INTER-AMERICAN TROPICAL TUNA COMMISSION

1ST WORKSHOP ON CLIMATE CHANGE

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DOCUMENT CC-01-02

A PROPOSED FRAMEWORK FOR IATTC'S CLIMATE CHANGE WORKPLAN

1. BACKGROUND

In recent decades, research has shown the direct and indirect impacts of climate change on marine species and ecosystems, as well as fishing communities. In recognition of such impacts on IATTC fisheries, and the conservation and sustainability of target and non-target species covered by the Antigua Convention, the IATTC adopted Resolution C-23-10 on climate change in 2023. The Resolution states that the Working Group on Ecosystem and Bycatch (EBWG), the Scientific Advisory Committee (SAC), and the Commission will include climate change as a recurrent agenda item at their respective annual meetings, and in general, "*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.*" As a result, the IATTC staff conducted a review of various climate-ready fisheries tools, frameworks, roadmaps and workplans that various countries and international organizations have developed, in order to facilitate the development and adoption by IATTC, if the Commission so decides, of a workplan which would provide a general structure to promote climate-resilient tuna fisheries in the EPO (SAC-15-12), in the understanding that the details of the workplan and its implementation would be elaborated in consultation as appropriate with all relevant stakeholders. This suggested approach was welcomed and supported during the 2nd Ecosystem and Bycatch Working Group, as well as by the 15th meeting of the Scientific Advisory Committee (see SAC-15 Recommendations). It was also briefly presented and discussed during the 102nd meeting of the IATTC in Panama in 2024.

This process, as proposed, anticipates five phases: 1) Planning, 2) Deciding on goal and scope, 3) Developing a framework, 4) Creating tools, and 5) Tool application and/or management implementation. Phase 1 may be considered as completed, following the review of climate tools and frameworks, along with other resources publicly available, as well as with the development of a proposed climate change workplan for the IATTC (SAC-15-12), and associated draft Terms of Reference (for a series of climate chToRs were also presented at the 102nd annual meeting of the Commission at its request. Although they were not formally endorsed then, there should not be any inconvenient in generally following the principles and guidelines that they contain, to the extent necessary, in order to start the proposed process of a series of workshops (see Table 1 in SAC-15-12 for a detail description of these workshops), without prejudice to their discussion and adoption by the Commission of a final version of the TORs that will be used for the remaining workshops. which were also presented at the 102nd annual meeting of the Commission at its request. Although they were not formally endorsed then, there should not be any inconvenient in generally following the principles and guidelines that they contain, to the extent necessary, in order to start the proposed process of a series of workshops (see Table 1 in SAC-15-12 for a detail description of these workshops), without prejudice to their discussion and adoption by the Commission of a final version of the TORs that will be used for the remaining workshops.

Consistent with the discussion during the last meeting of the Commission, the process should continue in 2025 with the holding of a workshop on goal and scope (Phase 2) (see document CC-01-01 for details on the proposed goal and scope), but also on the development of a framework (Phase 3). It is considered that these two phases, which both anticipate the provision of inputs and elements of discussion by members and relevant stakeholders, can be considered in the same workshop.

The purpose of this document is to focus on Phase 3, and to describe the different features and considerations that should be taken into account when developing and making recommendations on the framework of an IATTC climate change workplan. A framework is an important component of all relevant workplans because it helps define and regulate the operating structure of the workplan. This document contains a preliminary recommendation prepared by the IATTC staff as a starting point and reference to foster and facilitate discussion between members and relevant stakeholders. The outcomes of this informal discussion among workshop participants will be used to revise these preliminary recommendations, and the result will be presented to the EBWG, the SAC, and later to the Commission, at their 103rd meeting in 2025.

2. FRAMEWORKS

A framework provides an organized workflow consisting of operational steps that are often flexible, circular, and iterative that guide and support future actions and decisions, including, as appropriate, decision-making. It also helps determine how each step of the framework links to the next and where feedback may be required (i.e., where a specific step may need to be reassessed once new information has been added). Once a framework is created, multiple tools, strategic and/or tactical, can be developed to accomplish each step in the framework. Strategic tools help scientists and managers identify actions that need to be taken, and tactical tools determine how those actions are to be performed (see SAC-15-12 for additional details). Defining the right framework is important because often climate-ready fisheries tools are developed but they are not framed properly to answer the management questions, are not properly communicated to fisheries managers, or it is unclear to managers how these tools can be directly applied into management. To avoid these potential undesired outcomes, a goal-specific working framework should be developed—ideally prior to tool development—so these tools can properly be designed, developed, and incorporated into the best-science advice and management decision-making. Many features should be considered when developing a framework such as, their intended use, whether goals and scope are defined, what risk levels are to be assessed, whether stakeholder input occurs, etc. Below are four relevant examples of climate-resilient fisheries frameworks developed by various national and international organizations, which have been selected and analyzed by the IATTC staff among several available frameworks around the world. In addition, 13 common features in frameworks were assessed for their presence or absence in these four fisheries frameworks (Table 1). Based on this assessment, the IATTC staff has prepared a framework proposal for the consideration of the workshop participants, which is described in detail in Section 3 below.

2.1 CLIMATE SMART CONSERVATION CYCLE

Climate Smart Conservation was designed to provide guidance on US resource management under climate change (Stein et al. 2014). It was developed by multiple US federal, state, and non-governmental organizations and can be organized into a cycle consisting of seven steps (Figure 1). Currently, NOAA Fisheries is working to incorporate their climate change work into this framework. Each step in the cycle feeds into the next step while also creating opportunities to go back and make improvements, as needed. The process is intended to be iterative and adaptable while managing in a dynamic way rather than assuming that scientific knowledge and management are static. The process is designed to recognize and incorporate the variability in the system, while being intentional and transparent about assessing climate vulnerabilities and threats, identifying potential adaption plans, and implementing the selected/defined plans that reduce those vulnerabilities. At the same time, it is intended to meet dynamic conservation and

management goals. This framework has 7 steps, with Step 1: define goal and scope; Step 2: assess climate impacts and vulnerabilities; Step 3: review/revise conservation goals with the potential to feedback into re-assessment of vulnerabilities where necessary; Step 4: identify possible adaptation plans Step 5: evaluate and select adaptation actions; Step 6: implement prioritized adaptation actions; and Step 7: track and monitor action effectiveness with the potential feedback into adjusting implemented actions where necessary. For more information, see Figure 1 and the guidance document published in Stein et al. (2014).

2.2 FRAMEWORK FOR INTEGRATED STOCK AND HABITAT EVALUATION (FISHE)

FISHE (https://fishe.edf.org/) is a step-by-step framework developed by the Environmental Defense Foundation (EDF) to help managers assess and develop sustainable fisheries under climate change and is particularly designed for data-limited fisheries. Parts of this framework are starting to be applied to small scale fisheries in the Caribbean. FISHE has 11 steps (Figure 2), many of which require stakeholder engagement. The final output of FISHE is an adaptive fishery management plan. Along each step of the way, the framework includes tools and an entire workbook with fillable worksheets to help the user complete a particular step of the framework. For example, the first step focuses on projecting future fishery conditions, as these conditions will inform the subsequent steps, and so on. For the second step, "Goal Setting," common goals and objectives are provided and divided into "Fishery Sustainability Goals" and "Climate Resilience Goals." Steps 3-5 are a series of assessments starting with the ecosystem, then moving on to stock vulnerability, and ending with the fishery. Step 6 is where species prioritization occurs and Step 7 where performance indicators and reference points are developed to determine when a management action is required. In Step 8 harvest control rules are created for plausible futures, which would eventually be triggered by specific reference points. This may or may not lead to a more detailed fishery assessment determined by data availability, which corresponds to Step 9. Interpretation of the fishery assessment results is done in Step 10 and lastly, Step 11 is where the harvest control measures informed by the harvest control rules are implemented and eventually adapted for change over a specific timeframe. As more data are collected in subsequent years, it is important to reassess each step in the cycle. The entire process has been applied to a hypothetical case study on a nearshore tropical multispecies reef fishery (https://fishe.edf.org/case-study/fishe-tool-action).

2.3 CLIMATE ADAPTATION FRAMEWORK FOR FISHERIES (CAFF)

CAFF is a framework designed to support climate resiliency in Canadian marine fisheries (Boyce et al. 2023). Specifically, CAFF assesses climate vulnerabilities across various components of fisheries, including the three main axes: the harvest species ecology, the fishing industry's infrastructure, and fisheries management (Figure 3). CAFF consists of 20 indices/data sources that fit into these three axes. Climate vulnerabilities are assessed, barriers to adaptation are identified, and ways to overcome these barriers are determined across the three components. Outputs from CAFF can help fisheries scientists and managers prioritize research, assist municipal planners and coastal communities identify which harbors are most at threat to climate change, and help decision makers develop actionable climate adaptation strategies. Additionally, outputs can be fed into other tools such as scenario planning or climate-informed stock assessments. The Department of Fisheries and Oceans of Canada (DFO) is planning to develop an online dashboard where users can access the climate vulnerability outputs across the three main axes, at either a higher Canadian fisheries level or a more detailed level of information regarding each component. CAFF is designed to be rapid, reproducible, and flexible for a wide range of fisheries (Figure 3). More information on CAFF can be found in Boyce et al. 2023.

2.4 CLIMATE ADAPTATION HANDBOOK

The Climate Adaptation Handbook was developed by researchers, managers, and the fishing industry in Australia to understand the sensitivity of fishers to physical and ecological change, how easily the fishery can adapt to change, and whether a more elaborate process of changing management plans and methods is needed to accommodate change (Fulton et al. 2020). The handbook outlines a pre-risk assessment, a

three-step risk assessment, and a post-risk assessment (Figure 4). The pre-risk assessment is where the scope of the assessment is determined, including objectives, species of interest, stakeholders, and scale as well as the level of the risk assessment, which depends on available resources and data, among others.

The first step in the three-step risk assessment focuses on the physical drivers and their impacts on species and ecosystems. This is where research is conducted and tools are applied to understand how sensitive a species abundance, distribution, phenology, and physiology is to climate change. From this information an ecological risk score is determined using qualitive scores (low, medium, high) and a fillable table. The second step in the three-step risk assessment focuses on fishery risk through the development of three surveys designed to elicit advice from stakeholders about autonomous adaptation (actions fishers can take within the current management structure). Advice would include the potential adaptation responses, the likelihood of implementing those responses, and their potential economic and social impacts. Similar to the ecological risk, qualitative scoring criteria and a fillable table are used to determine the fishery risk score. The third step determines management risk. The handbook explains multiple agency management functions that can be used to pursue objectives of fisheries legislation, which in turn affects the impact of climate change on species abundance, distribution, phenology, and physiology through the management of catch, effort, gear, spatial, or temporal restrictions. The number of management tools, costs, implementation time, and level of accountability are used to determine management risk using the same format as above (i.e., qualitative scoring and a fillable table).

The post-risk assessment is where the final risk scores are used to provide recommendations, operationalizing those recommendations, and promoting adaptive management. From the detailed risk assessment, sensitivities of the fishery to physical and ecological change should be known, the adaptability of the industry to change should be identified, and whether management plans and policies need to change, and if so, how. This process can be repeated with the addition of new data, or if there are changes in productivity, if an indicator threshold is reached, or if changes in fish availability occur. The fillable tables and a comprehensive hypothetical example are provided within the handbook (Fulton et al. 2020).

3. A PROPOSED FRAMEWORK FOR THE IATTC

After a thorough review and assessment of currently available climate-resilient fisheries frameworks (see Table 1), the IATTC scientific staff developed a proposed framework that incorporated many of the common features found in the four relevant examples, particularly those found in the Climate-Smart Conservation Cycle (see 2.1) and Climate Adaptation Handbook (see 2.4). Those common features include stakeholder input, consideration of uncertainty, and examples of tools. Other features that were considered in the proposed framework that were common across most example frameworks were the inclusion of a goal and scope step, a cyclical and iterative structure, a risk assessment breakdown at multiple levels (e.g., species/stock(s), ecosystem, fishery, management), and at least one step where management actions could occur. In addition to some of the examples above, the simple structure the Climate-Smart Conservation Cycle made it an effective structural backbone to build the proposed IATTC framework from that would allow many of the details to be filled in during stakeholder workshops. The risk assessment levels, and associated tools described in the Climate Adaptation Handbook, as well as in FISHE and CAFF were adapted and combined with the simple structure defined above so that each step considered the needs and management structure of IATTC. The proposed 7-step modified version of this framework can be found in Figure 5. Below is a description of each step that would be included in the framework.

Step 1. Define goal and scope

Defining the goal and scope are usually the main elements of the initial step as established in many climate-resilient fisheries frameworks. The IATTC staff believes it is critical to have both defined before moving forward with the rest of the framework and workplan. At that stage, the definition of the goal of IATTC climate change workplan will provide a baseline that can be reassessed later throughout the workplan (the iterative and cyclical nature of the framework, as needed, should be kept in mind). Addressing the question of scope leads to the definition of a number of key elements and topics to be defined, such as: what decisions the climate change plan intends to support? Who will be implementing the plan? What are the conservation targets (e.g., specific species or fisheries)? What is the geographic extent (e.g., Eastern Pacific Ocean, Eastern Tropical Pacific) and temporal extent (e.g., one year, 10 years, 50 years, 100 years in the future)? Who are the key partners and stakeholders involved, and what resources are available to accomplish the workplan? Each one of these questions and the main goal are described in detail in the accompanying document CC-01-01 which includes a series of recommendations from the scientific staff in their respect.

Step 2. Assess climate impacts and vulnerabilities

This step is also common across all reviewed frameworks. Although it is simple, Step 2 in the Climate-Smart Conservation Cycle could benefit from being expanded to include a more detailed assessment process like some of those provided in other frameworks (e.g., Climate Adaptation Handbook). Therefore, it is proposed to merge Step 2 from the Climate-Smart Conservation Cycle with the three-part risk assessment from the Climate Adaptation Handbook. Those three parts assess climate impact, vulnerabilities, risk, and barriers at the species and ecological level, fishery level, and management level all of which are essential when understanding climate impacts and vulnerabilities at a fishery management organization. The three parts are represented in Step 2 in the proposed framework as a mini circle in which an assessment of each part/level is completed to fully understand climate impact, vulnerabilities, risk, and barriers. There are many assessment tools that can be applied at each level, which will be determined at the later workshops. Those workshops which will offer the opportunity to specifically discuss tools, as strategic tools, which are often tailored to specific goals, scopes, and frameworks, yet to be determined. Therefore, it is too early to assume that the way in which risk was assessed at each part in the Climate Adaptation Handbook should necessarily be followed by the Commission. For instance, assessment at the species and ecological level could be done through a species climate vulnerability assessment (Pecl et al. 2014, Hare et al. 2016, Boyce et al. 2024). A fishery assessment could be done through the participation of fishery operators and industry stakeholders in various fishery adaptation surveys such as those developed in the Climate Adaptation Handbook (Fulton et al. 2020-Appendices E-H). A management assessment could be conducted by fishery managers through scenario planning, qualitative modeling approaches, and surveys to identify which management instruments are or are not best suited to account for climate related issues. There may also be assessment tools where scientists, fishers, and managers need to come together to discuss climate risk at any of the three levels. Multiple tools may also need to be developed within a level (e.g., ecological level) to understand the full extent of the impacts and risk due to climate change. Thus, Step 2 will likely take longer than many other steps in the framework because this is the stage of the process in which much of the tools are designed and developed, and the bulk of the associated research is conducted. Additionally, this step could reoccur and have to be taken more than once whenever new data is available and climate impacts and priorities shift.

Step 3. Review goal and scope

Once the impacts and vulnerabilities are identified, it is important to review the main goal and scope of the workplan and to identify whether their redefinition is needed. For example, if the assessment shows that the potential impacts caused by climate change are different than preliminarily expected, certain aspects of scope, like conservation targets or temporal extent, may need to be modified and adapted. The

assessment may also lead to questioning or validating the relevance and feasibility of the previously discussed and considered main goal and scope.

Step 4. Identify possible adaptation/management actions

In this step, the IATTC and its staff, along with relevant stakeholders, come together to develop and identify ways to reduce the climate change impacts and vulnerabilities identified in Step 2. During this step it is important to focus on adaptation strategies that address the greatest climate impacts and vulnerabilities. Adaptation strategies can range from new management actions that will reduce climate related vulnerabilities to new science initiatives that may include innovative ways to more accurately measure the climate impacts on species, fisheries, and management. Additionally, potential adaptation/management efforts should ideally be based primarily on their effectiveness from an ecological perspective. Usually, at this stage of the process, emphasis should be put on being innovative and creative generating a broad range of options and courses of action. There will be opportunities afterwards to evaluate the feasibility of these actions and consider other factors (e.g., time, funding) during Step 5. As an example, Stein et al. 2014 urges adaptation options that manages for both persistence and change because in the near-term, actions may need to be made to maintain certain functions and elements, while in the long-term, actions may require structural and transformative changes. Similar to Step 2, there are tactical tools that have been developed and used to help identify possible adaptation/management actions, and this will be reviewed, explained, described and discussed in detail later in further workshops with participants (tentatively planned from 2026-2028, see the workplan in SAC-15-12).

Step 5. Evaluate and select adaptation/management actions

Once an extensive list of possible adaptation/management actions has been identified (Step 4), each should be discussed and evaluated to whittle that list down to the actions that should be effectively carried out. As mentioned above, priority should be given to actions that address both near- and long- term climate impacts and vulnerabilities that are robust to uncertainty. During the phase of evaluating, comparing, and weighing possible actions, it is important to take into account the effectiveness of each potential action on addressing the most critical impacts and vulnerabilities to meet the main goal. It is also necessary to consider how these possible actions may affect broader societal, cultural, and economic objectives. During this step it is also essential to evaluate factors that may enhance (i.e., opportunities) or prevent (i.e., barriers) successful adaptation or management action implementation, such as cost, CPC resources and capabilities, those of the IATTC and its Secretariat, and overall feasibility of the actions proposed. These types of criteria, as emphasized by Stein et al. 2014, should be clearly developed with metrics that measure how each action meets those criteria. Similar to Steps 2 and 4, there are decision support tools that already exist that can help with this evaluation and selection.

Step 6. Implement priority adaptation/management actions

This step is not only the most important step but is likely the most difficult step to accomplish. There can be countless assessments and potential adaptation actions developed over the prior four steps (Steps 2-5), but their positive impact on fisheries management would be significantly reduced if implementation of those actions doesn't happen. The uptake of climate resilient fisheries into management has been usually slow for several reasons, including, the uncertainty and variability surrounding climate change impacts, resource availability, and difficulties, challenges, and lack of full commitment or understanding to manage fisheries differently than has traditionally been done under a more stable and less variable climate. It is likely that any adaptation/management action implementation will follow similar procedures for any conservation management measure, but it is important that some flexibility exists. Likewise, Stein et al. 2014 discusses several factors that improve the chances of adaptation implementation, such as engaging with diverse stakeholders early on, plugging specific adaptation plans into the already existing management efforts, highlighting benefits across all sectors, demonstrating examples of success, and taking immediate action, but keeping sight on larger change.

Step 7. Track and monitor action effectiveness

Given the ever-changing environment as a consequence of climate change, it is imperative to continuously monitor and track the effectiveness of any adaptation/management action across time and space. The consistent monitoring of the fisheries systems and other related ecosystem elements would allow the Commission and its members to adjust implementation of the plans, as necessary. It also ensures that the process of climate-resilient fisheries is iterative since the IATTC, as a regional fisheries management organization, will continue, through such monitoring, to witness and experience any change in the EPO fisheries. Monitoring as well as tracking post implementation of any management action plan also allows to highlight both the link between impacts and the implemented actions as well as the benefits and importance of their adaptive nature. Considering the criteria and metrics developed in Step 5 used to evaluate and compare adaptation/management actions will also be important when designing how to monitor effectiveness. Also, some of the tools used in Step 2 may be applied to track and monitor effectiveness of the actions and plans. Lastly, and although some stability is desired, when facing constant change it is crucial to have an opportunity to continuously revisit planning and the main goal and scope of the workplan, as these may need to change as climate change impacts the EPO and priorities shift.

4. RECOMMENDATION

Based on the extensive review of available climate-resilient fisheries frameworks and considering how they could be adapted to IATTC, the IATTC staff recommends that:

The framework proposed in Section 3 and Figure 5 is considered for adoption and, therefore, guide the IATTC climate change workplan.

TABLE 1. The 13 features described for each of the four relevant climate-resilient fisheries frameworks. The features listed in the table are short for the following questions: 1) What is the intended use of the framework? 2) Where has this framework been applied? 3) Does it include a place where goal and scope are defined? 4) Is the framework cyclical and iterative? 5) Does it have any feedbacks in the cycle? 6) What is its periodicity (i.e., how often should the framework be re-run)? 7) Are examples of tools included? 8) Is a fillable workbook included? 9) Are there risk assessment levels and what are they? 10) Does the framework incorporate stakeholder input? 11) Does it discuss uncertainty? 12) Can the steps in the framework be adaptable? 13) Does at least one of the steps incorporate some type of management action/implementation?

Features	Feature Description	Climate-Smart Conservation Cycle	FISHE	CAFF	Climate Adaptation Handbook
1) Intended use	The sector(s) the framework was intended for.	natural resource management	Fisheries	Fisheries	Fisheries
2) Application	Institutions or countries where the framework has been applied.	U.S. NOAA Fisheries	Cuba, Belize,	Fisheries and Oceans Canada	Australian Fisheries Management Authority
3) Goal and scope defined	Inclusion of defining goal and scope	yes	yes	no	yes
4) Cyclical/Iterative	Whether the framework is cycle and iterative	yes	yes	yes	no
5) Feedbacks in cycle	If feedbacks are described in framework	yes	no	no	no
6) Periodicity	How often the framework should be re-run	new data, modified goals, user-defined	new data	user-defined	new data, user-defined
7) Tool examples	Whether tools are provided at various steps	yes	yes	yes	yes
8) Fillable workbook	An available workbook that the user can fill out when undergoing framework	no	yes	no	yes
9) Risk assessment levels	Various risk assessments levels discussed in the framework	no	species/stock(s), ecosystem, fishery	species/stock(s), management, infrastructure	species/stock(s), fishery, management
10) Stakeholder input	The framework provides opportunities for stakeholder input	yes	yes	yes	yes
11) Discusses uncertainty	The framework discusses and/or considers uncertainty	yes	yes	yes	yes
12) Designed to be adapted	Can be adjusted/adapted based on user's need	yes	yes	yes	yes
13) Management action	Incorporates some form of management action/implementation	yes	yes	no	yes

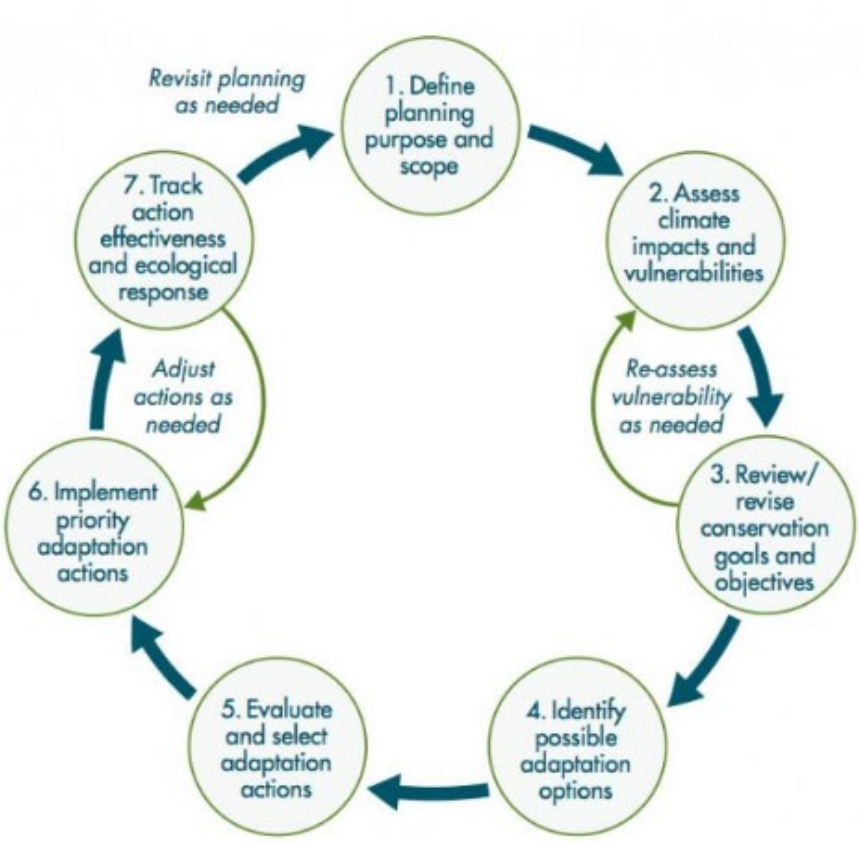

FIGURE 1. The Climate-Smart Conservation Cycle, a general framework for adaptation planning and implementation (taken from Stein et al. 2014).
FIGURA 1. El ciclo de conservación climáticamente inteligente, un marco general para la planificación e implementación de la adaptación (tomado de Stein et al. 2014).

FIGURE 2. FISHE's (https://fishe.edf.org/) 11-step framework to promote sustainable fisheries under climate change.
FIGURA 2. Marco de 11 pasos de FISHE (https://fishe.edf.org/) para promover pesquerías sostenibles ante el cambio climático.

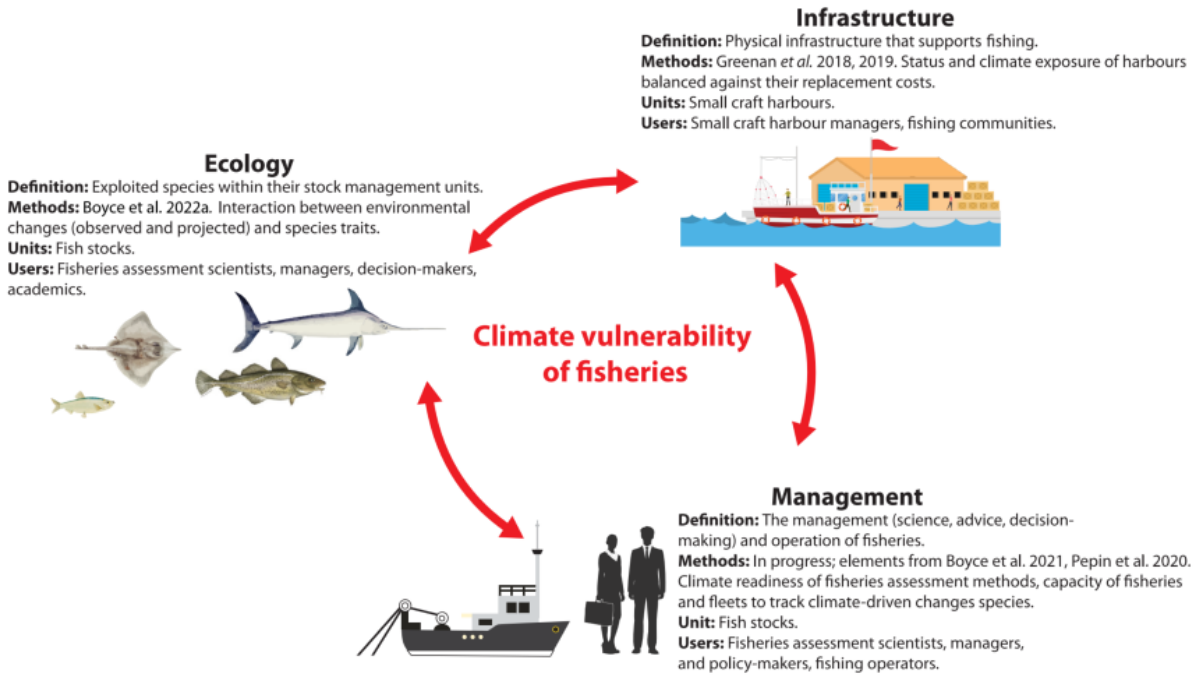

FIGURE 3. The graphic abstract describing CAFF from Boyce et al. (2023).
FIGURA 3. Resumen gráfico que describe el CAFF de Boyce *et al.* (2023).

FIGURE 4. The structure of the Climate Adaptation Handbook from Fulton et al. (2020).
FIGURA 4. Estructura del Manual de adaptación al cambio climático de Fulton *et al.* (2020).

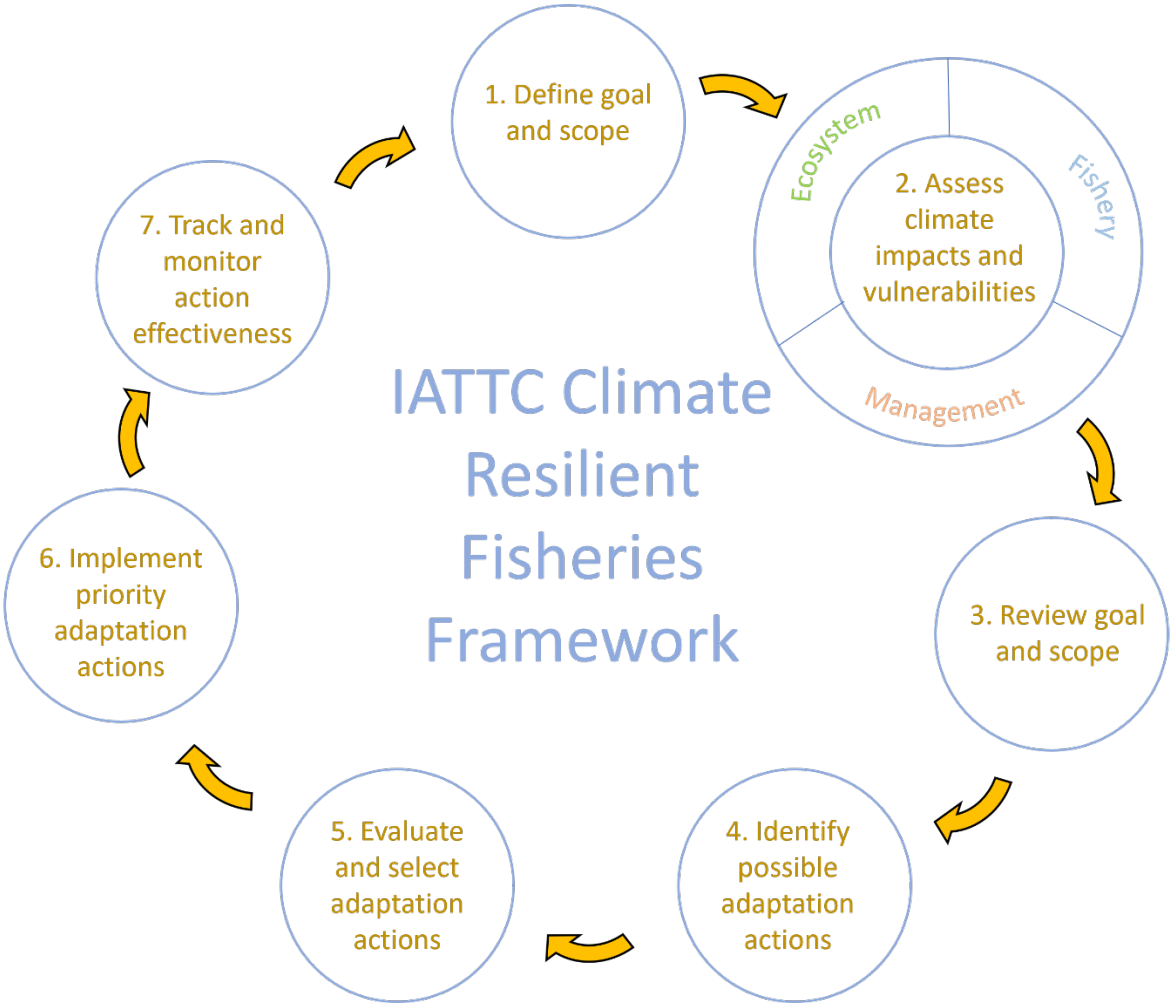

FIGURE 5. The proposed IATTC Climate Resilient Fisheries Framework, the structure for adaptation and fishery management implementation under a changing climate.
FIGURA 5. Propuesta de Marco de Pesquerías Resilientes al Clima de la CIAT, la estructura para la adaptación y la implementación de la ordenación pesquera ante un clima cambiante.

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