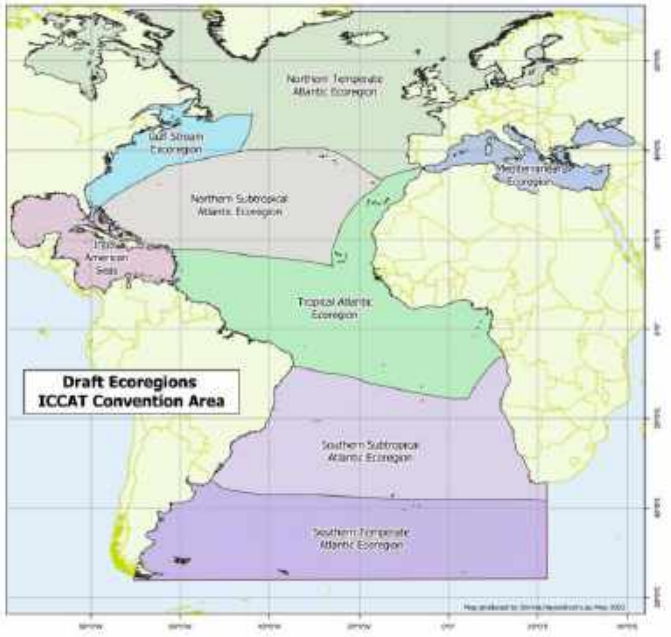


Report Card 1. Environment Indicators

Indicator	Description	Notes	Time-series
Sea Surface Temperature Anomalies (ANNEX 1 - A.1)			
Annual SST Anomaly	Mean annual SST anomaly (°C) across WCPO area	• Derived from ocean models • WCPO area western limit of 130°E • Anomaly from mean temperature 1993-2021	
	Mean annual SST anomaly (°C) across WCPO equatorial zone	• Derived from ocean models • Equatorial zone 5°S-5°N • Anomaly from mean temperature 1993-2021	
Nov-Apr Warm-pool SST Anomaly	Mean annual SST anomaly (°C) within warm-pool extent	• Derived from ocean models • Warm-pool defined by mean Nov-Apr temperature >29°C	
Warm-pool Indices (ANNEX 1 - A.2)			
Mean Size of Warm-pool	Approximate size of warm-pool in millions of km²	• Derived from ocean models • Warm-pool defined by mean Nov-Apr temperature >29°C	
Eastern Limit of Warm-pool Boundary	Longitude of strongest sea surface salinity boundary	• Derived from ocean models • Boundary defined as largest change over 10° distance	
Mean Warm-pool Mixed Layer Depth	Mean depth (m) of the mixed layer within warm-pool	• Derived from ocean models • Layer over which water temperature is homogenous	
Climate Indices (ANNEX 1 - A.3)			
Oceanic Niño (ONI) and Interdecadal Pacific Oscillation (IPO) Index	ONI indicates SST anomalies in the Niño 3.4 region during Nov-Jan each year IPO represents long-term oscillation between El Niño favourable and La Niña favourable phases	• ONI values > 0.5 indicative of El Niño events, values < -0.5 indicative of La Niña • IPO values > 0 indicative of more El Niño events, < 0 indicative of more La Niña events • Time series from 1993-2021	

Ongoing efforts to develop tools & products to support EAFM

- Tools & products vary in complexity, require different data types, have specific purposes
- All may be used to connect bycatch, ecosystem and climate considerations into advice for decision making



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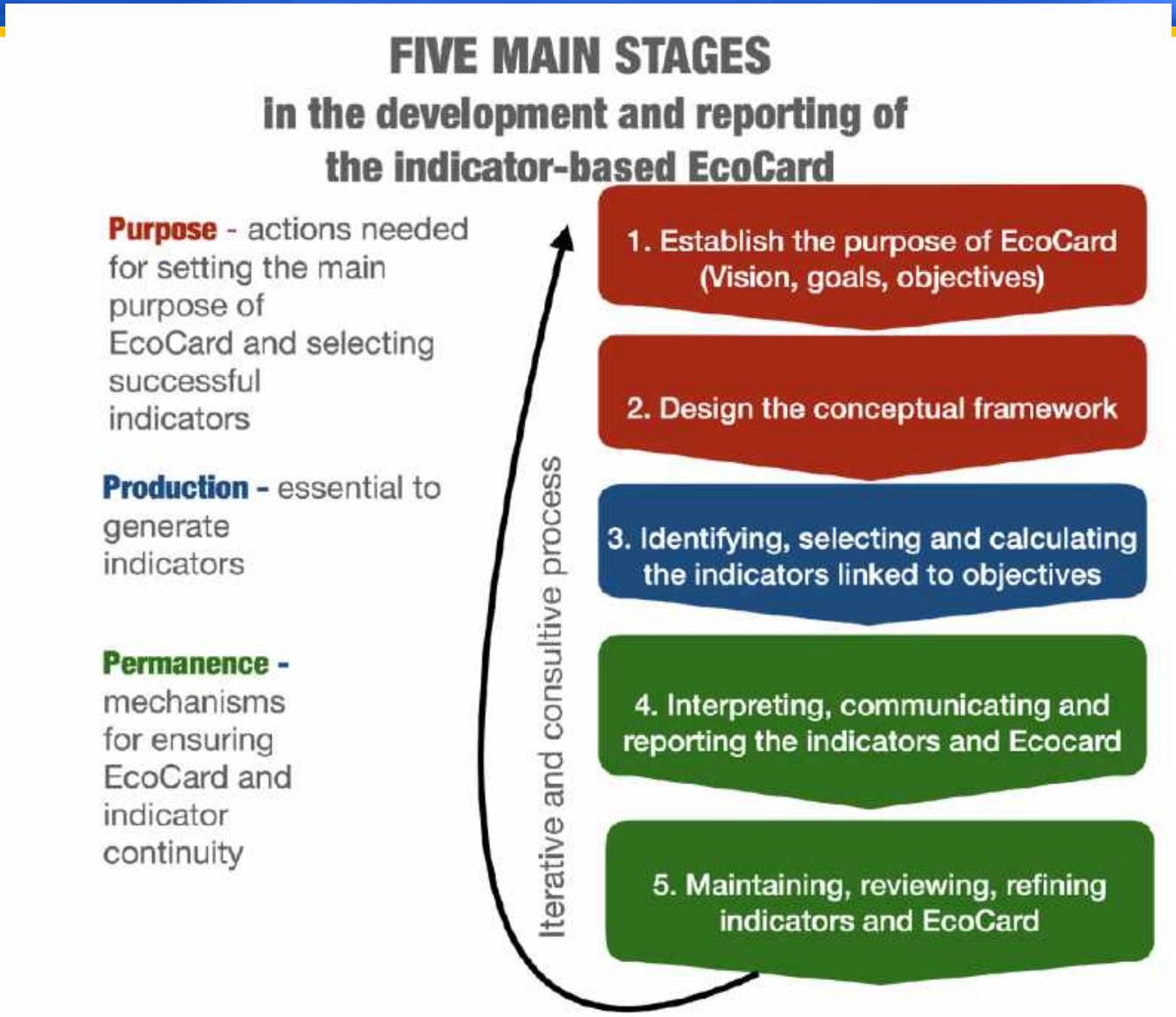
ECOSYSTEM CONSIDERATIONS

Western and Central Pacific Fisheries Commission
SCIENTIFIC COMMITTEE
NINETEENTH REGULAR SESSION

Koror, Palau
16-24 August 2023

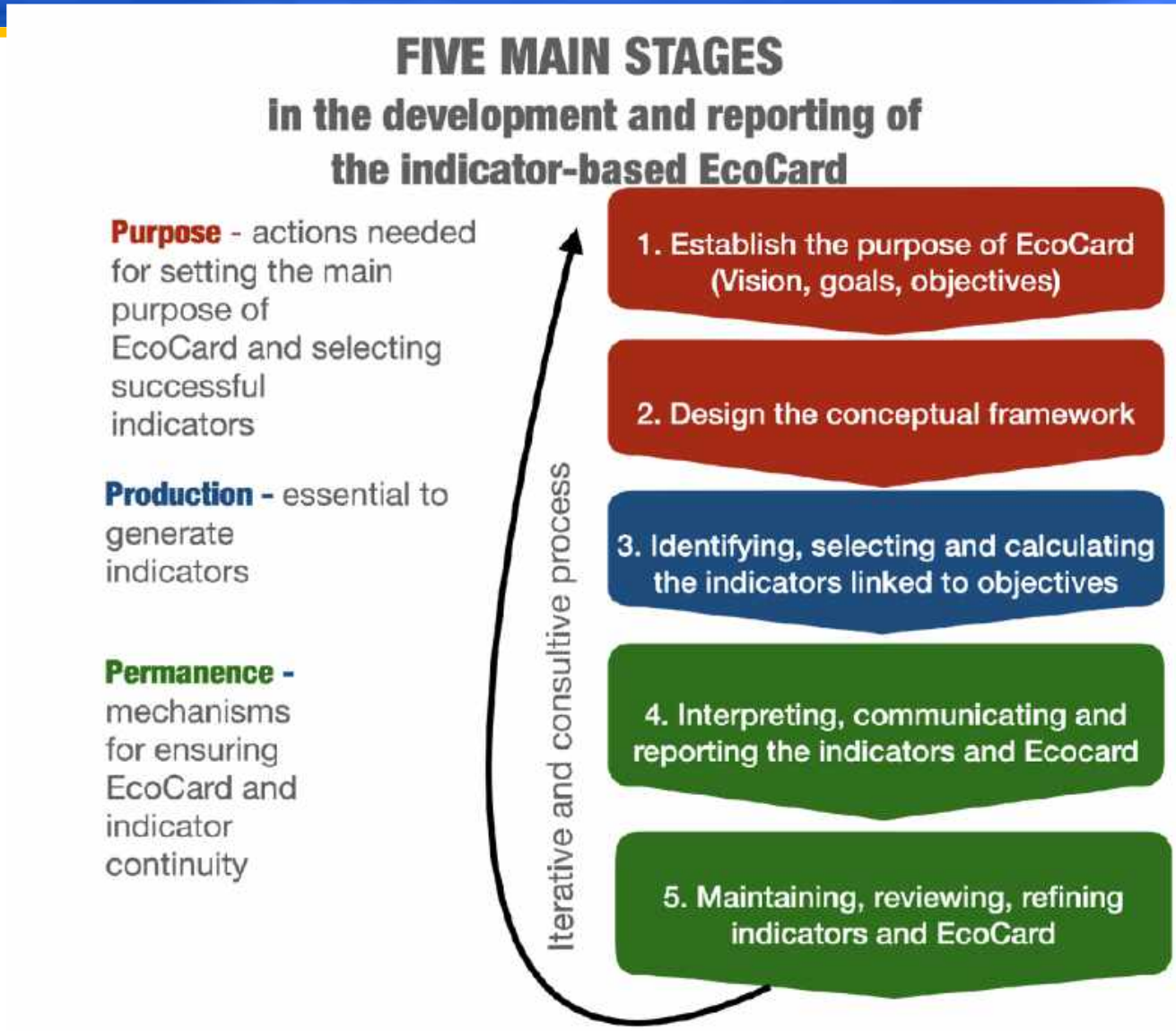
ECOSYSTEM AND CLIMATE INDICATORS
WCPFC-SC19-2023/EB-WP-01

Ongoing efforts to develop tools & products to support EAFM



Juan-Jordá, M.J., H. Murua, G. Diaz, P. Obregon, L. Kell, D. Alvarez-Berastegui, A. Eider, R. Coelho, T. Sachiko, D. Ochi, A. Domingo, D. Die, O. Yates, I. Tai, J. Bell, P. Tugores, and A. Hanke. 2022b. Report of the 1st Meeting of the Sub-Group on the Ecosystem Report Card. SCRS/2022/104. Collect. Vol. Sci. Pap. ICCAT 79(5): 152-164.

Ongoing efforts to develop tools & products to support EAFM



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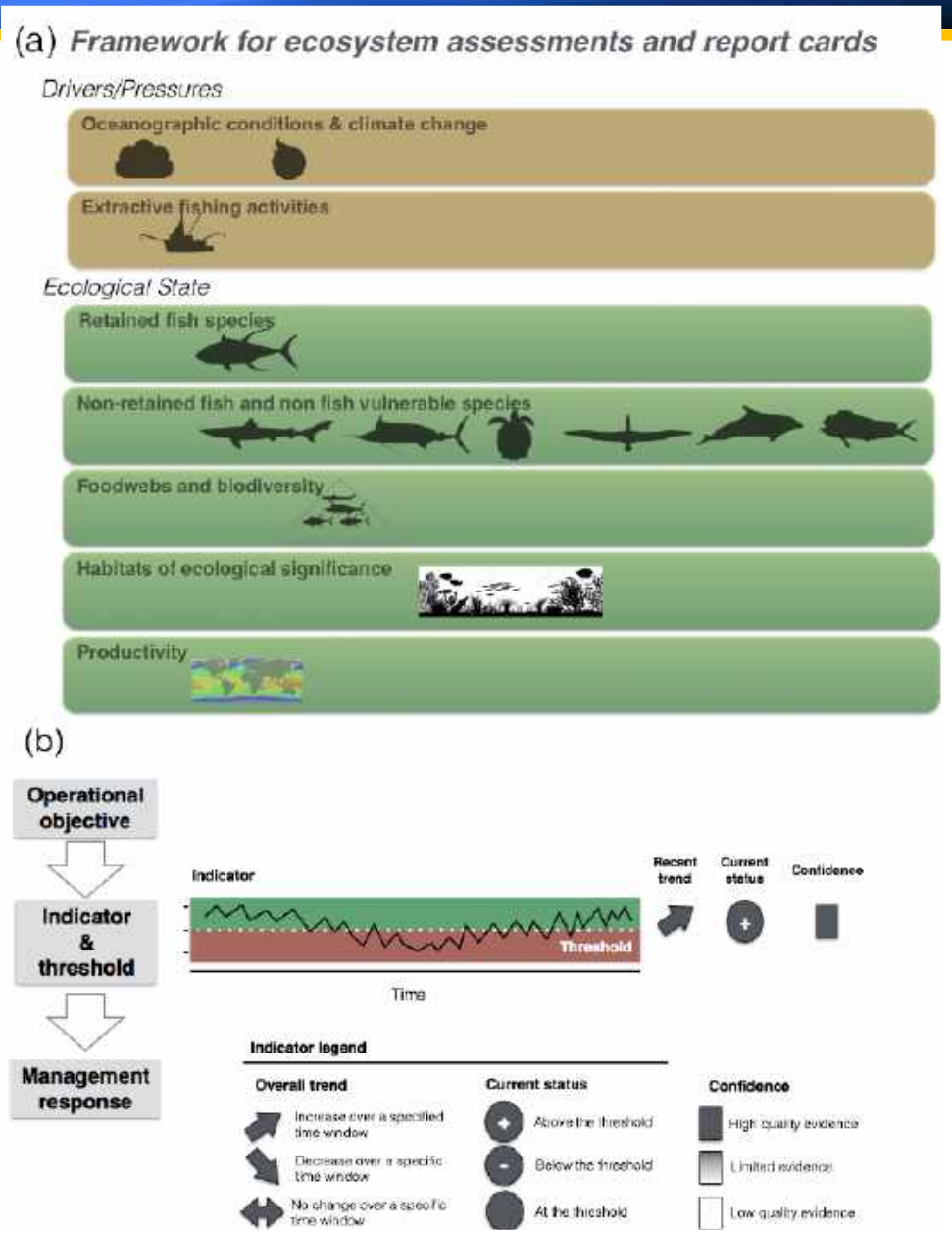

Juan-Jordá, et al. 2018. IOTC-2018-WPEB14-20.

Proposed EcoCard workplan: flow diagram

Development of an indicator-based *EcoCard* at the Ecoregion level and a complementary *Ecosystem Status Assessment* to support implementation of EAFM in the EPO

Main goal

Adoption

Components

Purpose of components

Phases and Activities

Legend: box boundary definitions

Involving IATTC staff

Involving IATTC staff, Commission & Stakeholders

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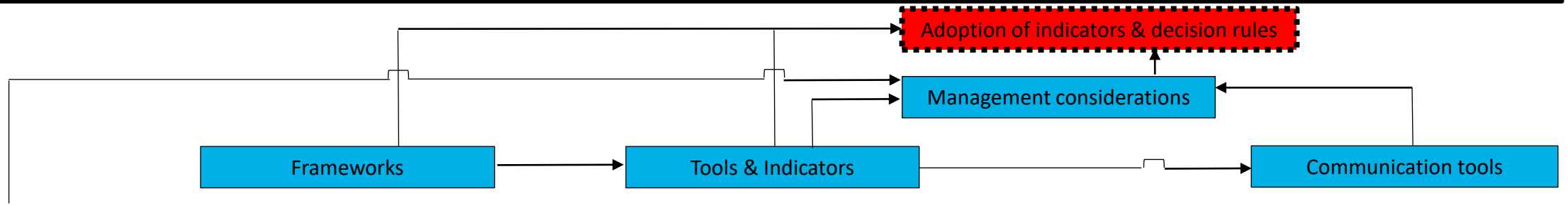

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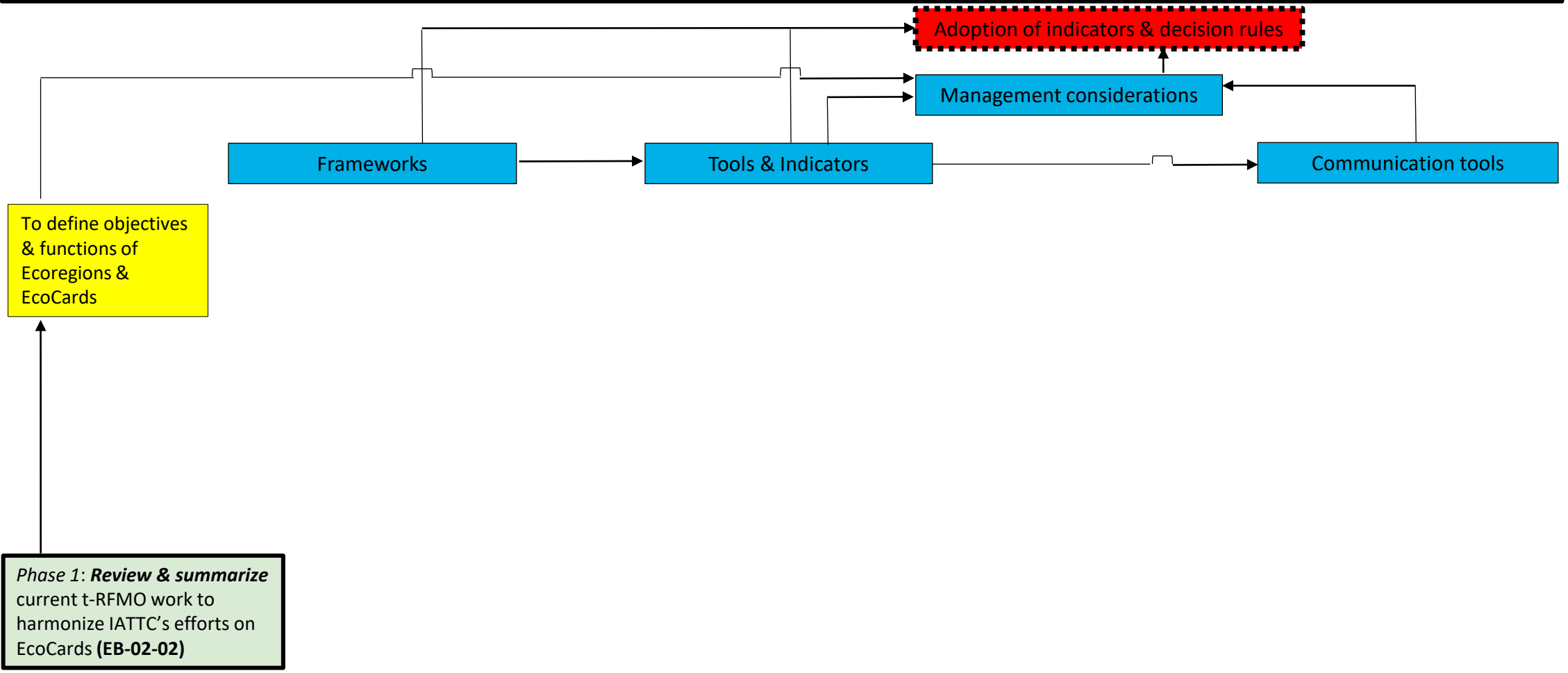

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Adoption of indicators & decision rules

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Management considerations

Frameworks

Tools & Indicators

Communication tools

Purpose of components

To define objectives & functions of Ecoregions & EcoCards

To determine criteria, data quality, & analytical models for guiding ecoregion delineation

To determine drivers (e.g., fishing, climate) & ecosystem elements to monitor (e.g., state of non-retained species, food webs, habitats)

Phases and Activities

Phase 1: ***Engage with global experts*** to ***determine functions*** of an EcoCard, ***scope*** of work, & ***frameworks*** for (1) delineating ecoregions & (2) developing EcoCards at the ecoregion level

Phase 1: ***Review & summarize*** current t-RFMO work to harmonize IATTC's efforts on EcoCards **(EB-02-02)**

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Phase 1: ***Review & summarize*** current t-RFMO work to harmonize IATTC's efforts on EcoCards **(EB-02-02)**

Phase 2: EcoCard discussion forums on available tools to ***establish criteria*** for (1) delineating ecoregions and (2) selecting, calculating, assessing, validating & interpreting candidate indicators for monitoring ecosystem components; consider strategic & tactical tools in indicator development & defining performance thresholds (e.g., overall trend: increase/decrease/no change; status: above/below/at threshold; confidence: high quality, moderate, low quality)

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To determine indicators & performance thresholds that may elicit a management response

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Phase 3: Use established criteria to (1) ***draft ecoregions*** and (2) ***develop indicators***

Legend: box boundary definitions

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Involving IATTC staff, Commission & Stakeholders

Involving Commission

Proposed EcoCard workplan: flow diagram

Development of an indicator-based *EcoCard* at the Ecoregion level and a complementary *Ecosystem Status Assessment* to support implementation of EAFM in the EPO

Main goal

Adoption

Adoption of indicators & decision rules

Components

Management considerations

Frameworks

Tools & Indicators

Communication tools

Purpose of components

To define objectives & functions of Ecoregions & EcoCards

To determine criteria, data quality, & analytical models for guiding ecoregion delineation

To determine drivers (e.g., fishing, climate) & ecosystem elements to monitor (e.g., state of non-retained species, food webs, habitats)

To develop indicators while considering available tools (e.g., EASI-Fish, Ecopath); to determine spatial units of an EcoCard

To determine indicators & performance thresholds that may elicit a management response

To support operationalization of EAFM

Phases and Activities

Phase 1: ***Engage with global experts*** to ***determine functions*** of an EcoCard, ***scope*** of work, & ***frameworks*** for (1) delineating ecoregions & (2) developing EcoCards at the ecoregion level

Phase 1: ***Review & summarize*** current t-RFMO work to harmonize IATTC's efforts on EcoCards **(EB-02-02)**

Phase 2: EcoCard discussion forums on available tools to ***establish criteria*** for (1) delineating ecoregions and (2) selecting, calculating, assessing, validating & interpreting candidate indicators for monitoring ecosystem components; consider strategic & tactical tools in indicator development & defining performance thresholds (e.g., overall trend: increase/decrease/no change; status: above/below/at threshold; confidence: high quality, moderate, low quality)

Phase 3: Use established criteria to (1) ***draft ecoregions*** and (2) ***develop indicators***

Phase 4: ***Produce recommendations*** from strategic & tactical tools and corresponding indicators with performance thresholds for management considerations

Legend: box boundary definitions

Involving IATTC staff

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To develop communication tools for visualizing progress & constraints

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*Phase 4: **Develop pilot products*** (1) EcoCard of 'key' indicators chosen to 'best' represent ecosystem status at the Ecoregion level (2) *Ecosystem Status Assessment* of data sources, methodology, interpretation, links to management objectives, associated challenges and uncertainty of all indicators

Legend: box boundary definitions

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To develop communication tools for visualizing progress & constraints

To develop a guidelines document on Ecoregions & EcoCards

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Phase 4: ***Establish guidelines*** for delineating ecoregions & developing an EPO EcoCard based on the pilot products

Legend: box boundary definitions

Involving IATTC staff

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Involving Commission

Proposed EcoCard workplan: tentative timeline

Phase	Activities	2024				2025				2026				2027				2028			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1) Planning	***Review & summarize*** current t-RFMO work to harmonize IATTC's efforts on developing an EcoCard (EB-02-02)																				
	Draft a proposed workplan to develop EcoCard(s) for the EPO																				
	Present proposed workplan to the EBWG																				
	Engage with global experts to determine functions of an EcoCard, scope of work & frameworks																				
	Create frameworks for (1) delineating ecoregions (2) developing EcoCards at the Ecoregion level																				
2) Identifying & Prioritizing Issues for Establishing Criteria	Discussion forums on tools to ***establish criteria*** for (1) delineating ecoregions, (2) developing indicators																				
	Present progress on EcoCard functions, frameworks and criteria to the EBWG																				
3) Development	Use established criteria from Phase 2 to ***draft ecoregions***																				
	Use established criteria from Phase 2 to ***draft indicators***																				
	Present progress on draft ecoregions and indicators to the EBWG																				
4) Management Considerations & Communication	***Produce recommendations*** from strategic & tactical tools & corresponding indicators for management considerations																				
	Develop pilot ecosystem-advice products : (1) EcoCard of 'key' indicators (2) detailed Ecosystem Status Assessment of all indicators																				
	Present progress on the pilot products to the EBWG																				
	Present recommendations for decision rules to the Commission																				
	Establish guideliines for delineating ecoregions & developing EPO EcoCards at the Ecoregion level, based on the pilot products																				

Examples: strategic vs. tactical tools

- To help visualize potential tools & candidate indicators for EPO fisheries:
- We can consider strategic and tactical tools
  - Strategic tools address *what* scientists will do to assess, monitor, and track the performance &/or status of a specific concern
    - e.g., ERA's used to assess, monitor, and track:
    - relative vulnerability of species to fishing and environmental impacts (EASI-Fish)

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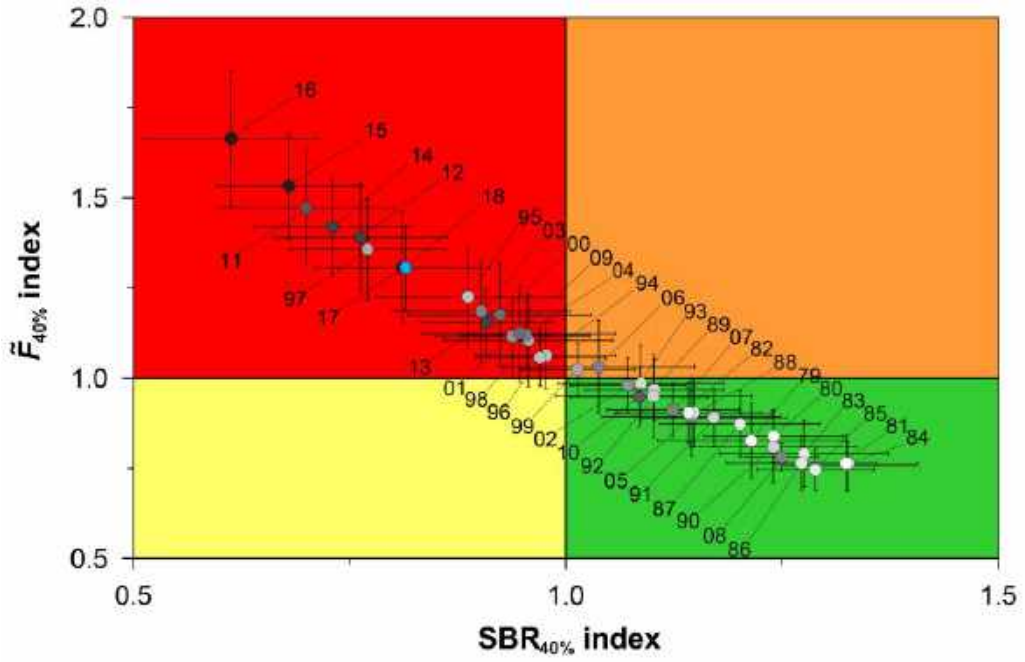
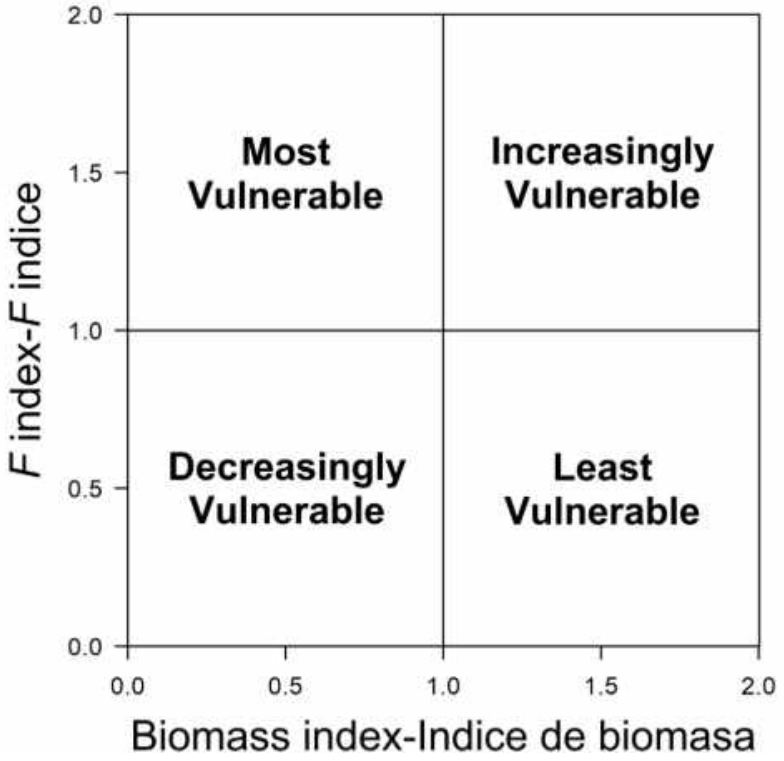
    - e.g., EASI-Fish used to reconstruct historical vulnerability status of the spinetail devil ray

***Mobula mobular* (Griffiths and Lezama-Ochoa, 2021)**



Examples: strategic vs. tactical tools

- Tactical tools address *how* resource managers will implement management actions for a specific concern:
  - suppose EASI-Fish BRPs are considered a ‘candidate’ indicator,
  - suppose the management objective is to ‘ensure ecological sustainability’
  - if threshold is exceeded (i.e., vulnerability = “most vulnerable”), a tactical tool(s) is needed



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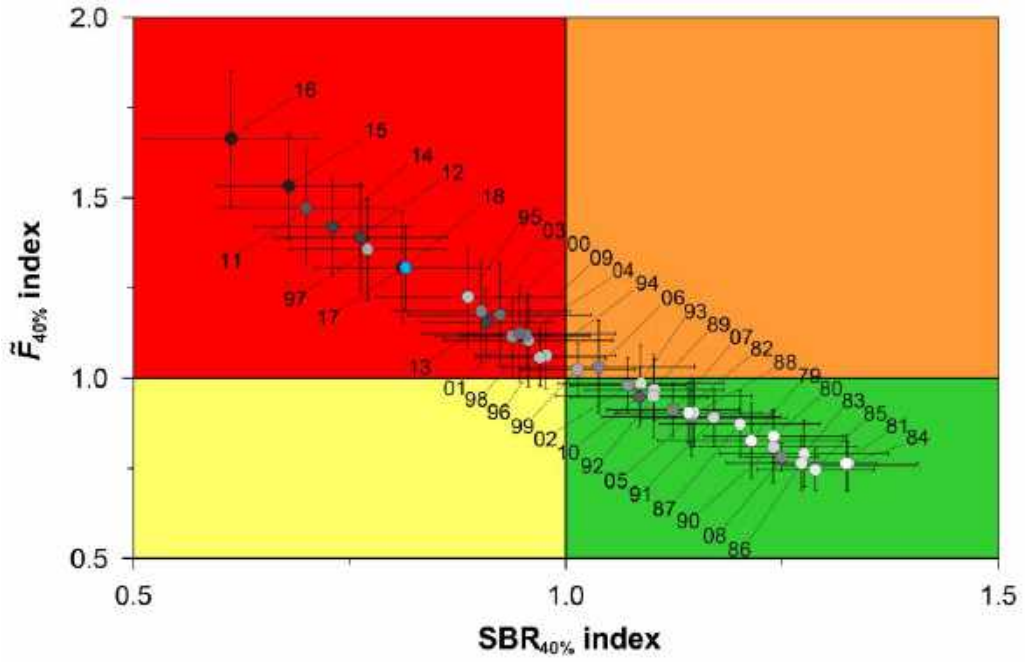
    - e.g., vulnerability of spinetail devil ray classified as ‘most vulnerable’ in recent years

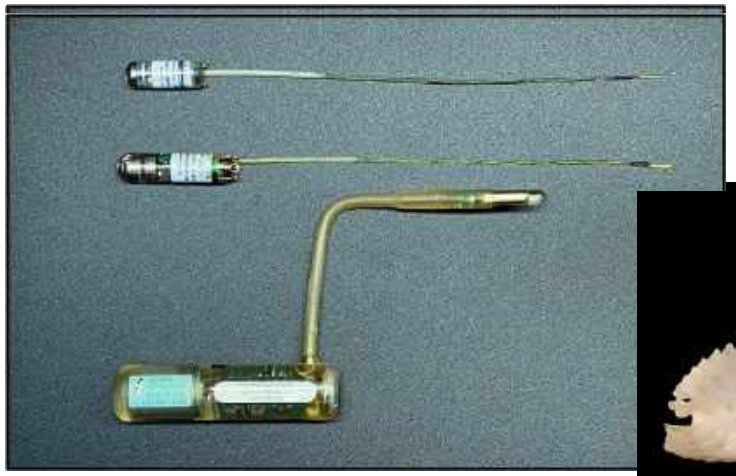
***Mobular mobular*, Griffiths and Lezama-Ochoa, 2021**

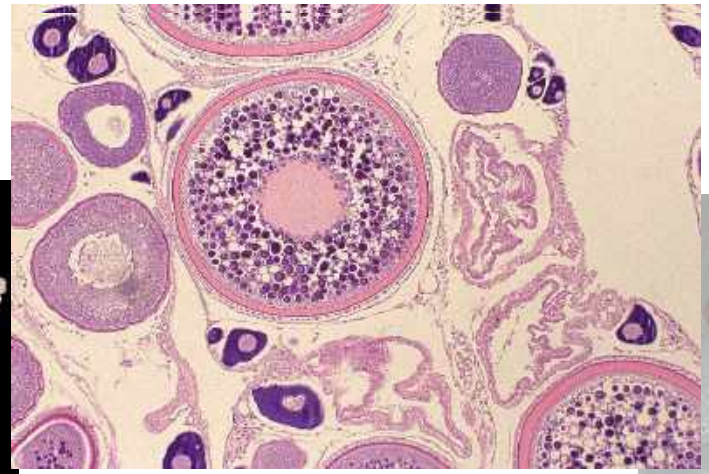


Examples: strategic vs. tactical tools

- Tactical tools address *how* resource managers will implement management actions for a specific concern:
  - Management action: prioritize research to fill data gaps and reassess through EASI-Fish

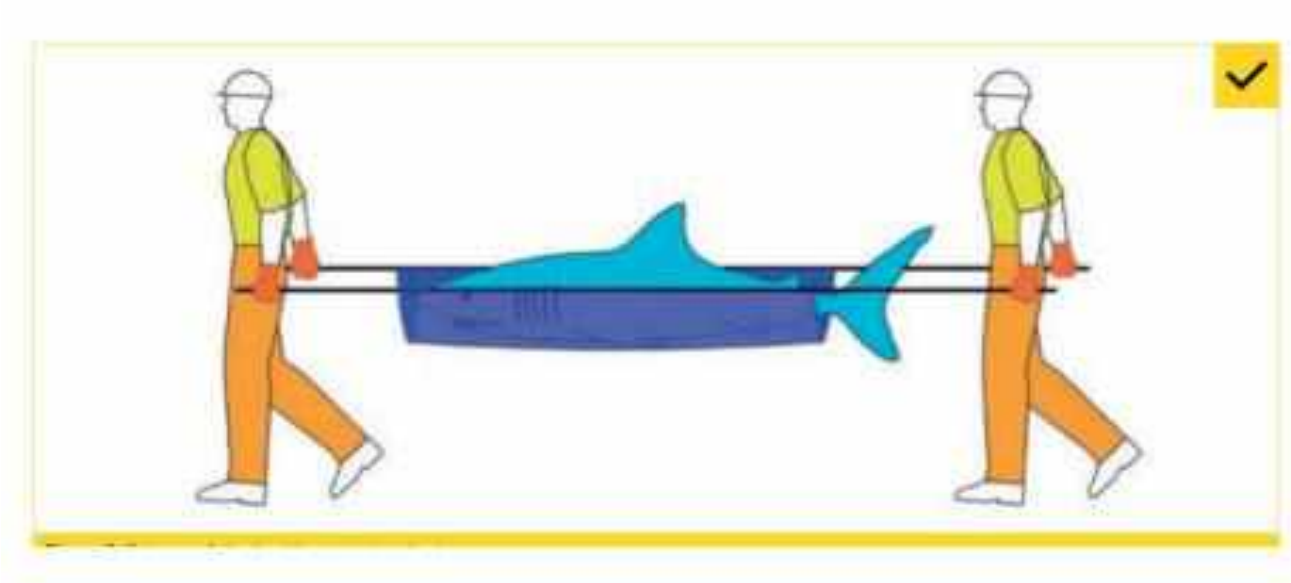
Project F.3.a - Feasibility study to develop a sampling program for updating morphometric relationships and collecting biological samples for priority species in EPO tuna fisheries: Phase 1





Examples: strategic vs. tactical tools

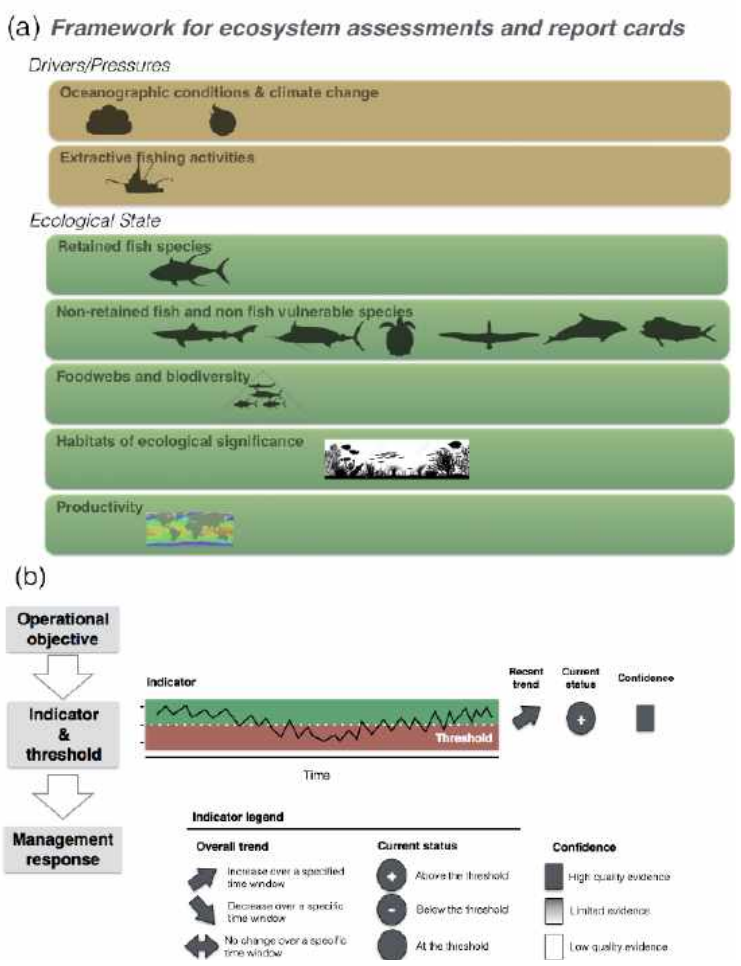
- Tactical tools address *how* resource managers will implement management actions for a specific concern:
  - Management action: implement bycatch mitigation measure
  - (e.g., best handling & release practices)



SAC-15-11

Summary: transitioning to the *EcoCard* concept

- Determine vision, goals, objectives
- Develop conceptual framework (what to monitor)



Juan-Jordá, et al. 2018. IOTC-2018-WPEB14-20.

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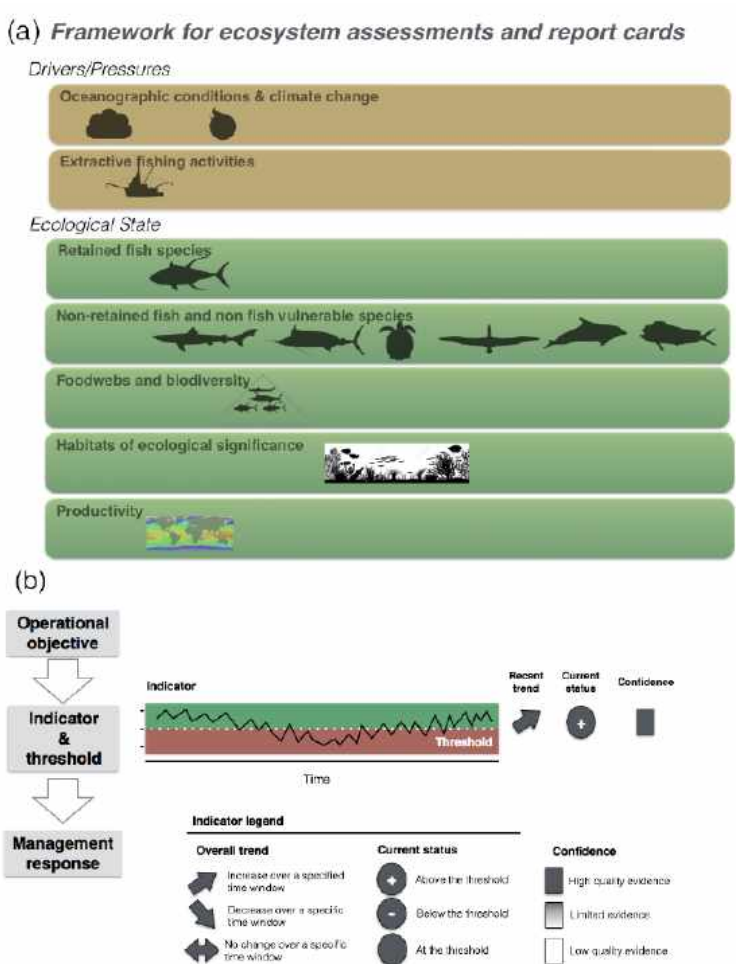

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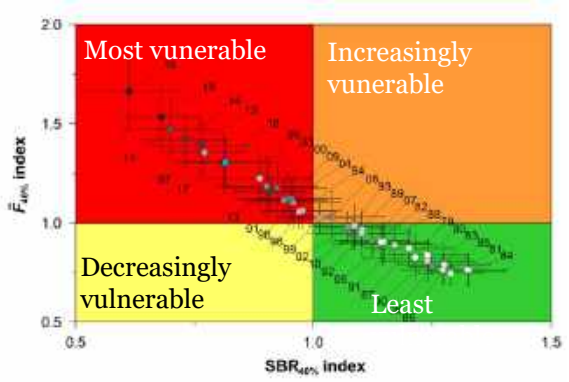
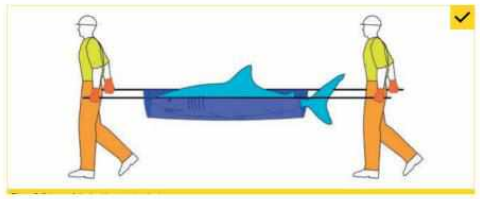


Griffiths & Lezama-Ochoa 2021



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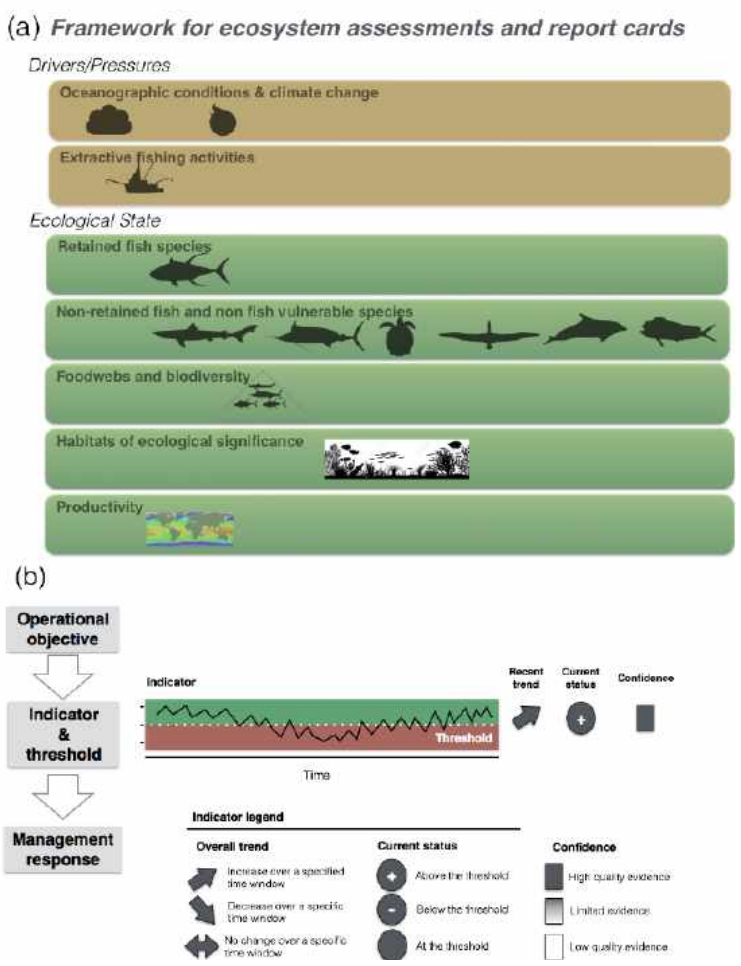

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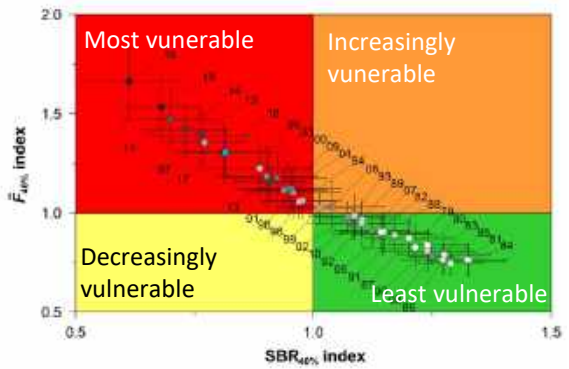

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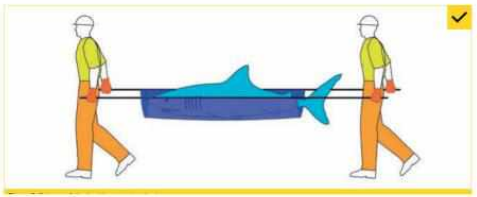
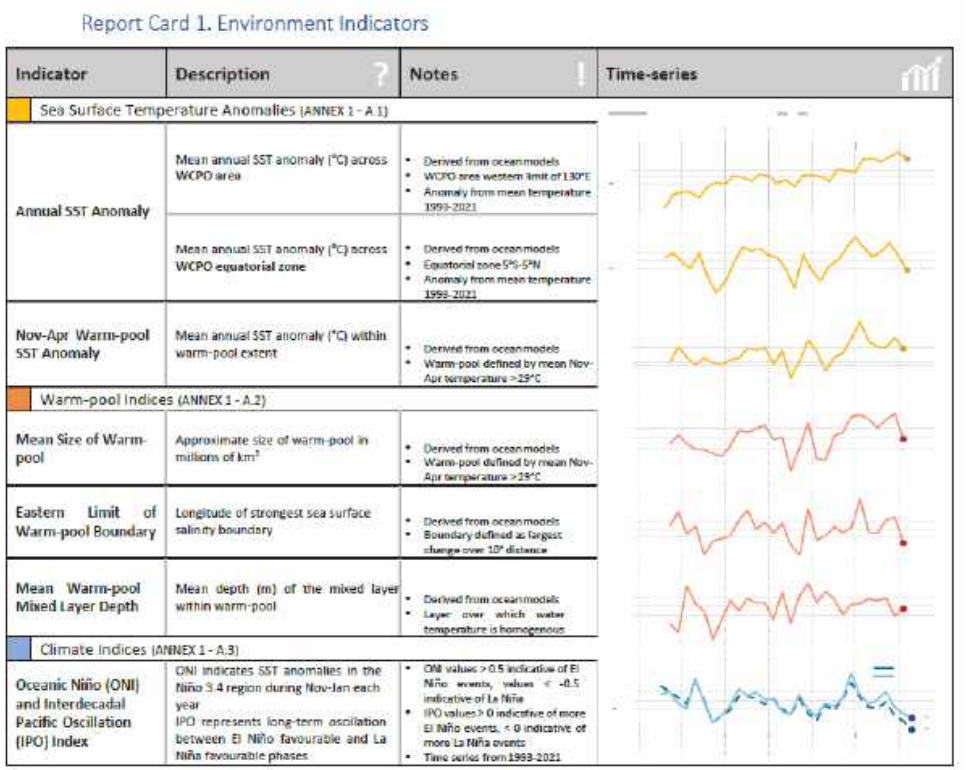


SAC-15-11

- Develop Ecosystem-advice products (e.g., indicator-based Ecosystem Report Card)



Report Card 1. Environment Indicators

Indicator	Description	Notes	Time-series
Sea Surface Temperature Anomalies (ANNEX 1 - A.1)			
Annual SST Anomaly	Mean annual SST anomaly (°C) across WCPO area	• Derived from ocean models • WCPO area western limit of 130°E • Anomaly from mean temperature 1993-2021	
	Mean annual SST anomaly (°C) across WCPO equatorial zone	• Derived from ocean models • Equatorial zone 5°S-5°N • Anomaly from mean temperature 1993-2021	
Nov-Apr Warm-pool SST Anomaly	Mean annual SST anomaly (°C) within warm-pool extent	• Derived from ocean models • Warm-pool defined by mean Nov-Apr temperature >28°C	
Warm-pool Indices (ANNEX 1 - A.2)			
Mean Size of Warm-pool	Approximate size of warm-pool in millions of km²	• Derived from ocean models • Warm-pool defined by mean Nov-Apr temperature >28°C	
Eastern Limit of Warm-pool Boundary	Longitude of strongest sea surface salinity boundary	• Derived from ocean models • Boundary defined as largest change over 10° distance	
Mean Warm-pool Mixed Layer Depth	Mean depth (m) of the mixed layer within warm-pool	• Derived from ocean models • Layer over which water temperature is homogeneous	
Climate Indices (ANNEX 1 - A.3)			
Oceanic Niño (ONI) and Interdecadal Pacific Oscillation (IPO) Index	ONI indicates SST anomalies in the Niño 3.4 region during Nov-Jan each year IPO represents long-term oscillation between El Niño favourable and La Niña favourable phases	• ONI values > 0.5 indicative of El Niño events, values < -0.5 indicative of La Niña • IPO values > 0 indicative of more El Niño events, < 0 indicative of more La Niña events • Time series from 1993-2021	

(WCPFC-SC19-2023/EB-WP-01)

- "*EcoCard*" concept in its infancy in t-RFMOs
- Candidate indicators proposed in other t-RFMOs
- Not yet directly linked to management

CIAT

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Questions