Updated Ecuador Mahi Mahi Fisheries Improvement Project (FIP) Action Plan

Report prepared by

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Contents

Glossary

CI	Conservation International
IATTC	Comisión Interamericana del Atún Tropical
CICIMAR	Centro Interdisciplinario de Ciencias Marinas de México (Mexico's Marine Sciences Interdisciplinary Center)
COMEX	Comité de Comercio Exterior de Ecuador (Ecuador's Foreign Trade Committee)
CPUE	Catch per unit effort
CNP	Cámara Nacional de Pesquería de Ecuador (Ecuador' Fishery National Chamber)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCRP	Dirección de Control de Recursos Pesqueros (Ecuador's Directorate for Fishery Resources Control)
EPESPO	Escuela de Pesca del Pacífico Oriental (Eastern Pacific Fishing School)
EPO	Eastern Pacific Ocean
ETP	Endangered, threatened or protected species
FENACOPEC	Federación Nacional de Cooperativas Pesqueras del Ecuador (Ecuador's National Federation of Fish Cooperatives)
FIP	Fisheries Improvement Project
GEF	Global Environment Facility
HCRs	Harvest Control Rules
INAPESCA	Instituto Nacional de Pesca de México (Mexico's National Fisheries Institute)
INP	Instituto Nacional de Pesca del Ecuador (Ecuador's National Fisheries Institute)
MSC	Marine Stewardship Council
MSE	Management Estrategy Evaluation
MSY	Maximum Sustainable Yield
OFCF	Overseas Fishery Cooperation Foundation
PAN Dorado	Plan de Acción Nacional para la Conservación y el Manejo del Recurso Dorado en Ecuador (Ecuador's National Action Plan for Mahi Mahi Conservation and Management)
PI	MSC Fisheries Standard's Performance Indicator
SAC	Scientific Advisory Committee
SENPLADES	Secretaría Nacional de Planificación y Desarrollo del Ecuador (Ecuador's National Secretariat of Planning and Development)

SRP	Subsecretaría de Recursos Pesqueros del Ecuador (Ecuador's Sub-secretariat of Fishing Resources)
VMAP	Viceministro de Acuacultura y Pesca del Ecuador (Ecuador's Deputy Minister of Aquaculture and Fisheries)
WWF	World Wildlife Fund

Introduction

In order to progress with guarantees of success towards a MSC full assessment process for the Ecuador mahi mahi artisanal longline fishery, in 2009 were defined a set of improvement actions aimed to address the weaknesses highlighted during the pre-assessment of the fishery. The set, structured in a plan, was updated during the workshop held in Manta in 2014 to review the FIP progress. The current report constitutes a further update of the Action Plan, providing information about the progress status of all the actions included, their milestones and deadlines, as well as their priority levels (based on the highest level assigned to each Performance Indicator within the FIP scoping document). Furthermore, new actions and milestones have been added to strengthen the improvement of particular Performance Indicator's scores. Several of those actions were agreed during the review workshop held in Manta in April 2018, while others have been suggested by the consultant, in which case it has been highlighted in the relevant sections.

As in the case of the PAN Dorado, the SRP is the leading body for the implementation of the FIP Action Plan, as well as for the coordination of the development of all the actions included in the plan, with the assistance of the INP, WWF and the consortium comprising Ecuador's fresh fish exporting companies.

Given that the FIP approaches its final stage, it is critical to review the progress of the current Action Plan on a regular basis in order to reassure that it fulfils its role to ensure the fishery moves towards a MSC full assessment process. Furthermore, within the plan there are specific activities (e.g. the development and implementation of reference points and harvest control rules) that, if completed, would represent a significant progress in the FIP development, which should be assessed. Additionally, the Action Plan is completed by a budget report detailing the costs of the new actions and milestones added during the update.

1 Definition of the stock

From the inception of the improvement project for the Ecuador artisanal mahi mahi fishery, it was highlighted the lack of information about the geographical distribution and the stock structure of the mahi mahi in the Eastern Pacific Ocean. Considering the importance that information has in order to determine all fish mortality sources when carrying out a stock assessment or establishing management measures, a number of activities aimed to address the lack of information were defined within the FIP Action Plan. Their implementation has allowed progress in various areas relevant to the general development of the FIP, especially those relative to appropriate data collection to conduct stock assessments and support management decision-making processes.

However, more information is still required and the genetic and morphometric analysis carried out are not conclusive at establishing a final definition of the stock structure. The final results of the mentioned otolith morphometric and chemical analysis from several locations in the EPO and the Atlantic have not been received yet. Currently, the last analysis carried out to characterize the genetic structure of the mahi mahi stock in the EPO confirms the high genetic variability noted in previous studies. In addition, the analysis suggests that the species forms a single population in the Pacific. However, the work has not stopped due to the uncertainty of not knowing the whole structure and the progress has continued on the assumption that there is a spatial structure for the mahi mahi stock with a core region. Data availability for the mentioned region, located off Ecuador and Peru coasts, and the fact that the catches registered there by both countries represent the 90 % of the total for the species in the EPO, justifies to undertake a stock assessment for the mahi mahi fished in the South-Eastern Pacific Ocean. Proving that there is an efficient and precautionary management that is responsive to the stock status, on the basis of reference points and harvest control rules for the mahi mahi stock in the Southern EPO, would allow to consider that portion of the whole stock suitable for a MSC full assessment process.

1.1 Genetic analysis

As noted in the updated FIP Action Plan report of 2014 (MRAG, 2014), this activity has been completed for FIP purposes with the presentation of the *Characterization of population genetic structure of dolphinfish (*Coryphaena hippurus*) samples from the Eastern Pacific* report (Concepto Azul, 2013). The results agree with those of previous studies regarding the existence of a single and highly genetically variable mahi mahi stock in the Pacific Ocean. Accordingly, it is very unlikely that further genetic research would provide a definition of the stock unit, although they could contribute to highlight local substructures.

Key stakeholders	SRP
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	1.2.3 Information and monitoring

***Action 1.2 have been removed** (see Annex 1)

1.3 Otolith micro-elemental analysis

This action has met the milestones defined for its completion (see Table 1), following its inclusion in the FIP Action Plan in 2014 after being removed previously. Instituto Politécnico Nacional (National

Polytechnic Institute) and Mexican INAPESCA scientists presented the results of the morphometric analysis of sagittal otoliths during the first international technical meeting on mahi mahi, held by IATTC in October 2014 in Manta, Ecuador. One of the research conclusions is that the otolith contour analysis it is considered useful to differentiate mahi mahi stocks and that it can be applied to the whole EPO. Subsequently, it was decided that the SRP collaborates with INAPESCA technicians in the collection and analysis of otolith samples from Mexico, Peru and Ecuador in order to determine the presence of mahi mahi sub-populations in the EPO. The research technical report is still being analysed and have not being published yet, however, it seems that there are not significant differences in the morphometric characteristics of distinct areas.

Following IATTC's Scientific Advisory Council decision to carry out a mahi mahi stock assessment in the South-Eastern Pacific Ocean, the need for this action was discussed. On the other hand, during the FIP review meeting of 2018, it was suggested to wait until receiving the final results of the otolith morphometric and chemical analysis before taking a decision. A further two milestones (milestones 3 and 4; see Table 1) have been proposed to complete this action.

Key stakeholders	INP (otolith collection) – SRP – INAPESCA
Priority	Medium
Status	Updated – New milestones added
Timeframe	Ongoing – Expected in Quarter 3 2018
MSC PI(s)	1.2.3 Information and monitoring

Table 1. Milestones for the completion of Action 1.3

	Commencing	Ending	Status (May 2018)
Milestone 1: Proposal to present at international workshop	Quarter 2 2014	Quarter 3 2014	Completed
Milestone 2: Decision following international workshop	Quarter 4 2014	Quarter 4 2014	Completed
Milestone 3: Presentation of technical report with final results	Quarter 3 2018	Quarter 3 2018	Ongoing
Milestone 4: Decision following the technical report presentation	Quarter 3 2018	Quarter 3 2018	Not started

1.4 Training national technicians

The implementation of a wide training program conducted by the SRP and intended for scientists, managers and technicians allowed for the completion of this action in 2013. The SRP continues to provide training to Ecuadorian scientists and technicians on a range of topics relative to biology, ecology, management, bycatch, etc.

Key stakeholders	INP – SRP
Priority	Completed
Status	Completed

Timeframe	Ongoing
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

1.5 National mahi mahi workshop (genetics, stock assessment & status, biological characteristics, monitoring)

The lack of information about the mahi mahi made it advisable the celebration of a set of national workshops to coordinate the research conducted and highlight weaknesses in different areas, such as genetic studies, information on stock status, biological characteristics (e.g. growth, mortality, etc.), catch data, compliance, etc. The SRP organized a national workshop in 2013 in Santa Rosa de Salinas, there, the results and progress of a number of studies lead by the SRP itself were presented to key stakeholders, mainly fishermen. The Sub-secretariat is committed to hold regular workshops to allow stakeholders to be updated on available information about the research status and the management of the fishery. In light of the foregoing, it was possible to consider the action completed in 2013.

Key stakeholders	INP – SRP – WWF – Fishing cooperatives
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status

1.6 International mahi mahi workshop (genetics, stock assessment & status, biological characteristics, monitoring)

In order to share information and work towards a stock assessment for the mahi mahi in the Easter Pacific, it was decided to include an action aimed to encourage the celebration of an international workshop. However, the initiative promoted by Ecuador in coordination with the Commission's scientific staff resulted in a series of workshops with the Eastern Pacific coastal countries that are member of IATTC.

Since 2014, within the IATTC framework and enjoying strong support from the SRP, several technical meetings have been held providing a discussion forum for the coordination and cooperation between States, as well as to evaluate requirements relative to data, stock structure and different methodologies available to conduct a stock assessment of the species in the EPO. The first meeting, held in Manta in 2014, contributed to establish the required collaborative research forum and to identify the available sources from IATTC countries for biological and fishing data for the mahi mahi. The second meeting, held in Lima, Peru, in 2015, led to achieve significant progress relative to the mahi mahi stock structure in the EPO and the methodologies and indices to be used. A third meeting took place in Panama in 2016, focussed on the analysis of data and assessment methods requirements for mahi mahi data-poor fisheries in the EPO. Additional information about the meetings held to date is available by clicking on the following links:

- First meeting, held in Manta, Ecuador, in 2014.
- Second meeting, held in Lima, Peru, in 2015.
- Third meeting, held in Panama City, Panama, in 2016.

The work conducted after the meetings led to the presentation of an assessment of the stock distributed along the mahi mahi core region, located in the EPO off Ecuador and Peru coasts, as well as an exploratory evaluation of management strategies.

The activities mentioned above allow for the completion of this action as it was defined originally (see Table 2 below). However, the nature of the work relative to know the stock status, data collection, the development of indices, etc., will require further technical meetings to be held within the IATTC framework for the mahi mahi.

Key stakeholders	IATTC – INP – SRP – WWF – CEDEPESCA
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status

Table 2. Milestones for the completion of Action 1.6

	Commencing	Ending	Status (May 2018)
Milestone 5: Plan international workshop	Quarter 2 2014	Quarter 3 2014	Completed
Milestone 6: Hold international workshop	Quarter 4 2014	Quarter 4 2014	Completed

1.7 Define Practical Stock Unit

During the first international technical meeting for the mahi mahi (see Action 1.6 for additional information), held in Manta in 2014, the INP presented scientific evidence about the likelihood of a mahi mahi stock in the Southern EPO (milestone 7; see Table 3 below), separated from the northern component by the Equatorial Front. During the second meeting, held in 2015, IATTC scientists suggested three alternative approaches (a – to consider a single stock for the entire EPO; b – to consider a separate population in the Southern EPO; and c – to work on a stock structure based upon the core region, off Ecuador and Peru, for the catches registered in the EPO) to address the definition of an adequate stock unit to conduct the stock assessment on (milestone 8; see Table 3 below). Each approach entails different challenges relative to data requirements to carry out the assessment and the implementation of harvest strategies that ensure the biomass fluctuates at or above a level consistent with MSY. Following the evaluation of the afore-mentioned approaches and on the assumption that the results of the genetic studies are not conclusive when establishing the existence of sub-populations, during the 7th Meeting of the SAC in May 2016 the IATTC scientific staff presented a stock assessment for the mahi mahi in the core region of its distribution in the EPO, where the artisanal fleets of Ecuador and Peru catch the 90 % of the mahi mahi fished in the Eastern Pacific. The use of the unit of stock proposed to carry out the assessment would be justified with

regard to a MSC full assessment process as long as precautionary reference points and robust HCRs, which consider the uncertainty assoIATTCed to the non-inclusion of data about the remaining mahi mahi population, are developed.

Key stakeholders	INP – SRP – WWF – IATTC
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status

Table 3. Milestones for the completion of Action 1.7

	Commencing	Ending	Status (May 2018)
Milestone 7: Assemble and report on evidence for a southern stock	Quarter 2 2014	Quarter 3 2014	Completed
Milestone 8: Present evidence and develop consensus position at international workshop	Quarter 4 2014	Quarter 4 2014	Completed

1.8 Bilateral technical workshop with Peru

The first technical workshop between Ecuador and Peru was organized by the INP in Guayaquil (Ecuador) in September 2014. The workshop registered the participation of INP, SRP and Peru's IMARPE representatives. The topics covered included similarities in several biological-fishery indicators, the exchange of information, the standardization of research methodologies, as well as the development of joint research. The second bilateral workshop was held in Piura, Peru, in September 2015. One of the main outcomes of the workshop was the implementation of a new bilateral agreement to carry out joint research activities on mahi mahi throughout the following year, as well as to collaborate in the development of a regional stock assessment. During the third bilateral technical workshop, held in Guayaquil in April 2017, representatives from both countries agreed on the standardization of biological, CPUE and oceanographic variables data collection methodologies. The results of the agreement, as well as the collaboration towards a binational management of the resource, are expected to be discussed during the following workshop to be held along the second half of 2018 (it was scheduled originally in May, but recent changes of government in Peru are delaying it).

The activities described above allow to complete the action as it was conceived originally (see Table 4 below). However, given that combined fishing activities of Ecuador and Peru represent the largest portion of the mahi mahi catches in the EPO, it should be a priority that technicians from both countries further coordinate their work through bilateral meetings. Additionally, during the last meeting held in Manta in April 2018 to review the progress of the FIP, it was advised to include

fisheries control authorities from both countries in the bilateral workshops (milestones 11 and 12; see Table 4 below).

Key stakeholders	INP – SRP – IMARPE
Priority	High
Status	Updated – New milestones added
Timeframe	Ongoing
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status 3.1.3 Long term objectives 3.2.2 Decision-making processes 3.2.3 Compliance and enforcement 3.2.4 Monitoring and management performance evaluation

Table 4. Milestones for the completion of Action 1.8

	Commencing	Ending	Status (May 2018)
Milestones 9: Plan for bilateral workshop	Quarter 2 2014	Quarter 3 2014	Completed
Milestones 10: Conduct bilateral workshop	Quarter 3 2014	Quarter 3 2014	Completed
Milestones 11: Suggest the Peruvian counterpart to include fisheries control authorities in the bilateral workshops	Quarter 2 2018	Quarter 2 2018	Not started
Milestones 12: Conduct a bilateral workshop that includes the participation of fisheries control authorities	Quarter 2 2018	Quarter 2 2018	Not started

2 Stock status and abundance indices

The considerable effort carried out by the SRP, INP and IATTC over the four years following the last updated of the FIP Action Plan in 2014, has represented a significant step forward regarding the quantity and quality of the data collected and the analysis conducted upon them. The work undertaken to develop CPUE series in Ecuador allowed its use in the assessment carried out in 2016 for the mahi mahi stock in the Southern EPO, being considered as the most reliable index of abundance to calibrate the assessment model. Currently, Ecuador collects information on a regular basis, which subsequent analysis contributes to achieve a better understanding about the stock size, weight, sex and age composition, as well as the species maturity, growth, fecundity and trophic ecology in the Southern EPO.

The qualitative assessment of the stock status using the MSC Risk-Based Framework (RBF), carried out for both the Ecuadorian and the Peruvian fisheries, highlighted the need for a quantitative stock assessment for the mahi mahi in the EPO when considering a future MSC full assessment process. Therefore, the completion of the assessment for the portion of the stock that is distributed south of the Eastern Pacific represents a critical step forward towards achieving the FIP objectives. However, important elements still remain to be improved, including the need to define reference points consistent with B_{MSY} and develop efficient harvest control rules that maintain high productivity levels for the stock.

2.1 VPA evaluation

Action removed following the completion of the stock assessment for the mahi mahi in the Southern EPO using the *Stock Synthesis* model, which appropriateness was successfully proved.

Key stakeholders	INP – SRP
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

2.2 Develop CPUE series (index of abundance / status of resource)

During the previous update of the FIP Action Plan, carried out in 2014, the CPUE series was considered as developed, hence, reaching the completion of the action. IATTC determined that the CPUE index and the biological data collected by Ecuador were sufficient to monitor the fishery. When IATTC carried out the stock assessment of the mahi mahi in the Southern EPO, the Ecuador artisanal fishery CPUE series was considered as the most reliable index of abundance to calibrate the model used.

Ecuador continues the standardized collection of catch and effort data, through the information registered in fishing logbooks and port inspections, to allow the estimation of CPUE as an abundance index. Furthermore, during the bilateral technical meeting held in 2017, INP, SRP and IMARPE technicians agreed on a joint protocol for data collection in order to produce CPUE indices in both countries, which will be subsequently shared between Ecuador and Peru.

On the other hand, as noted in the MSC Fisheries Standard, the use of CPUE values as reference points to monitor the status of the resource requires to be grounded on a robust rational that ensures they are consistent with MSY.

Key stakeholders	SRP – IATTC
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

***Actions 2.3 & 2.4 have been removed** (see Annex 1)

2.5 Literature review on mahi mahi assessment and management

In order to support other activities within the Action Plan, notably the development of CPUE series (see Action 2.2), the SRP and IATTC have conducted a joint literature review about the different approaches used to carry out assessments and manage mahi mahi populations around the world.

In December 2014, the SRP presented the *Revisión bibliográfica del estado actual del conocimiento del* Coryphaena hippurus *Linnaeus, 1758 (Dorado, Mahi-mahi, Lampuga, Perico)* report (Mariuxy García, 2014). The report provides a summary of current information about various aspects relative to mahi mahi, including references to trophic ecology, genetic structure of the populations, catch levels and stock status, age and growth, reproduction, conservation measures, etc.

The completion of this action was achieved with the elaboration of the literature review report (see Table 5 below).

Key stakeholders	INP – SRP – IATTC
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	1.1.1 Stock status 1.2.1 Harvest strategy 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status

Table 5. Milestones for the completion of Action 2.5

	Commencing	Ending	Status (May 2018)
Milestone 13: Report summarizing previous actions taken by other countries to manage and evaluate mahi stocks	Quarter 2 2014	Quarter 4 2014	Completed

2.6 Ageing

The *Consultoría para la determinación e interpretación de los parámetros poblacionales, edad, crecimiento y reproducción del dorado (*Coryphaena hippurus*) capturado en aguas del Océano Pacífico suroriental durante 2008 a 2012* report (Zúñiga, 2014) is the result of the collaboration between scientists and technicians of the SRP and Mexico's CICIMAR. The analysis was carried out using biological samples of mahi mahi (scales and gonads) collected at the main landing ports (Esmeraldas, Manta and Santa Rosa – Anconcito) and provides information about size, age and growth structure, as well as the reproductive biology. The report allows to achieve the completion of all the milestones defined for the action (see Table 6 below).

Given the MSC Principle 1 PIs requirements for adequate information about the stock structure of the mahi mahi, in Ecuador, the SRP continues collecting and analyzing biological samples, both at port and via the observer program. The last report on age and growth in mahi mahi scales, from

samples collected during the period of 2011 to 2016, was presented during the FIP workshop held in 2018.

Key stakeholders	SRP – CICIMAR
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

Table 6. Milestones for the completion of Action 2.6

	Commencing	Ending	Status (May 2018)
Milestone 14: Deliver final consultancy report	Quarter 2 2014	Quarter 3 2014	Completed

2.7 5-95 Percentile analysis

The presentation of an *Exploratory Stock Assessment of Dorado in the Southeastern Pacific Ocean* (Aires-da-Silva *et al.*, 2016) by IATTC in May 2016 allowed the completion of the three milestones (see Table 7 below) defined for this action.

Key stakeholders	IATTC – SRP
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

Table 7. Milestones for the completion of Action 2.7

	Commencing	Ending	Status (May 2018)
Milestone 15: Finalize indicators	Quarter 2 2014	Quarter 1 2015	Completed
Milestone 16: Deliver final report	Quarter 2 2014	Quarter 3 2015	Completed
Milestone 17: Complete Southern EPO stock assessment	Quarter 2 2014	Quarter 1 2016	Completed

2.8 Definition of reference points consistent with B_{MSY} and HCRs development

In order to be considered as acceptable against the MSC Fisheries Standard, a fishing exploitation rate must ensure that the stock level is maintained above a limit reference point, avoiding recruitment impairment, and trying to reach a target reference point consistent with B_{MSY} or a similar high productivity level. Accordingly, the stock assessment conducted by IATTC for the mahi mahi in the Southern EPO is a significant step forward towards a better understanding of the species

regional dynamic. However, the development of reference points providing conclusions about the stock status relative to the level of B_{MSY} is still required. A budget line to carry out a proposal for potential reference points and HCRs for the mahi mahi in the EPO was approved by IATTC in July 2017. The Commission seeks to continue the collaborative work developed to date and expand the mahi mahi MSE, assessing alternative reference points and HCRs against specific management objectives within the national regulations (those objectives will determine the information that feeds the HCRs themselves).

Further information on the milestones updated for this action may be found in Table 8 below.

Key stakeholders	IATTC – SRP
Priority	High
Status	Updated – New milestones added
Timeframe	Ongoing (ongoing IATTC and SRP work along 2018-2019)
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.3 Information and monitoring 1.2.4 Assessment of the stock status

Table 8. Milestones for the completion of Action 2.8

	Commencing	Ending	Status (May 2018)
Milestone 18: Management Strategy Evaluation to establish reference points and limits	Quarter 1 2016	Quarter 2 2016	Completed
Milestone 19: Send fishery specific management objectives to IATTC	Quarter 2 2018	Quarter 2 2018	Completed
Milestone 20: Suggest the Peruvian Government to send the specific management objectives of its fishery to IATTC	Quarter 2 2018	Quarter 2 2018	Completed
Milestone 21: Porposal for reference points (target and limit) and HCRs for the mahi mahi in the EPO	Quarter 3 2018	Quarter 2 2019	Not started
Milestone 22: International workshop to evaluate for their implementation the proposed reference points (target an limit) and HCRs	Quarter 2 2019	Quarter 2 2019	Not started

2.9 Development of an abundance index (CPUE) to implement responsive measures for effort limitation

Alternatively and pending the respective IATTC recommendations on reference points and HCRs, it can be considered the addition of a new FIP action for the SRP to consider the use at a national level of empirically defined reference points based on CPUE series or other biological parameters (e.g. size modes progression, etc.), which could inform the launch of dynamic management measures in the fishery. The aim of this action, suggested by the consultant, is not to replace the development of formal reference points and HCRs for the mahi mahi in the EPO (see Action 2.8) but to complement it, improving the knowledge on the population dynamics and to implement dynamic effort limitation guidelines (e.g. reduction/increase in the number of fiberglass vessels towed by each mother-ship, dynamic fishery openings/closures, etc.) based on resource abundance levels (e.g. range of CPUE rates, etc.). If deemed appropriate, the results of the project could be presented during the relevant bilateral meeting with Peru.

The results of this action could serve as additional input for the implementation of formal reference points and HCRs. para el establecimiento de puntos de referencia y HCR formales. For further information on the milestones defined for this action see Table 8 below.

Key stakeholders	SRP (IATTC – IMARPE)
Priority	High
Status	New
Timeframe	From Quarter 2 2018 to Quarter 2 2019
MSC PI(s)	1.1.1 Stock status 1.2.1 Harvest strategy 1.2.2 Harvest control rules and tools

Table 9. Milestones for the completion of Action 2.9

	Commencing	Ending	Status (May 2018)
Milestone 21: Establish precautionary reference points for abundance indices or biological parameters	Quarter 2 2018	Quarter 3 2018	Not started
Milestone 22: Design dynamic management measures based on the indices	Quarter 3 2018	Quarter 4 2018	Not started
Milestone 23: National workshop to present and validate indices and dynamic management measures	Quarter 1 2019	Quarter 1 2019	Not started

3 Monitoring and evaluation

Over the past years Ecuador has undertaken a significant effort intended to implement data collection and analysis programs for both target and bycatch species. The observer program, the fishing logbook records and the port inspections allow the collection of extensive information about the structure and productivity of the mahi mahi stock, the fleet composition, the bycatch levels, etc. The progress of the actions defined to improve the information available about the fishery are detailed below.

3.1 Characterization of Ecuadorian artisanal mahi mahi fishery

The preparation of the *Estudio de caso / Estado actual del conocimiento del recurso dorado (*Coryphaena hippurus*) Linnaeus, 1758 en aguas del Océano Pacífico suroriental (2008-2011)* report (Martínez-Ortiz y Zúñiga-Flores, 2012) allowed to achieve the objectives of this action during the FIP Action Plan update of 2014. The report provides a comprehensive analysis of all the information available about different aspects of the fishery, including the characterization of the fleet, fishing areas, fishing effort, catches, biological data, etc.

Key stakeholders	INP – SRP
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	1.2.3 Information and monitoring

3.2 Development and training for observers

Through the Ministerial Agreement no. 204 (Article 1), in 2011 Ecuador implemented a single observer program for the longline fleet that each year catches mahi mahi from October to February. The main objective of the program is data collection in real time, which both informs the fishery management and the conservation of the various elements of the ecosystem. Additionally, the program provides detailed handbooks and continuous training for the SRP staff involved.

Key stakeholders	SRP – INP
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

3.3 Design a mahi mahi observer program

During the workshop held in April 2018 to review the FIP, it was highlighted that the actual coverage of the observer program for the longline fleet was around the 12 % of fishing trips undertaken by longline vessels above 20 meters length and the mother-ship fleet, which means it is above the 10 % stated in the Ministerial Agreement no. 204 that defined the program. However, although noted as completed by IATTC in 2014, it has been impossible to access the results of the analysis of statistical robustness of the program. The analysis was laid out as one of the milestones for this action (milestone 24; see Table 10 below). Furthermore, the level of discards of mahi mahi specimens

below the minimum landing size occurring within the fishery remains unknown (see milestone 25). For this reason, the corresponding milestones have been labelled as “behind”. In order to evaluate the adequacy of the current program, as well as possible improvement actions, it is required to assess the information produced by the completion of milestones 24 and 25.

On the other hand, a study carried out by the SRP using data collected by observers on board for the period 2008-2012 analyzed 927 sets conducted by vessels using the “doradero” fishing gear. There were registered interactions with sea turtles in 131 sets (the 14.13 % of all the sets monitored). Of the total number of turtles registered on board, the 88.59 % were released alive, although some having minor injuries or still carrying hooks, while the 11.41% of the specimens were released with serious injuries. Additionally, the SRP presented a study assessing the efficiency of circular hooks to reduce the bycatch in the longline fishery, which allowed to collect further data about the impact on sea turtles and sharks. The data analysis stated that this is a highly targeted fishery, where mahi mahi represents up to the 98.38 % of the catch by number of specimens. Based on that information, the milestone 26 can be regarded as completed (see Table 10 below).

Key stakeholders	SRP – INP – Fishery stakeholders
Priority	Medium
Status	Behind – New milestones added
Timeframe	From Quarter 2 2018 to Quarter 1 2019
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

Table 10. Milestones for the completion of Action 3.3

	Commencing	Ending	Status (May 2018)
Milestone 24: Statistical robustness analysis	Quarter 1 2014	Quarter 4 2014 (Update: Quarter 3 2018)	Behind
Milestone 25: Estimate discards of mahi individuals below minimum legal size at fleet level	Quarter 1 2014	Quarter 4 2014 (Update: Quarter 2 2018)	Behind
Milestone 26: Estimate sea turtle catch rate/mortality at fleet level	Quarter 1 2014	Quarter 4 2014	Completed
Milestone 27: Evaluate the adequacy of the current observer program and define possible improvement actions based on information from milestones 24, 25 and 26, as well as	Quarter 3 2018	Quarter 1 2019	Not started

consulting the stakeholders			

3.4 Literature review of pelagic ecosystems

In 2014, the SRP and IATTC started a literature review about pelagic ecosystems in the EPO in order to understand the structure and function of the ecosystem and determine the risk posed by the fishery. The review was completed after IATTC published the *Ecosystem Considerations* (2016) report. The document provides an ecosystem model for the EPO, as well as adequate information to understand the key elements of the ecosystem, highlighting sea turtles as its sensitive species.

Key stakeholders	SRP – IATTC – NGOs (CI, WWF)
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	2.5.3 Ecosystem information

Table 11. Milestones for the completion of Action 3.4

	Commencing	Ending	Status (May 2018)
Milestone 27: Deliver literature review	Quarter 1 2014	Quarter 1 2015	Completed

3.5 Review of ecosystem/trophic models

Given the complexity of ecosystem models and the lack of information, this action was removed from the FIP Action Plan during its previous update in 2014. Based on the amount of information collected and analysed over the last years on the various components of the ecosystem where the mahi mahi fishery operates, it is recommended to evaluate the appropriateness of recovering Action 3.5 to explore which ecosystem models available are best suited to forecast the effects that changes in mahi mahi captures may have on other components, as well as to contribute in the definition of management strategies.

Among the multiple options that could contribute to the development of this task, it is recommended the use of two. *Ecopath with Ecosim* is one of the most tested and widely used tools to assess the effects of fishing on the ecosystem and explore options for management policies. There is a broad user community and a stable offer for training. On the other hand, *Atlantis* is an ecosystem model developed by CSIRO, which allows to consider all the elements that form the ecosystem and influence its function. The general structure of this model is based on the Management Strategies Evaluation (EEO).

The SRP technical staff has been in contact with scientists from the Spanish Institute of Oceanography working on the development of pelagic models, who could contribute to build an ecosystem model for the Southern EPO, including the mahi mahi and other pelagic species, as well as oceanographic variables. Additionally, the SRP could participate and include the work on mahi mahi in a project developed by the Pontificia Universidad Católica del Ecuador and the Migramar Fundation for the assessment of pelagic fish biomass and the implementation of ecosystem models based on the use of uderwater video footage.

Key stakeholders	SRP – INP – IATTC (IMARPE)

Priority	Medium
Status	Removed in 2014, added in 2018
Timeframe	From Quarter 2 2018 to Quarter 4 2018
MSC PI(s)	2.5.3 Ecosystem information

Tabla 13. Milestones for the completion of Action 3.5

	Commencing	Ending	Status (May 2018)
Milestone 28: Evaluate the volume and quality of the current information for its use in ecosystem models	Quarter 2 2018	Quarter 2 2018	Not started
Milestone 29: Explore the use of different ecosystem models and tools based on the information available	Quarter 2 2018	Quarter 4 2018	Not started

4 Turtle bycatch reduction

Stakeholder collaboration in establishing and implementing improvement actions to reduce incidental fishing has contributed to turn the Ecuador artisanal longline fishery into a highly targeted and effectively free of unwanted catches fishery nowadays. The reduction of the fishery impact on sea turtles has contributed to the general increase in the scores for the Principle 2 of the MSC Fisheries Standard.

***Action 4.1 has been removed** (see Annex 1)

4.2 Implement and confirm turtle handling procedures

As confirmed in the last FIP Action Plan update, the SRP has developed a suite of tools and procedures to release sea turtles hooked or entangled in the gear, which is known by all the observer staff. Furthermore, there is a comprehensive program to educate and train fishermen on sea turtle conservation, as well as on handling and releasing techniques. The program also includes training videos on sea turtle and shark handling procedures.

The training program has been implemented at a national level, although there have not been registered new capacitation activities recently.

Key stakeholders	SRP – WWF – CONSORTIUM OF EXPORTING COMPANIES – EPESPO – OFCF – FENACOPEC – General Artisanal Fishery Sector
Priority	Completed
Status	Completed

Timeframe	Ongoing
MSC PI(s)	2.3.2 ETP species management strategy

4.3 Conversions of longline fishery to circle hooks

The results of the *Estudio de la eficiencia de los anzuelos circulares para reducir las capturas incidentales en la pesquería de dorado (*Coryphaena hippurus*)* (Diz y Bravo, 2018) were presented during the workshop held in 2018 to review the FIP progress. The study aims to analyse the efficiency of the replacement of J type hooks for circular (C15) ones in the Muisne cove (Esmeraldas province) for bycatch (specimens of shark species) and impacts on sea turtles populations reduction in the fishery. The results show no significant differences between the hooks regarding their efficiency catching the fishery's target species. In the case of the replacement effect on incidental fishing, the data was regarded as insufficient to carry out a statistical analysis, although it has been proved that sea turtle specimens are more easily unhooked from circular hooks. Given the larger size of the mahi mahi fished at the north and central coast of Ecuador, fishermen are more inclined to use C15 type hooks at coves like Muisne, which highlights the need for the SRP to focus on assessing the feasibility of carrying out gear replacements in southern coves. Accordingly, it has been proposed a new pilot project to conduct J hook replacements for C15 ones in mother-ships from the Santa Marianita cove (see Milestone 31), analysing also the effects of such replacement. WWF already has the required hooks to carry out the project, which will, additionally, involve the participation of Muisne observers and the support of the consortium of mahi mahi exporting companies. Furthermore, it has been agreed to extend the work to other coves where fishermen have already expressed their interest in the replacement of the gear.

In order to complete Action 4.3, it was defined a task (see Milestone 32 in Table 13 below) to update the *Reporte Nacional del Programa de Reducción de la Captura Incidental de Tortugas Marinas de Ecuador* (Sondheimer *et al.*, 2013), establishing milestones and targets for the replacement of hooks at the national level. However, due to various reasons (e.g. lack of funding, low catches, etc.) have restricted the replacement and best practices dissemination activities to at a local level. The extension of the project to coves sited in the central and south coast, as well as the presentation of a technical report about the current number of hooks replaced, could serve as the basis for the development of an integrate program to replace hooks at the national level.

Key stakeholders	SRP – OFCF – CONSORTIUM OF EXPORTING COMPANIES – General Artisanal Fishery Sector – WWF – CI – EPESPO
Priority	Medium
Status	Behind – New milestones added
Timeframe	From Quarter 2 2018 to Quarter 4 2019
MSC PI(s)	2.3.1 ETP species outcome 2.3.2 ETP species management strategy 2.3.3 ETP species information

Table 13. Milestones for the completion of Action 4.3

	Commencing	Ending	Status (May 2018)
Milestone 30: Present the technical report about the current	Quarter 2 2018	Quarter 3 2018	Not started

number of J hooks replaced by C15			
Milestone 31: Implementation of new pilot projects for hook replacement in southern and central fishing coves	Quarter 2 2018	Quarter 3 2018	Ongoing
Milestone 32: Develop a plan to integrate the various mechanisms for extending best fishing practices to fishing villages, including milestones, timeframes and reasonable objectives, from the MAP.	Quarter 1 2014	Quarter 2 2014 (Update: Quarter 4 2019)	Behind

4.4 Eliminate tariffs on circular hooks

As noted in the report for the FIP Action Plan update carried out in 2014, in 2012 the COMEX eliminate tariffs on the imports of circular hooks in Ecuador through its Resolution no. 75, in order to promote its use and reduce incidental catches in the mahi mahi longline fishery. The resolution was subsequently implemented by Ecuador's National Customs Service.

Key stakeholders	SRP – WWF – COMEX
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	2.3.1 ETP species outcome 2.3.2 ETP species management strategy 2.3.3 ETP species information

***Action 4.5 has been removed** (see Annex 1)

4.6 Project 'T' to prevent entanglement of turtles

The development of this action has been deferred due to the low amount of catches registered for the fishing campaigns occurred since 2016. The SRP has not presented any report about the fishermen adoption of this gear modification intended to reduce sea turtle entanglement. Subsequently, the progress of this action is deemed as "behind".

The SRP considers adequate to combine this action with Action 4.3 and include it in the new pilot projects (Milestone 31).

Key stakeholders	SRP – OFCF – WWF – CONSORTIUM OF EXPORTING COMPANIES – General Artisanal Fishery Sector
Priority	Medium

Status	Behind
Timeframe	From Quarter 2 2018 to Quarter 4 2019
MSC PI(s)	2.3.1 ETP species outcome 2.3.2 ETP species management strategy 2.3.3 ETP species information

Table 14. Milestones for the completion of Action 4.6

	Commencing	Ending	Status (May 2018)
Milestone 32: Develop a plan to integrate the various mechanisms for extending best fishing practices to fishing villages, including milestones, timeframes and reasonable objectives from the MAP	Quarter 1 2014	Quarter 2 2014 (Update: Quarter 4 2019)	Behind
Hito 33: Convert the majority of the fishery to using mainline 'T' connectors to branch lines	Quarter 1 2014	Quarter 2 2016 (Update: Quarter 3 2019)	Behind

4.7 Long-term monitoring of turtle interactions

As noted for Action 3.3, during the workshop held in April 2018 for reviewing the FIP, it was highlighted that the actual observer's coverage for the longline fleet was about the 12 % of fishing trips undertaken by the mother-ship fleet, above the 10 % stated in the Ministerial Agreement no. 204 that defined the program. However, although noted as completed by IATTC in 2014, it has been impossible to access the results of the analysis of statistical robustness of the program. The analysis was defined as a milestone for this action as well (Milestone 24; see Table 15 below).

The observer program implemented for the Ecuador longline fleet incorporates a "Registro biológico de especímenes individuales" form as well as an additional one called "Registro de tortugas", which have to be filled in the event of the capture of sea turtles. For each specimen captured it is registered the species and the point of capture, as well as the curved carapace length (CCL), sex and status at the time of being released. All this data feeds a database created to gather all the information generated by the longline fleet and it is updated in nearly real-time. . A study carried out by the SRP, using information collected by on-board observers from 2008 to 2012, analysed a total number of 927 fishing sets carried out by vessels using the "doradero" gear. The study registered interactions with sea turtles in 131 sets (a 14.13 % of the total monitored sets). Of the total number of turtles registered on board, the 88.59 % were released alive, although some having minor injuries or still carrying hooks, while the 11.41% of the specimens were released with serious injuries. An additional research focused on the use of C15 type hooks in Muisne along the period from 2013 to 2014 has proved the low incidence of turtles in the fishery. Based on all the previous information, the continuity of the observer program and the analysis of the data collected, Milestone 26 can be considered as completed (see Table 15 below).

Key stakeholders	WWF – EPESPO – SRP – CONSORTIUM OF EXPORTING COMPANIES – General Artisanal Fishery Sector
Priority	Low
Status	Behind
Timeframe	Ongoing
MSC PI(s)	2.3.1 ETP species outcome 2.3.3 ETP species information

Table 15. Milestones for the completion of Action 4.7

	Commencing	Ending	Status (May 2018)
Milestone 24: Statistical robustness analysis (shared with Action 3.3)	Quarter 1 2014	Quarter 4 2014 (Update: Quarter 3 2018)	Behind
Milestone 26: Estimate sea turtle catch rate/mortality at fleet level (shared with Action 3.3)	Quarter 1 2014	Quarter 4 2014	Completed

4.8 OFCF research cruises

This action was already considered as complete during the previous update of the Action Plan in 2014. The video, outcome for this action, it is being used as a tool for training fishermen on sea turtles handling.

Key stakeholders	OFCF – SRP – FENACOPEC – General Artisanal Fishery Sector – CONSORTIUM OF EXPORTING COMPANIES – EPESPO – IATTC – WWF
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	2.3.1 ETP species outcome 2.3.2 ETP species management strategy 2.3.3 ETP species information

5 Education and outreach

Education and dissemination of information to stakeholders is a key factor in order to move the fishery towards sustainability. The impact of a relevant communication strategy, as well as the training programs in areas such as bycatch reduction or regulation compliance, is a transversal element for the three Principles of the MSC Fisheries Standard. All the defined actions for education and dissemination were labelled as complete at the FIP Action Plan update conducted in 2014. However, they are included as well in this report in order to highlight the importance of its continuity.

5.1 Develop a communications strategy

It is crucial to assess the communication strategy in order to highlight weaknesses and define possible improvement actions.

Key stakeholders	SRP
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information 3.2.3 Compliance and enforcement

5.2 Program to educate fishermen on resource state, changes in fishery, etc.

The SRP has noted that no further dissemination or training activities have been conducted in fishing communities over the last years.

Key stakeholders	SRP – INP – NGOs (WWF, CI) – General Artisanal Fishery Sector – CONSORTIUM OF EXPORTING COMPANIES – EPESPO
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	1.2.3 Information and monitoring 3.2.3 Compliance and enforcement

5.3 Program to educate fishermen on bycatch reduction

The SRP has noted that no further dissemination or training activities have been conducted in fishing communities over the last years.

Key stakeholders	SRP – INP – NGOs (WWF, CI) – General Artisanal Fishery Sector – CONSORTIUM OF EXPORTING COMPANIES – EPESPO
Priority	Completed
Status	Completed
Timeframe	Ongoing
MSC PI(s)	2.2.3 Secondary species information 3.2.3 Compliance and enforcement

5.4 Incorporate new education and outreach initiatives into existing compulsory programs

There is no evidence about the inclusion of further dissemination or training initiatives to the existing programs.

Key stakeholders	SRP – INP – General Artisanal Fishery Sector – Ecuadorian Navy – WWF – EPESPO
Priority	Completed
Status	Completed
Timeframe	Completed

MSC PI(s)	3.1.2 Consultation, roles and responsibilities 3.2.3 Compliance and enforcement

6 Management and governance

An effective management system and adequate governance to the size and scale of the fishery are crucial to ensure the long term sustainable use of the resource. The actions included in this section are aimed to contribute to the improvement of participatory mechanisms within the fishery, the development of an integrated international management system, as well as its compliance and the regular evaluation of its performance.

6.1 Develop strategic research plan for mahi

The definition of a research program for the mahi mahi, included in the National Plan for Fisheries Research of 2012 and aimed to generate information and knowledge to support the management measures of the mahi mahi fishery, completes this action. The program establish several research areas relative to understand the genetic structure of the mahi mahi stock, the relationship between species abundance and environmental factors, as well as to develop gear modifications to reduce bycatch and the capture of mahi mahi specimens below the minimum size.

In order to address the various research components for the mahi mahi, it has been proposed to include the SRP's technical teams in the existing scientific collaboration agreement between the INP and Peru's IMARPE (linked to that stated in Action 1.8). The aforementioned could be the basis to suggest contacts with IATTC's scientific staff in order to get a deeper understanding of all the information requirements for the mahi mahi and, subsequently, design a joint research plan.

Key stakeholders	INP – SRP – General Artisanal Fishery Sector – IMARPE – IATTC
Priority	Medium
Status	Updated – New milestones added
Timeframe	Next PAN Dorado update – Ongoing
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

Table 16. Milestones for the completion of Action 6.1

	Commencing	Ending	Status (May 2018)
Milestone 34: Strategic plan developed for PAN Dorado	Quarter 1 2014	Next PAN Dorado update	Completed
Milestone 35: Include the SRP in the scientific collaboration agreement between Peru and Ecuador	Quarter 2 2018	Quarter 3 2018	Not started
Milestone 36: Design an international	Quarter 3 2018	Quarter 2 2019	Not started

research plan for the mahi mahi			

6.2 Evaluate options to develop international agreement on shared stocks

This action was already considered complete in the FIP Action Plan review conducted in 2014. Since then, the governments of Peru and Ecuador have discussed with IATTC about options to develop an international agreement for shared stocks. The MSE undertaken by IATTC's scientific staff in 2016 outlined different approaches for the design of an international management framework for the mahi mahi in the EPO. Furthermore, Ecuador has defined a roadmap for the implementation of a Binational Action Plan for the mahi mahi fishery (see Action 6.11).

Key stakeholders	SRP – INP – NGOs (WWF, CI) – MRAG
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	3.1.1 Legal and/or customary framework 3.1.2 Consultation, roles and responsibilities 3.1.3 Long term objectives 3.2.1 Fishery specific objectives 3.2.2 Decision-making processes 3.2.3 Compliance and enforcement 3.2.4 Monitoring and management performance evaluation

6.3 Describe decision-making processes

Within the framework of the PAN Dorado and through the Ministerial Agreement no. 055 of 2011, it was agreed to implement an Advisory Council comprised of the administration, fishermen, exporting companies, as well as the INP, WWF and EPESPO as advisory bodies. The main target of the council is to advise the Ministry of Aquaculture and Fisheries on the definition of strategies and policies to strengthen the sustainable management of the mahi mahi. Additionally, the Advisory Council is responsible for the evaluation of the progress of the plan, as well as the implementation of measures for its adequate development. However, this governing body of the PAN Dorado has not been formally established thus far. The VMAP presented a report in March 2014 describing the general process to generate policies and regulations, as well as to reach agreements, within the Ecuadorian fisheries sector. The report completes the single milestone defined for Action 6.3 (Milestone 37; see Table 17 below).

In a way, the FIP structure has served as a consultation, discussion and proposal submission forum relative to the management of the mahi mahi and its fishery in Ecuador. However, in order to reach a full pass for the PI 3.2.2 within a MSC full assessment process, the assessors will require information about the existence (when was it established?; is it there information available about previous meeting?), organization (which actors and organizations participate in the council and what are their roles?) and operation (how and when is it summoned?; which are the consultation procedures?; are there management proposals defined within its framework?; does the fishing authorities consider those proposals?; does the council monitors the performance of the management?; etc.) of the Advisory Council. The governance schemes of the mahi mahi fishery are going to undergo an analysis through the development of two projects funded by GEF (within the *Coastal Fisheries Initiatives* and *Large Marine Commodities* programs). Additionally, those two

projects aim to create a steering committee for the FIPs currently implemented for the species in the region (in Ecuador and Peru), as well as to redesign the governance system of Ecuador artisanal mahi mahi fishery. The objective is to create dialogue roundtables for the resource, with a clear organizational chart of responsibilities, acting as both advisory and decision-making bodies. There have been added two new milestones for Action 6.3 (see Table 17 below) to monitor the development of the activities mentioned above.

Key stakeholders	SRP – INP – FENACOPEC – General Artisanal Fishery Sector – CONSORTIUM OF EXPORTING COMPANIES
Priority	Medium
Status	Ongoing – New milestones added
Timeframe	From Quarter 2 2018 to Quarter 4 2018
MSC PI(s)	3.2.2 Decision-making processes

Table 17. Milestones for the completion of Action 6.3

	Commencing	Ending	Status (May 2018)
Milestone 37: Report on Advisory Council and decision-making of the fishery	Quarter 1 2014	Quarter 2 2014	Completed
Milestone 38: Organization and operation plan for the Advisory Council of the PAN Dorado	Quarter 2 2018	Quarter 4 2018	Ongoing
Milestone 39: Evaluation of the Advisory Council of the PAN Dorado	Quarter 4 2018	Quarter 1 2019	Not started

6.4 Improve co-ordination between monitoring and enforcement

Action 6.4 was noted as complete during the FIP Action Plan update carried out in 2014. During workshop held in Manta in 2018 to evaluate the progress of the FIP, the DCRP highlighted the increase in the number of inspectors from 84 in 2014 to the current 220, who carry out their daily tasks at the international ports and the landing areas for single fiberglass vessels.

Despite the high compliance levels stated for the fishery, the 2016 Annual Technical Report presented by the SRP to the SENPLADES notes that the samples collected at landing sites in fishing locations of Esmeraldas and Manta registered a 44 % of mahi mahi specimens below the minimum landing size for its commercialization. If confirmed, it will be necessary to review the current control and sanction systems, as well as to promote a better understanding of the regulations among fishermen.

Key stakeholders	SRP – INP – FENACOPEC – General Artisanal Fishery Sector – Ecuadorian Navy – EPESPO – CONSORTIUM OF EXPORTING COMPANIES
Priority	Completed
Status	Completed

Timeframe	Completed
MSC PI(s)	3.2.3 Compliance and enforcement

***Actions 6.5 & 6.6 have been removed** (see Annex 1)

6.7 Revise internal and external review of the management systems

The objectives for this action were deemed as reached based on the index spreadsheet presented by the SRP to the SENPLADES in 2014. Furthermore, in 2016 the SRP presented to the SENPLADES an already filled technical report. A formalized Government by Results process, which provides advice to perform changes that are taken into account, may be considered as a framework for internal (if, as currently operates, the SRP undertakes the main part of the analysis and it also involves the Advisory Council of the PAN Dorado) or external (if the SENPLADES conducts the evaluation throughout the process) evaluation.

The independent evaluation of the PAN Dorado through auditors, planned to be undertaken within the framework of one of the GEF funded projects, would allow to meet the occasional external reviews requirement for the PI 3.2.4. The full implementation of the Advisory Council for the PAN Dorado (considered in Milestone 39; see Tables 17 and 18), whose responsibilities include to carry out annual evaluations of the plan, is a necessary step towards obtaining evidence of internal revisions.

Key stakeholders	SRP – INP – NGOs (WWF, CI)
Priority	Medium
Status	Updated – New milestones added
Timeframe	From Quarter 2 2018 to Quarter 4 2018
MSC PI(s)	3.2.4 Monitoring and management performance evaluation

Table 18. Milestones for the completion of Action 6.7

	Commencing	Ending	Status (May 2018)
Milestone 39: Evaluation of the Advisory Council of the PAN Dorado (shared with Action 6.3)	Quarter 4 2018	Quarter 1 2019	Not started
Milestone 40: Formalization of the Government by Results process	Quarter 2 2018	Quarter 4 2018	Not started
Milestone 41: Undertake an external audit (GEF project)	Quarter 4 2018	Quarter 1 2019	Not started

6.8 Develop timelines, budget and indicators in the mahi action plan

The PAN Dorado update of 2013 allowed to highlight this action as complete in the FIP Action Plan update of 2014.

Key stakeholders	SRP – INP – FENACOPEC – General Artisanal Fishery Sector – NGOs (WWF, CI) – CONSORTIUM OF EXPORTING COMPANIES
Priority	Completed
Status	Completed
Timeframe	Completed
MSC PI(s)	3.1.3 Long term objectives 3.2.1 Fishery specific objectives 3.2.4 Monitoring and management performance evaluation

6.9 Incorporate an ecosystem management strategy into mahi National Plan

A PAN Dorado update is planned to be carried out through the implementation of the GEF funded project of the *Coastal Fisheries Initiative* program, which is expected to start along 2018. Among other aspects, the update would include the introduction of an explicit ecosystem management strategy in the plan. The development of this activity is linked as well to the results of Actions 3.4 and 3.5, the IATTC *Ecosystem Considerations* (2016) document and the review of ecosystem models.

Key stakeholders	SRP – INP
Priority	Medium
Status	Ongoing
Timeframe	Next PAN Dorado update – Ongoing
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

Table 19. Milestones for the completion of Action 6.9

	Commencing	Ending	Status (May 2018)
Milestone 42: Explicit ecosystem management strategy in next PAN Dorado	Quarter 1 2014	Next PAN Dorado update	Ongoing

6.10 Establish National Plan of Action for mahi

The PAN Dorado was created by the Ecuadorian Government in February 2011 (Ministerial Agreement no. 023, Article 1) as a conservation and management tool for the species and its fishery at the national level. The mentioned plan was updated in 2013.

Key stakeholders	SRP – INP – FENACOPEC – FENACOPEC – General Artisanal Fishery Sector – EPESPO – CONSORTIUM OF EXPORTING COMPANIES – NGOs (WWF, CI)
Priority	Completed
Status	Completed
Timeframe	Completed

MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.2 ETP species management strategy 2.3.3 ETP species information 2.5.2 Ecosystem management strategy 2.5.3 Ecosystem information 3.1.1 Legal and/or customary framework 3.1.2 Consultation, roles and responsibilities 3.1.3 Long term objectives 3.2.1 Fishery specific objectives 3.2.2 Decision-making processes 3.2.3 Compliance and enforcement 3.2.4 Monitoring and management performance evaluation

6.11 International Management Agreement for mahi mahi

Since the last update of the FIP Action Plan conducted in 2014, when Action 11 was defined, significant progress has been achieved towards the implementation of an international management system for the mahi mahi in the EPO. Three technical meetings on mahi mahi have been held at the regional level within the framework of the IATTC (Milestone 44), which led to the development of a stock assessment and a management strategy evaluation for the mahi mahi in the Southern EPO. Currently, IATTC has been given the mandate from the member States to proceed with the development of reference points and HCRs for the mahi mahi stock in the Eastern Pacific.

To date, Ecuador and Peru have held three technical workshops (Milestone 43) to discuss different topics relevant to the joint management of the mahi mahi. Currently, there is a roadmap to implement a Binational Action Plan for the fishery and the VMAP formally required its Peruvian counterpart to hold a bilateral meeting at the beginning of 2018 to address the matter. Additionally, the design of a Bilateral Action Plan between both countries was about to be discussed during the 4th Binational Workshop to be held in May 2019 in Piura, Peru. Recent changes of Peru Government are delaying the development of this activity.

As noted in the MRAG report for recommendations on minimum levels of international management (Trumble, 2014; see Milestone 45), MSC requires the existence of cooperation agreements for management between countries that fish on a given straddling stock. In the case of the mahi mahi, given that Ecuador and Peru represent most of the catches registered in the EPO, both countries could agree on a joint harvest strategy even if the remaining coastal States do not participle in the agreement. The development and implementation of harvest control rules by IATTC would complete the design of a regional management for the mahi mahi.

Key stakeholders	SRP – INP – FENACOPEC – General Artisanal Fishery Sector – EPESPO – CONSORTIUM OF EXPORTING COMPANIES – NGOs (WWF, CI)
Priority	High
Status	Ongoing
Timeframe	Ongoing until completed
MSC PI(s)	1.2.3 Information and monitoring 2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

	3.1.1 Legal and/or customary framework 3.1.2 Consultation, roles and responsibilities 3.1.3 Long term objectives 3.2.1 Fishery specific objectives 3.2.2 Decision-making processes 3.2.3 Compliance and enforcement 3.2.4 Monitoring and management performance evaluation

Tabla 20. Milestones for the completion of Action 6.11

	Commencing	Ending	Status (May 2018)
Milestone 43: Bilateral workshop with Peru	Quarter 1 2014	Quarter 3 2014	Completed
Milestone 44: Discussion at international workshop	Quarter 1 2014	Quarter 4 2014	Completed
Milestone 45: Evaluate level of international agreement needed (e.g. EU mackerel fishery)	Quarter 1 2014	Quarter 2 2014	Completed
Milestone 46: International agreement	Quarter 1 2014	Until completion	Ongoing

Summary and next steps

Since the previous FIP review conducted in 2015, the fishery has achieved significant progress at both the national and international levels. Notably, Ecuador has completed most of the actions that are its solely responsibility. It is worth highlighting the effort invested on the development of CPUE series, which were the basis for the stock assessment undertaken by IATTC in 2016 Furthermore, there has been a reinforcement of the data collection processes for target and associated species, the observer program, the port inspections, as well as all the other elements that form the harvest strategy of the fishery at the national level. The SRP regularly monitors the impact of the fishery on non-target species, mainly sharks and sea turtles, allowing the addition of measures within the management system to reduce the risk posed by the fishery for the mentioned species. However, there are areas relative to the organization and performance of consultation and decision-making processes within the fishery (see Action 6.3), as well as the mechanisms to evaluate the mahi mahi management system (see Action 6.7), where Ecuador could achieve further progress.

At the international level, the quantitative stock assessment for the mahi mahi in the Southern OPO conducted by IATTC represents a significant step towards a MSC full assessment process. However, it is still required to define reference points relative to B_{MSY} or a similar productivity level, which allow to draw conclusions on the stock status, as well as the implementation of harvest control rules that provide a responsive management to changes in the mentioned stock status (see Actions 2.8 and 2.9). The definition of reference points and the implementation of harvest control rules, for the

regional management of the mahi mahi, would allow the possibility to consider the inception a MSC full assessment process.

Additionally, it is advisable for the FIP managers to prioritize the work towards achieving an integral management for the mahi mahi fisheries in Peru and Ecuador through the implementation of a binational action plan in line with the elements prescribed within the PAN Dorado (encompassing aspects such as the harvest strategy, data collection and analysis, the enforcement, etc.). Either way, greater coordination between the FIPs developed in both countries for their mahi mahi fisheries would contribute decisively to avoid duplication and create synergies in order to achieve the shared objectives.

Annex 1: Actions removed in previous Action Plan updates

1.2 Parasite analysis

Low likelihood of success led to dropping this Project in 2014.

Key stakeholders	INP – SRP
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	1.2.3 Information and monitoring

2.3 Length-based assessment

This action was removed because length-based assessment methods were not used in the final stock assessment carried out by IATTC. However, it is highlighted to use the mentioned methods in case others do not provide sufficient robustness to meet the MSC requirements and to provide the link to B_{MSY}.

Key stakeholders	SRP – IATTC
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

2.4 Egg-size assessment

As egg-size data do not appear to be useful as a component of the efforts to determine stock status, this action was removed from the FIP Action Plan during the 2014 update.

Key stakeholders	INP – SRP
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	1.1.1 Stock status 1.2.2 Harvest control rules and tools 1.2.4 Assessment of the stock status

4.1 Determine bycatch levels for fibras fishing with nets

Once it was decided that the FIP would focus on the longline fishery, this action was removed. However, there is a report carried out by the INP and CI in 2011 that provides information about the bycatch levels of various species in the floating gillnet fishery in the Santa Rosa de Salinas cove.

Key stakeholders	INP – CI
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	1.2.3 Information and monitoring

	2.2.3 Secondary species information 2.3.3 ETP species information 2.5.3 Ecosystem information

4.5 Manufacture circle hooks at national level

This action was removed in the 2014 update it was impractical given the relatively small demand of hooks expected and the high cost of tooling up for manufacturing.

Key stakeholders	SRP – Metal industry
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	2.3.1 ETP species status 2.3.2 ETP species management strategy 2.3.3 ETP species information

6.5 Identify new schemes for co-management

This action was combined with Action 6.3 in 2014.

Key stakeholders	SRP – INP – FENACOPEC – General Artisanal Fishery Sector – Ecuadorian Navy
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	3.2.3 Compliance and enforcement

6.6 Develop and implement Code of Responsible Fishing

This action was combined with Action 5.1 in 2014 as part of the overall communications strategy.

Key stakeholders	SRP – FENACOPEC – General Artisanal Fishery Sector
Priority	Removed
Status	Removed
Timeframe	Removed
MSC PI(s)	3.2.3 Compliance and enforcement

Annex 2: Update of proposed actions for 2018 for Ecuador mahi mahi FIP Action Plan

ACTION	KEY STAKEHOLDERS	ORIGINAL TIMEFRAME 2014	STATUS / NEW TIMEFRAME	Ongoing work	New additional work	Link to MSC PIs									
						P1				P2			P3		
						1.1.1 Stock status	1.2.1 Harvest strategy	1.2.2 Harvest control rules and tools	1.2.3 Information and monitoring	1.2.4 Assessment of stock status	2.3.3 ETP species information	2.5.2 Ecosystem management strategy	2.5.3 Ecosystem information	3.2.1 Fishery specific objectives	3.2.2 Decision-making processes	3.2.4 Monitoring and management performance evaluation
1. Definition of the stock															
1.1 Genetic analysis	SRP	Completed	Completed												
1.2 Parasite analysis	INP - SRP	Removed	-												
1.3 Otolith micro-elemental analysis	INP - SRP	October 2014	September 2018	✓	✓				M						
1.4 Training national technicians	INP - SRP	Completed	Completed	✓											
1.5 National mahi mahi workshop (genetics, stock assessment & status, biological characteristics, monitoring)	INP – SRP – WWF – Cooperatives	Completed	Completed	✓											
1.6 International mahi mahi workshop (genetics, stock assessment & status, biological characteristics, monitoring)	IATTC – INP – SRP – WWF – CEDEPESCA	October 2014	Completed	✓											
1.7 Define Practical Stock Unit	INP – SRP – WWF – IATTC	2014	Completed												
1.8 Bilateral technical workshop with Peru	INP - SRP - IMARPE	August 2014	Updated	✓	✓	H		H	H	H				H	H
2 Stock status and abundance indices															
2.1 VPA evaluation	INP - SRP	Inactive/Long-term	Removed												
2.2 Develop CPUE series (index of abundance / status of resource)	SRP - IATTC	Completed	Completed	✓											
2.3 Length-based assessment	SRP - IATTC	Removed	-												
2.4 Egg-size assessment	INP - SRP	Removed	-												
2.5 Literature review on mahi mahi assessment and management	INP - SRP - IATTC	November 2014	Completed												
2.6 Ageing	SRP - CICIMAR	June 2014	Completed												
2.7 5-95 Percentile analysis	IATTC - SRP	July 2017	Completed												
2.8 Definition of reference points consistent with BMSY and HCRs development	IATTC - SRP	July 2017	June 2019	✓	✓	H	H	H		H					
2.9 Development of an abundance index (CPUE) to implement responsive measures for effort limitation	SRP (IATTC - IMARPE)	New action	January 2019		✓	M	M	M							
3 Monitoring and evaluation															
3.1 Characterization of Ecuadorian artisanal mahi mahi fishery	INP - SRP	Completed	Completed												
3.2 Development and training for observers	SRP - INP	Completed	Completed	✓											
3.3 Design a mahi mahi observer program	SRP - INP - Stakeholders	December 2014	Enero 2019	✓	✓				M		M	M			
3.4 Literature review of pelagic ecosystems	SRP – IATTC – NGOs (CI, WWF)	November 2015	Completed												
3.5 Review of ecosystem/trophic models	SRP – INP – IATTC (IMARPE)	Inactive/Long-term	October 2018		✓								M		
4 Turtle bycatch reduction															
4.1 Determine bycatch levels for fibras fishing with nets	INP - CI	Completed/Removed	-												
4.2 4.2 Implement and confirm turtle handling procedures	SRP – WWF – CONSORTIUM – EPESPO – OFCF – FENACOPEC – Fishery sector	Completed	Completed	✓											
4.3 Conversions of longline fishery to circle hooks	SRP – OFCF – CONSORTIUM – Fishery sector – WWF – CI – EPESPO	Partially completed	Partially completed	✓	✓						M				
4.4 Eliminate tariffs on circular hooks	SRP – WWF – COMEX	Completed	Completed												
4.5 Manufacture circle hooks at national level	SRP – Metal industry	Removed	-												
4.6 Project 'T' to prevent entanglement of turtles	SRP – OFCF – WWF – CONSORTIUM – Fishery sector	June 2016	October 2019	✓							M				
4.7 Long-term monitoring of turtle interactions	WWF – EPESPO – SRP – CONSORTIUM – Fishery sector	December 2014	September 2018	✓							M				
4.8 OFCF research cruises	OFCF – SRP – FENACOPEC – Fishery sector – CONSORTIUM – EPESPO – IATTC – WWF	Completed	Completed												
5 Education and outreach															
5.1 Develop a communications strategy	SRP	Completed	Completed	✓											
5.2 Program to educate fishermen on resource state, changes in fishery, etc.	SRP – INP – NGOs (WWF, CI) – Fishery sector – CONSORTIUM – EPESPO	Completed	Completed	✓											
5.3 Program to educate fishermen on bycatch reduction	SRP – INP – NGOs (WWF, CI) – Fishery sector – CONSORTIUM – EPESPO	Completed	Completed	✓											
5.4 Incorporate new education and outreach initiatives into existing compulsory programs	SRP – INP – Fishery sector – Ecuadorian Navy – WWF – EPESPO	Completed	Completed												
6 Management and governance															
6.1 Develop strategic research plan for mahi	INP – SRP – Artisanal sector – IMARPE – IATTC	Update in PAN Dorado	Update in PAN Dorado	✓	✓				M		M		M		
6.2 Evaluate options to develop international agreement on shared stocks	SRP – INP – NGOs (WWF, CI) – MRAG	Completed	Completed												
6.3 Describe decision-making processes	SRP – INP – FENACOPEC – Artisanal sector - CONSORTIUM	June 2014	November 2018	✓	✓										M
6.4 Improve co-ordination between monitoring and enforcement	SRP – INP – FENACOPEC – Artisanal sector – Ecuadorian Navy – EPESPO - CONSORTIUM	Completed	Completed												
6.5 Identify new schemes for co-management	SRP – INP – FENACOPEC – Articanal sector – Ecuadorian Navy	Removed	-												
6.6 Develop and implement Code of Responsible Fishing	SRP – FENACOPEC – Artisanal sector	Removed (incluided in A5.1)	-												
6.7 Revise internal and external review of the management systems	SRP – INP – NGOs (WWF, CI)	Completed	Reopened/December 2018	✓	✓										M
6.8 Develop timelines, budget and indicators in the mahi action plan	SRP – INP – FENACOPEC – Artisanal sector – NGOs (WWF, CI) – CONSORTIUM	Completed	Completed												
6.9 Incorporate an ecosystem management strategy into mahi National Plan	SRP - INP	Update in PAN Dorado	Update in PAN Dorado	✓					M		M		M		
6.10 Establish National Plan of Action for mahi	SRP – INP – FENACOPEC – Artisanal sector – EPESPO – CONSORTIUM – NGOs (WWF, CI)	Completed	Completed												
6.11 International Management Agreement for mahi mahi	SRP – INP – FENACOPEC – Artisanal sector – EPESPO – CONSORTIUM – NGOs (WWF, CI)	New action in 2014	Until completed	✓					H		M		M	H	H	H

*A=high priority, M=medium priority, from FIP scoping document. All activities for a given PI generally have the same priority. However, in some cases actions received different priorities based on its relevance for the improvement of the indicator's score.