ECUADOR MAHI MAHI (CORYPHAENA HIPPURUS)

LONGLINE FISHERY

PRELIMINARY DRAFT REPORT

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Prepared by: **BUREAU VERITAS IBERIA**

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Client:
Propemar S.A., Mardex
MARISCOS DE EXPORTACION S.A., FRIGORIFICO Y LABORATORIO SAN MATEO, FRIGOLAB SAN MATEO CIA. LTDA., Ocean Fish, Transmarina C.A., FRESH FISH DEL ECUADOR CIA. LTDA., FRIGOLANDIA S.A.

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Executive Summary

The Client Group includes the fleet working for 7 Limited Fishing Companies: Propemar S.A., Mardex MARISCOS DE EXPORTACION S.A., FRIGORIFICO Y LABORATORIO SAN MATEO, FRIGOLAB SAN MATEO CIA. LTDA., Ocean Fish, Transmarina C.A., FRESH FISH DEL ECUADOR CIA. LTDA., FRIGOLANDIA S.A. The aforementioned companies signed a Memorandum of Understanding to put together a consortium of Mahi mahi export companies in order to undertake the mahi mahi fishery MSC certification.

This Preliminary Draft Report (PDR) provides details to the client on the outcome of the assessment of the Ecuador Mahi mahi Longline Fishery against Version 2.0 of the MSC Fisheries Certification Requirements (1st October 2014). The assessment team used the default assessment tree (SA) without adjustments. The MSC Full Assessment Reporting Template V2.0 (issued by MSC on the 8th October 2014) was used as basis for this report.

This report was prepared by Bureau Veritas Iberia. The assessment team for this fishery was comprised by Luis Ambrosio (external assessor who acted as team leader, expert covering Principle 3 and local knowledge of the fishery and country), Carola Kirchner (covering external assessor covering Principle 1) and Gemma Quílez-Badia (expert covering Principle 2). A short BIO of each of them can be found in Section 2.

The fishery started the MSC certification process in February 2019, following the publication of the official announcement and the timeline at the MSC website. Previously, the client had performed a FIP (https://fisheryprogress.org/fip-profile/ecuador-mahi-mahi-longline).

Between May 21 and 24, 2019 the assessment team visited Manta and Puerto Pesquero Artesanal de San Mateo, Ecuador in order to meet with managers, scientists and fishers' representatives to discuss and gather information on the assessed fishery. After the site visit, the team compiled and analysed the information collected and, when necessary, additional information was requested to the stakeholders. Each expert prepared their respective draft scores and rationales, and then all the team discussed and weighed up the evidences for assigning the final scores. Detailed scoring rationales are provided in Appendix 1.

During the assessment process (prior and post the site visit), a couple of issues regarding the use of RBF for PI 1.1.1 and PI 2.2.1 were raised (see Section 4.4.4 for further details). These are summarized below:

RBF issue:

RBF for PI 1.1.1

During the pre-assessment (January 2010) of the Ecuador Mahi Mahi it was noted that there was little known about the biology and the fishery of this species. For this reason, the assessment team (MRAG, 2010) found that the status of the mahi mahi stock was unknown in relation to limit reference points or proxy values. Even though a significant amount of new, then recent, information had been collected on the biological characteristics and

fishing operations of the Ecuador fleet, the data was not sufficient to be used in a formal stock assessment and therefore the risked based approach was conducted.

For this full assessment, considering the above and following MSC rules (PF2.1.1) the Bureau Veritas team was uncertain whether the RBF should be followed and, therefore, announced the "Use of the RBF in a fishery assessment form" on the MSC website on the 26th of February, 2019, to ensure at least 30 days for stakeholder consideration.

Since then, after a desk top research analysis, it was found that a formal stock assessment was conducted in 2016 and that although no formal reference points had been adopted, certain management quantities (B0, MSY, Bsp) had been estimated, therefore, proxy reference points could be determined. Also, following the FIP, the collecting of biological characteristics and data on fishing operations continued to be collected, therefore, it cannot be said that this fishery is data deficient and, therefore, no longer qualifies to be evaluated using the RBF approach.

RBF for PI 2.2.1

At the time of the site visit (21-24 May, 2019), the team had only the UoA catch data from 2013 to 2015 in number of individuals. With those data, two of the shark species (the pelagic thresher shark, *Alopias pelagicus* and the blue shark, *Prionace glauca*) were classified as 'Minor'.

However, during the assessment process, once the team received the UoA catch data from 2013 up until 2017 and in metric tons (and not just from 2013 to 2015 in number of individuals, as it was originally received), they were reclassified as 'Main' (see **Table 3.4.2.2.1**).

Since stock status reference points are not available (either derived from analytical stock assessments or using empirical approaches) for neither of these two species to be assessed against P2, the fishery was considered to be data-deficient with respect to PI.2.2.1, according to FCR 7.7.6 and Table 3 of MSC FCR v2.0. Therefore, the use of the RBF tool was recommended and announced on the MSC website on 26th of November, 2019. Thus, as per MSC FCR 7.3.4.1 Bureau Veritas Certification opened a 30 calendar day consultation period to provide stakeholders the opportunity to submit any new information in relation to this fishery.

The team was going to conduct the RBF (either onsite or offsite), however, due to the decision of the client to not continue with the certification process, the RBF was never carried out. Therefore, and in order to be able to have a preliminary score for P2, the assessment for these two species was carried out as a "desk-approach" RBF, using only the information available to the team, and not being able to take into account the multi-stakeholder approach of the RBF. The results obtained for these two species, therefore, are preliminary.

The **main strengths of the client's operations** are listed below:

Principle 1

i. Based on the existing information on stock status, the assessed mahi mahi stock is considered to be above the PRI and fluctuates around a level consistent with MSY.
ii. There are a robust and precautionary harvest strategy and well defined and effective harvest control rules in place.
iii. There are sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.

Principle 2

i. Once the UoA catch data in metric tons from 2013 up until 2017 were received by the team, we could observe that they were gathered thoroughly and in detail.

ii. The fishery does not interact directly with any benthic habitat. In addition, collection of proper and adequate information continues to be carried out.

Principle 3

i. Ecuador's existing general legal framework is generally effective and consistent with the objectives of the MSC for Principle 1 and 2.
ii. There is a well articulated decision-making process for the fishery that takes into account all parts of the management system.
iii. Ecuador has been working on improving the fishery for several years and there are evident management results through specific regulations such as PAN DORADO.

On the other hand, the **main weaknesses of the client's operations** are detailed herein:

Principle 1

i. The Exploratory Stock Assessmente took place in 2016. It has not been conducted since then and it is not known when it will be conducted again by the IATTC.
ii. There is no coordination between the scientists of IMARPE (Peru) and INP (Ecuador) to work in a coordinated manner in the knowledge of the Stock and in homogenizing harvest strategies and harvest control rules in the fishery
iii. There is not a high degree of certainty that the stock is still fluctuating around a level consistent with MSY in 2019

Principle 2

i. As explained above, at the time of the site visit (21-24 May, 2019), the team had only the UoA catch data from 2013 to 2015 in number of individuals. During the assessment process, the team asked for more recent data and data in metric tons. Once the team received such data, the P2 species classification changed and two shark species (the pelagic thresher shark, *Alopias pelagicus* and the blue shark,

Prionace glauca) were classified as Main Secondary (see **Table 3.4.2.2.1**), which triggered the RBF announcement on the MSC website on 26th of November, 2019.

ii. Regarding Main Primary species, several issues were found: (a) the high percentage of blue marlin catches in 2016 (i.e., 14.47%, **Table 3.4.2.1.1**); (b) the fact that the national management measures are not specific for silky sharks; (c) that even Executive Decree 486 (on Shark fishing, trading and export) in its Art 6 states that those who, during the exercise of the fishing activity, catch sharks as the sole and exclusive product of bycatch, may trade and use their meat entirely; (d) that silky sharks are listed in the Shark's MoU of the CMS since 2016; and (e) that the UoA silky shark percentage catch in 2016 amounted to almost 2.3% (**Table 3.4.2.1.1**).

iii. Regarding Main Secondary species, also several issues were found: (a) the extremely high % catch of pelagic thresher and blue shark in 2016, i.e., 28.5% (even higher than the target species, mahi mahi, whose percentage catch that year was only 28.38%) and 10.42%, respectively; (b) Art 6 of Executive Decree 486 (on Shark fishing, trading and export) that allows shark's trade and the use their meat entirely; and (c) the observer coverage of 10%, which, in addition to be only based on number of trips of the mothership vessels and not the whole fleet (i.e., not including the fiberglass vessels associated to a mothership), it is not following the MSC guidance (FCR v2-0, GSA3.6.3) regarding observer coverage which states that for species that are highly variable, clumped in distribution and/or relatively rare (which is the case for minor species and for the two shark species classified as), higher levels of observer coverage are needed (i.e., 20%).

iv. In 2016, *C. hippurus* catch was only 28.38% of the total UoA catch for that year, while 28.50% was *Alopias pelagicus* (the pelagic thresher shark). In fact, 42.47% of the catch that year was of several shark species and 27.54% of other apex fish species (including several tuna species, marlins or swordfish). This high percentage of catches of top predators (other than the target species) can have top-down trophic implications.

Principle 3

i. Short- and long-term objectives are not defined in a quantifiable way that can be measured and evaluated in time.
ii. There is no effective cooperation with Peru for the management of the joint fishery and since the portion of mahi mahi that Peru extracts is much larger than that of Ecuador, Peruvian management may undermine Ecuador's interest in it.
iii. The Ecuadorian regulations in force, up to the date of the audit, do not allow the fight against IUU fishing to be effective both in terms of capacity to act and because of the sanctions that are not very dissuasive
iv. There are deficiencies in fisheries research capacities in Ecuador that should be strengthened.
v. Peru catches are about 90% of the mahi mahi in the region so it is necessary to analyze the Peruvian management framework in the evaluation of the P3 MSC indicators. During the evaluation process, it was not possible for the team to contact

the Peruvian authorities and the fishing sector, nor to have relevant data on the capture and management of mahi mahi in Peru.

Traceability

i. The team could not confirm that the current traceability system of tracking and tracing the fish is sufficient to ensure that the product identified and sold by the fishery client comes from the Unit of Certification.
ii. The traceability table (**Table 5-1**) identifies several risk factors without mitigation measures established by neither the client nor the authorities.

The Ecuador Mahi mahi (*Coryphaena hippurus*) longline fishery could not achieve a weighted score of 80 or more for each of the three MSC Principles: **P2 and P3 do not reach a score of 80**. Scores allocated to default performance indicators are summarised in section 6.2.

The assessment team agrees that the assessed fishery DOES NOT COMPLY with the MSC Fisheries Principles and Crieria. Therefore, the fishery **FAILS** and **IT IS NOT RECOMMENDED TO AWARD THE MSC-FISHERY CERTIFICATE TO THIS FISHERY**.

As 15 PIs do not reach a score of 80 (see section 6.2), and in accordance to FCR 7.21.2, 15 conditions (see section 6.3 and Appendix 1.3) would have had to be opened to provide an indication of the actions that may have been required should the fishery have been certified.

1. Authorship and Peer Reviewers

The Team will be formed by:

- Luis Ambrosio, external assessor as team leader, P3 expert and local knowledge of the fishery and country.
- Carola Kirchner, external assessor as team member expert on P1
- Gemma Quílez, external assessor as team member expert on P2

LUIS AMBROSIO BLAZQUEZ, holds an MSc in Biology, Marine and Environmental Sciences from the University of Alicante, and Aquaculture science from the Spanish Institute (ICADE), Spain. Since 1989, he has worked as a consultant on fisheries, aquaculture and marine biosphere. In relation to Fisheries and Aquaculture, he has collaborated for different public administrations and private companies highlighting the work carried out for the General Secretariat of Marine Fisheries of Spain (SGPM) and focused, among other issues, on the extractive activity of fleets of community interest, to the control and monitoring of fishing activities, fishing subsidies, commercialization and improvement of quality of fishery products, environmental interactions of fishing and socioeconomic impact of fishing activity and illegal fishing. On the other hand, he has participated in cooperation projects and missions in the field of fisheries and aquaculture for the Spanish Agency for International Development Cooperation (AECID), United Nations Development Program (UNDP), Latin

American Organization for Fisheries Development (OLDEPESCA), International Labor Organization (ILO / ILO)and other international cooperation agents.

Regarding his work in the marine environment, it is worth highlighting those carried out for the Administration of the Government of Spain in charge of environmental matters, the Higher Council for Scientific Research and different Non-Governmental Organizations, especially WWF Spain, of which he was an advisor in issues of fisheries, aquaculture and marine protected areas. His field of work in this field has been based, among other issues, on the application of the Directive of European Habitats in the Marine Environment, the identification and characterization of Marine Protected Areas, socioeconomic studies linked to marine conservation, inventoried works of marine habitats and taxa included in International Directives and Agreements, as well as in the coordination of groups of experts for the selection and characterization of new Marine Areas to be protected.

For this assessment he will be the team leader and P3 expert.

Dr. CAROLA KIRCHNER. Dr Kirchner has been working in the field of fisheries for the last 24 years. Her highest qualification is a PhD. Her PhD focussed on the population dynamics and stock assessment of a linefish species. She also completed her MBA part-time through the University of Cape Town. Her research thesis focused on the Namibian hake fishery, where she not only indicated areas of resource rent loss, but also presented a new method of providing bio-economic advice to the fishing industry and management. Included in the thesis was an evaluation of Namibia's postindependence fisheries policies. Dr Kirchner worked for the Ministry of Fisheries in Namibia for 18 years, where she was responsible for the stock assessment and management advice for most commercial species (eg. Hake, Horse mackerel and Sardine). These fisheries differ vastly, from longlived species (Orange roughy) to the short-lived Sardine. Also, different gear types were used between these fisheries; bottom trawl, purse-seine and handline. Dr Kirchner has over the years built up international relationships, for example she was involved in the stock assessment and management of southern Atlantic Albacore tuna through ICCAT. Further, she worked for two years in the stock assessment and modelling section of the Secretariat of the Pacific Community (SPC).

There, her main role was to support the Parties of the Nauru agreement (PNA) members to maintain the compliance to the MSC certification, by evaluating reference points and harvest control rules. In addition, she was working on a regional bio-economic model that aims to evaluate and optimize the various fishing activities and includes all four major tuna resources in the Pacific as in Skipjack, Yellowfin, Bigeye and Albacore tuna.

Her 18 years at the Ministry of Fisheries and Marine Resources of Namibia and her work at the Secretariat of the Pacific Community ensure that she meets the qualification and competency criteria established in PC3 on (i) fish stock assessment, (ii) fish stock biology and (iii) fishing impacts on aquatic ecosystem. Furthermore, her experience in Namibian fisheries administration supports the qualification and competency criteria established in PC3 for (iv) fishery management and operations.

For this assessment she will be in charge of Principle 1 and, and with her experience as a practicing fisheries manager, she will collaborate with other team members on the report for the Principle 3.

Dr. GEMMA QUÍLEZ holds a Biology degree from Barcelona University (Spain), an MSc in Natural Resource Management from Leicester University (UK) and a PhD in Marine Biology from Newcastle upon Tyne University (UK).

She has around 20 years of experience working in Marine Biology, Marine Ecology, Marine Conservation Biology and Fisheries. In 1998, she did her MSc thesis on neritic and oceanic fish larvae from the Irish Sea. From 1999 to 2001 she worked at the ICM-CSIC (Marine Science Institute) of Barcelona (Spain) on trophic ecology of pelagic species larvae and participated in different oceanographic cruises on board the RV García del Cid. In 2004, while doing her PhD on Marine Invasive species, she was employed at the Fisheries Research Institute of Kavala, Greece, to conduct a study on trophic ecology of anchovy larvae. Also, during her PhD (2001-2006), she participated on several research cruises on board the RV Bernicia. Once she finished her PhD she went to work on marine invasive species for the Smithsonian Environmental Research Center (USA) until 2010.

From 2010 until 2016, she worked as fisheries policy officer for the Mediterranean Programme of WWF (World Wild Fund for Nature) in Barcelona, Spain. As such she worked on fisheries regional and international policy processes (e.g. GFCM, ICCAT, MedAC), mostly on Atlantic and Mediterranean bluefin tuna and at ICCAT, both at a scientific and policy level. She also participated in the creation and in the following functioning of the co-management committee of the Catalan sandeel fishery.

Since 2010 until present she has been working studying the biology, ecology and population dynamics of Atlantic and Mediterranean bluefin tuna and being deeply involved in the stock assessment of the species at ICCAT level.

In addition, from 2008 until 2018 she has been one of the two the Spanish representatives at two ICES working groups (WGBOSV - Working Group on Ballast and Other Ship Vectors, and WGITMO - Working Group on Introductions and Transfers of Marine Organisms).

Her experience (over 8 years) studying the biology, ecology and population dynamics of Atlantic bluefin tuna, deeply involved with ICCAT, as well as her previous work on trophic ecology of pelagic species larvae, proves her capacity to meet the qualification and competency criteria for PC3 (i) Fishing impacts on aquatic ecosystems. Her 6 years as WWF fisheries officer working on fisheries policy processes (mostly on Atlantic and Mediterranean bluefin tuna) and on the co-management of the Catalan sandeel, proves her capacity to meet the qualification and competency criteria for PC3 (ii)

Fishery management and operations. For this assessment she will be the expert on Principle 2.

In accordance to MSC FCR 7.8.3.4 Bureau Veritas Iberia has analyzed the experience of each team to determine that:

(i) The team has no conflict of interest in relation to the fishery under assessment

(ii) Each team member meets the qualification and competency criteria established in PC2. Explanation on how they meet the competence is provided in Appendix 1

The fishery team (as a whole) meets the qualifications and competency criteria established in PC3

2. Description of the Fishery

3.1. Unit(s) of Assessment (UoA) and Scope of Certification Sought

3.1.1 UoA and Proposed Unit of Certification (UoC)

The CAB confirms that the fishery is within the scope of the MSC fisheries certification sought as:

- It is a non-enhanced wild-capture fishery
- The fishery is not based on any introduced species
- There are no catches of non-target species that are inseparable or practically inseparable (IPI) from target stock
- It does not target species classified as 'out-of-scope' (amphibians, reptiles, birds, mammals)
- It does not make use of any kind of destructive practices
- Ecuador is member of the Inter-American Tropical Tuna Commission (IATTC), which is responsible for the conservation and management of tuna and other marine resources in the eastern Pacific Ocean. The evaluated fishery takes place both within Ecuador EEZ and international waters. Therefore, the fishery is not conducted under any controversial unilateral exemption to an international agreement.
- The Ecuadorian government created the PAN Dorado (National Action Plan for the mahi mahi) in February 2011 (Ministerial Agreement no. 023, Article 1). Among other things, its Advisory Council (Ministerial Agreement no. 055) is in charge of resolving disputes.
- Ecuador has been a member of the International Labour Organization (ILO) since 1934. The country has ratified 61 Conventions, of which 54 are in force, including the 8 fundamental Conventions, 3 Governance Conventions and 50 Technical Conventions. The CAB is not aware of any of the fishing operators included in the UoA having been prosecuted for forced labour in the last 2 years.
- As explained in section 4.1, harmonization with other certified IATTC fisheries is not applicable.
- The client carried out a pre-assessment in 2010 with MRAG. It is available in the following link: https://fisheryprogress.org/system/files/documents_assessment/Final%20Mahi%20Assessment%20Report%20-%20Revised%20by%20MRAG%20Jan%202010-FINAL.pdf;
- The fishery has not previously failed an assessment and has no certificate withdrawn;
- The fishery does not include an entity that has been successfully prosecuted for violations against forced labour laws.

According to the UoA definition given by MSC in its MSC-MSCI Vocabulary and the information collected during and after the site visit, BV concludes that the UoA presented below meets the MSC fisheries requirements while also suits client's needs:

Target stock	Mahi mahi (Coryphaena hippurus)
Fishing Area	Southeast Pacific Ocean (FAO 87, subarea 87.1)
Fishing method	Longline (thin surface longline, 'doradero'). The fleet that catches mahi-mahi in the UoA is composed of fiber vessels and mother ships. More details are included below (rationale for choosing the UoA).
Fishing operators	fishing vessels owned by the 7 companies of the client group
Other eligible fishers	The longline fleet registered in Ecuador and licensed to target mahi mahi with this surface longline (doradero).

A rationale for choosing the UoA(s)

A through explanation of the fishing method was needed in order to understand the UoA chosen by the client. The fiber vessels are small boats ranging in length from 3 meters to approximately 10 meters. The mother ships are larger boats (10-24 meters) used, in general, to tow up to 10-12 fiber vessels to the fishing grounds. In addition, the mother ships have their own catching capacity as most of them have installed longline fishing lines.
Once the fishing zone is reached, the fiber vessels are independently separated from the mother and start fishing. To do so, they cast their lines and when they retrieve them, they take their catches to the mother ship. In the mother ship, the catches of each fiber are counted and stored in the refrigeration chambers.
The fiber vessels do not usually belong to the owners of the mother ships. They are independent. On the other hand, the mother ship deploys her own longlines.
This fishing system allows the fibres to be moved (they have outboard motors) to areas that they could not reach on their own. Initially, the mother ships only had the role of towing the fibres and storing the catches, but later they were given the capacity to fish.

There are also fiber vessels not associated with mother ships that fish for dorado during the permitted season and with the same fishing gear. These fibers operate directly from land and the distance at which they can work is limited so there is no interaction with towed fibers.

Other eligible fishers

Other eligible fishers exist in cases where a client enters into assessment with the aim of initially certifying only part of a fishery, but also wishes to have the possibility of expanding the UoC at a later data by the mechanism of certificate sharing (see FCR G7.4.7-G7.4.9). According to FCR 7.4.12 the CAB shall identify if there are other eligible fishers or other entities that may share the certificate as new client group members.

The client decided to leave the certificate open for the longline fleet registered in Ecuador and licensed to target mahi mahi with this surface longline (doradero). The certicate sharing agreement was published in the MSC website on the 26th of February 2019.

The UoC proposed is:

Target stock	Mahi mahi (Coryphaena hippurus)
Fishing Area	Southeast Pacific Ocean (FAO 87, subarea 87.1)
Fishing method	Longline (thin surface longline, 'doradero'). The fleet that catches mahi-mahi in the UoA is composed of fiber vessels and mother ships. More details are included below (rationale for choosing the UoA).
Fishing operators	The fleet working for the 7 fishing companies included in the client group (see below). The mother-ships (nodrizas) covered by the certificate will be included in a list approved by the client and updated on an annual basis.

The Client Group includes 7 Limited Fishing Companies: Propemar S.A., Mardex MARISCOS DE EXPORTACION S.A., FRIGORIFICO Y LABORATORIO SAN MATEO, FRIGOLAB SAN MATEO CIA. LTDA., Ocean Fish, Transmarina C.A., FRESH FISH DEL ECUADOR CIA. LTDA., FRIGOLANDIA S.A. The aforementioned companies have signed a Memorandum of Understanding to put together a consortium of Mahi mahi export companies in order to develop the mahi mahi fishery MSC certification.

3.1.2 Total Allowable Catch (TAC) and Catch Data:

As the species is very short lived ("annual crop") and recruitment success is determined to a very large degree (if not entirely) by environmental factors and may fluctuate by an order of magnitude or more, no TAC is applicable to this fishery (for more information, see Section **3.3** and PI 1.2.1).

Table 3.1.2 shows that annual catches of the assessed fleet in 2016 and 2017 differed significantly, being 1,255.26t and 5,376.18t, respectively. Total catches of mahi mahi in Ecuador in 2017 amounted up to 10,728.96t, therefore, the UoA accounted for 50.11% of them.

Table 3.1.2 Annual UoA catches (t). No TAC or quotas are set for this fishery. Source: the Client.

	Year	Tons
TAC	2017	**N/A**
UoA share of TAC	2017	**N/A**
Total UoA mahi mahi annual catches	2017	**5,376.18**
Total UoA mahi mahi annual catches	2016	**1,255.26**

3.2. Overview of the assessed fishery

3.2.1 Ownership, history and organisational structure of the assessed fleet

Mahi mahi is exploited by Ecuadorian artisanal fisheries, mainly the multi-species longline fishery which shifts target among large pelagic fish species, including dorado, tuna, billfishes, and sharks.

The Ecuadorian longline fleet targeting Mahi mahi fishes by means of two different types of vessels (see **Table 3.2.1** for more details on their specific characteristics):

- Fiberglass vessels (fibras): these vessels operate either independently up to a distance not exceeding 120 NM from the coastline, or associated to a mothership in more distant fishing grounds (see below).

- Mother-ships (nodrizas): which are larger vessels, usually converted from small purse seiners that formerly fished small pelagics. They tow fiberglass vessels, up to a limit of 10 vessels (Ministerial Agreement no. 407, Article 3) to distant fishing grounds.

Table 3.2.1 Technical characteristics of the vessels that catch mahi-mahi in Ecuador.

Characteristics	*Nodrizas*	*Fibras*
Length	9.84 - 23.95	3.16 - 9.90
Beam	3.20 - 7.35	0.50 - 3.90
Depth	1.50 - 3.85	0.26 - 1.90
TRN	3.78 - 48.52	0.05 - 8.63
Engine (HP)	180 - 480	75
Conservation	Ice	Ice
Autonomy	10 - 40 days	1 - 3 days

3.2.2 Assessed area: jurisdiction and user's rights

The mahi mahi is a highly migratory species with a wide global distribution as shown in **Figure 3.2.2.1**. Ecuador captures 5,400 tons of the total species in this area (SRP, 2017). Peru, with 39,000 tons landed in 2018-19 (IMARPE, 2019) season and represents close to 11% of the total volume of catches. For this reason, since these two bordering countries are the most important in relation to the catches of this species, the situation of the fishery in Peru must be taken into account, in addition to the international component and management in Ecuadorian waters.

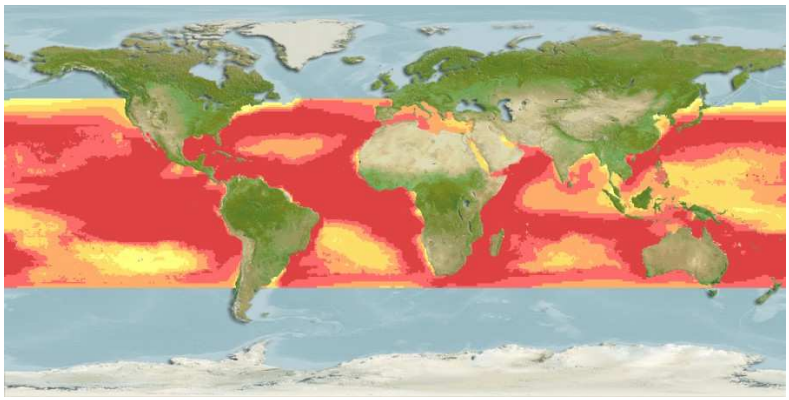


Figure 3.2.2.1 Range of mahi-mahi (*Coryphaena hippurus*). Available at: https://www.fishbase.se/summary/6

Being a migratory pelagic species, it is distributed according to patterns such as temperature and nutrient availability.

Targeted fisheries for the species are conducted in many of the countries adjacent to its range. This is true in the area of the eastern central Pacific (EPO) where mahi mahi is caught mainly from California (USA) to Peru.

The area of operation of the UoA corresponds to the jurisdiction of Ecuador and international zones outside the 200 miles.

The effort of the Ecuadorian oceanic longline fleet is directed at the area between the coordinates 04°00′N and 14°00′S and 092°00′W, as indicated in **Figure 3.2.2.2**.

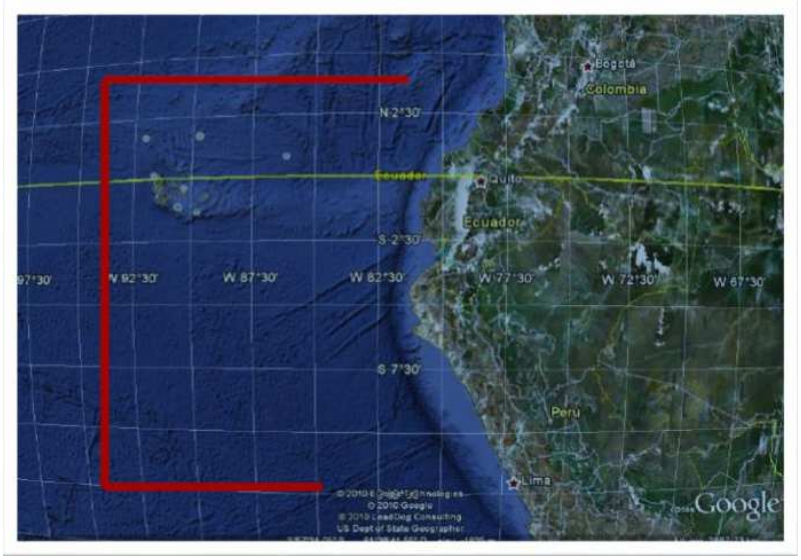


Figure 3.2.2.2 Fishing area (red line) of the artisanal oceanic and coastal fleet (mother ships and fibers). Martínez-Ortiz et al., 2010 - Cited by de Gómez-Zamora, W. M. 2016.

3.2.3 Outline the fleet types or fishing categories participating in the fishery.

The UoC is composed of 98 industrial mother ships that use the doradero (fine spinel) longline as a fishing gear. These vessels are called mother ships because they tow several

smaller vessels (maximum 10) to the fishing area, which set them longlines individually and whose catch is transhipped and stored on the mother ship. The small boats are called 'fibres'. The mother ship itself also carries out fishing operations.
In the following pictures you can see the detail of a mother ship, as well as the auxiliary boats or fiberglass vessels.

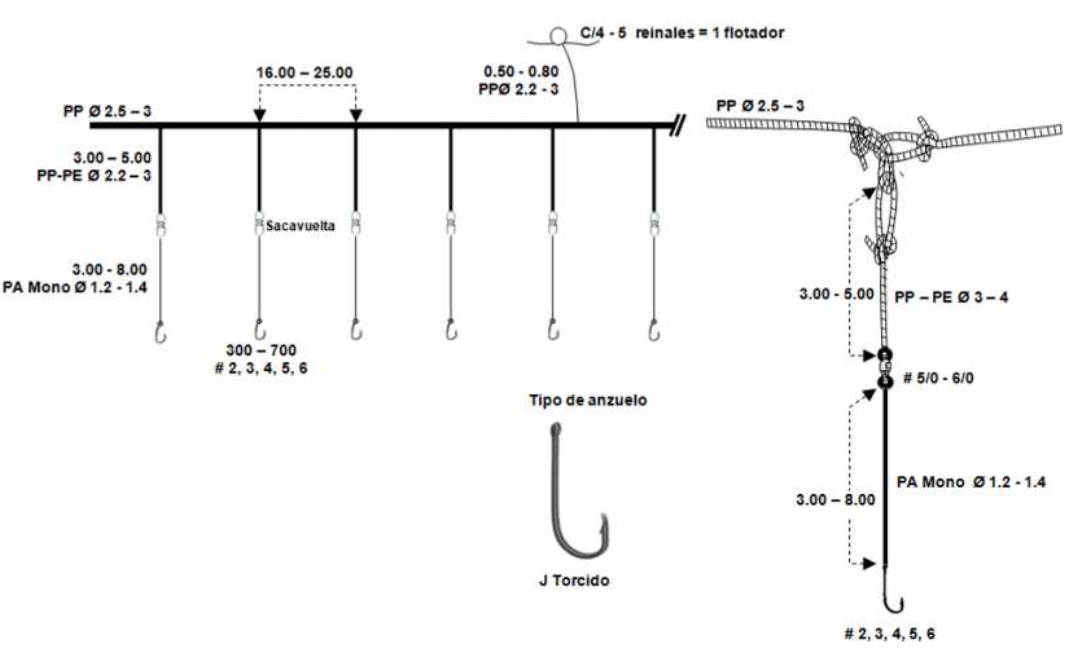
Figure 3.2.3.1 Mahi mahi mother ship (Manta, 2019).

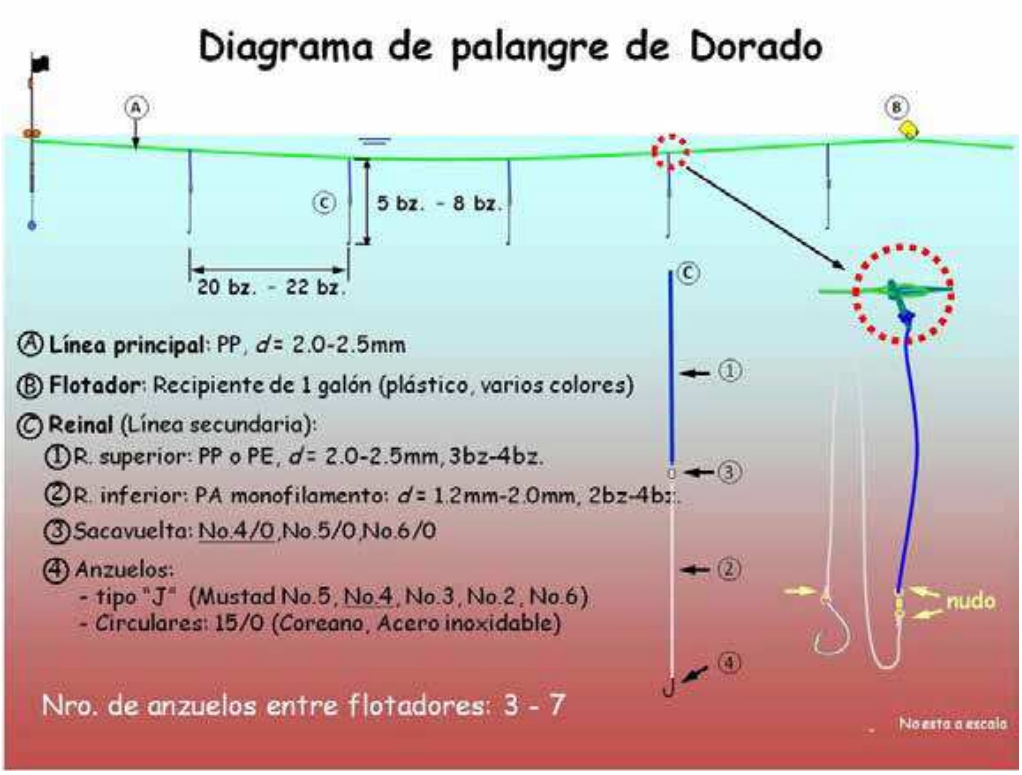
Figure 3.2.3.2 Mahi mahi longline mother ship with fibres alongside (Manta, 2019).

In addition to mother ships and auxiliary fibres, mahi mahi is also caught by other artisanal boats not associated with fibres. However, due to their autonomy, catches are lower since they cannot go as far from the coast (in distance and time) as a mother does.

3.2.4 Fishing practices and catches

The LL-DOL configuration consists of a mainline with 300 – 700 branch lines, each separated by 16–25 m. Branch lines are 6 – 13 m in length and typically hold a J-shaped hook with a straight shank (Martínez-Ortiz, et al., 2015).





Figures 3.2.4.1 and **3.2.4.2** Fishing gear and longline diagram used for fishing for mahi mahi in Ecuadorian waters. Source: Martínez-Ortíz and Zúñiga-Flores, 2012.

This fishery began gradually in the mid-1970s, but underwent a great expansion during the 1990s and 2000s. The traditional fishing areas, which were initially within 40 nm off the coast, have expanded gradually over the years to as far as 1,400 nm from the mainland coast west off the Galapagos Islands, establishing what is now known as the “oceanic-artisanal fishery” in Ecuador.

There is a great seasonality in this fishery: the longline fishery targeting dorado operates mainly during November-February, with peak catches in December and January. When there is "El Niño" event, mahi mahi’s availability lasts almost all year round, but the opposite happens during "La Niña" event.

The distribution of the catch is related to the sea surface temperature (SST). The availability of mahi mahi may be associated with the introduction from west to east of equatorial and subtropical water masses off the Peruvian and Ecuadorian coasts, mainly between November and February, when mahi mahi highest abundances are found. During this period, the SST related to mahi mahi fluctuated between 20 °C and 26 °C, but it was mostly associated with the 23 °C isotherm (Martínez-Ortíz & Zúñiga-Flores, 2012).Varela et al., 2016 In Ecuador, this species is exploited by artisanal boats and represents one of the most important fishery resources because its flesh is highly appreciated in American markets (Patterson & Martinez, 1991). In spite of the local commercial importance, few studies have been conducted so far to evaluate the feeding habits of the dolphinfish in the Ecuadorian Pacific coast.

3.3 Principle One: Target Species Background

3.3.1 Background

Mahi Mahi (*Coryphaena hippurus*) Linnaeus, 1758, is an epipelagic and primarily oceanic species with a wide distribution throughout the tropical and subtropical waters of the world’s oceans world (Palko et al., 1982). Also known as mahi mahi, dolphinfish, doradilla, lampuga, palometa, and perico, it is one of the most important species caught in the artisanal fisheries of the coastal nations of the eastern Pacific Ocean (EPO). The species is thought to be highly resilient to overfishing due to its high productivity in all the oceans of the world (Palko et al., 1982). In the EPO in particular, Mahi Mahi shows high rates of growth during a very short lifespan (about three years), early maturity (50% maturity at 0.5-1 years of age), high fecundity, and the capacity to spawn throughout the year in some areas (Martínez-Ortiz and ZúñigaFlores, 2012). In the EPO, Mahi Mahi is exploited by the fleets of nearly all coastal nations, from Chile in the south to Mexico in the north, and even occasionally in the southwestern waters of the United States, at the northernmost distribution of the resource (Dapp et al., 2013; Lasso and Zapata, 1999; Martínez-Ortiz and Zúñiga-Flores, 2012; Norton, 1999; Solano-Sare et al., 2008). The available fisheries statistics indicate that the EPO is the dominant region in global production of Mahi Mahi, with between 47 and 70% of the total world catches during 2001-2012 (Aires-da-Silva et al., 2014). It is estimated that the average total annual catch of Mahi Mahi in the EPO was about 71,000 metric tons (t) during 2008-2012 (**Figure 3.3.1**).

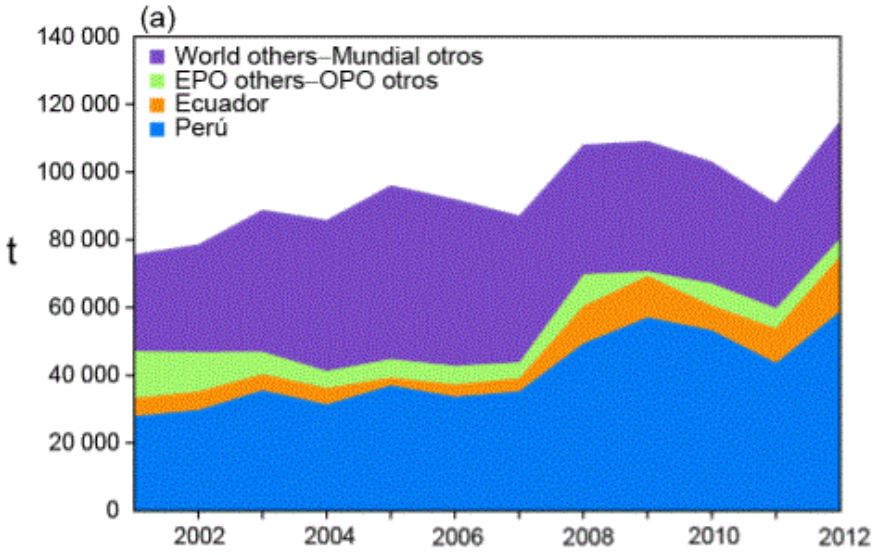


Figure 3.3.1. World catches of Mahi Mahi, 2001-2012, by weight (a) and percentage (b). Source: Aires-da-Silva et al. (2014). Catch statistics were compiled from the following sources: 1) FAO FishStat database, 2) US import trade records (United States International Trade Commission, USITC), and 3) statistics reported by EPO coastal nations.

3.3.2 Conceptual life-history model for Mahi Mahi in the EPO

One important outcome of the 2nd Technical Meeting on Mahi Mahi, (Maunder et al., 2015) was the elaboration by regional experts of a hypothesized conceptual model (**Figure 3.3.2**) of the population structure and dynamics of Mahi Mahi in the EPO, based on analyses of complementary data sets such as observer data from large (IATTC Class 6; carrying capacity greater than 363 t) purse-seine vessels, artisanal longline CPUE data, and compilations of monthly catches from Central American countries.

The genetic studies available are preliminary, but they indicate high genetic variability within the EPO, and most indicate the need for increased sample sizes and improved spatio-temporal sampling. At this point, there is no clear evidence that there is more than one population of Mahi Mahi in the EPO, but some information suggests that there may be coastal and oceanic sub-stocks (Téllez and Caballero, 2017). If that is the case, the coastal (or "more resident") substock would be more available during the whole year towards the coast slightly north of the equator, while the oceanic sub-stock would move seasonally towards the coastal areas of the EPO around October-November. The Mahi Mahi fishing season for the longline artisanal fleet starts around October-November, peaks around December, and ends around February-March (Martínez-Ortiz et al. 2015). This coincides with oceanographic changes in the oceanic waters off Peru and Ecuador, between 2°S and 10°S from 90°W to 105°W, and particularly with the 23°C isotherm, with which Mahi Mahi are mostly associated. When the Mahi Mahi season begins, subtropical waters with moderate (20-25°C) sea-surface temperatures (SSTs) are located south of the Equatorial Front and west of the cold (16-20°C) water mass associated with upwelling and the Humboldt Current system off Peru. As these warmer waters approach the coast, the cool water mass shrinks, and Mahi Mahi become vulnerable to artisanal longline gear. By February-March, when the Mahi Mahi fishing season ends, the cooler water is confined to

the area along the Peruvian coast, and there is little habitat below 25°C available in the equatorial and tropical Pacific. The catches of Mahi Mahi by purse-seine vessels, although they account for less than 5% of the total known catches of the species in the EPO, can be used to expand the approximate spatial distribution of Mahi Mahi indicated by the artisanal fishery data. Purse-seine effort is widely distributed in the EPO, and Mahi Mahi is present in almost all the areas of operation of the purse-seine fleet; also, all trips by large vessels are covered by observers, who have been recording bycatches by species and length category (30 cm, 30-60 cm, and >60 cm) since 2005. The size at maturity for Mahi Mahi is around 60 cm, so the first two size categories are indicative of juvenile fish, and the third of adults. Purse-seine bycatches of Mahi Mahi are most frequent in the floating-object (OBJ) fishery. The catch per set (in numbers of large fish) in that fishery is greatest closer to the coast in the first and fourth quarters of the year, i.e. from October to March. In the fourth quarter, there is almost no purse-seine effort on floating objects, and thus almost no catch, in the coastal areas south of the equator, but this is offset by the large catches of the artisanal longline fishery.

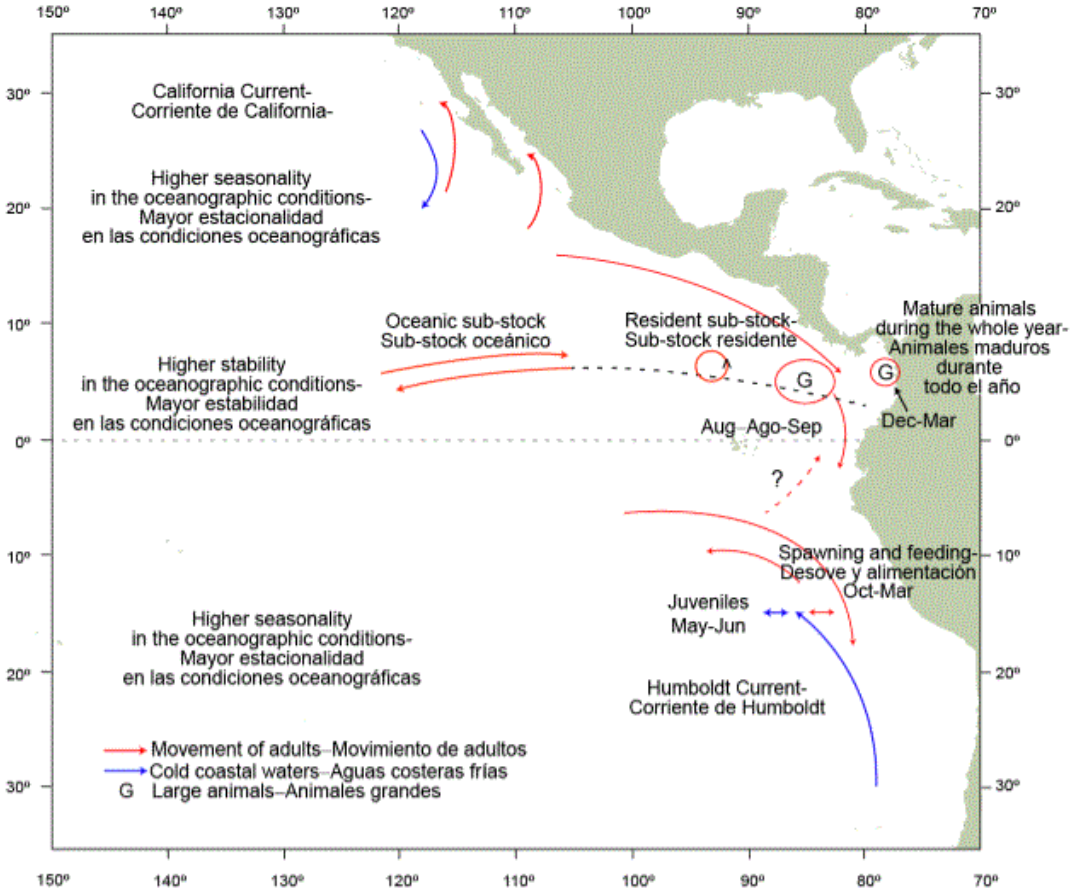


Figure 3.3.2. Conceptual model of the movements and spatial distribution of Mahi Mahi (2nd Technical Meeting on Mahi Mahi, Maunder et al, 2015)

In Central American waters, there is an apparent gap in distribution off southern Mexico and Guatemala, which maybe due to selectivity. The proportion of floating-object sets with catches of small (≤ 60 cm) and large (> 60 cm) Mahi Mahi in different areas of the EPO

indicates an almost synchronous and markedly seasonal pattern, except in coastal areas. From January to May, the proportion of sets with small fish (juveniles hatched during October-January) increases steadily. Around June, when the fish are about 6 months old, the proportion of sets with large fish increases markedly; then, from October to December, it decreases south of the equator and in area (0°-10°N, 130°-150°W), while off Central America and Colombia it remains about the same, due most likely to movement towards coastal areas. From January to March there is a marked decrease in adults in all areas, as the cohort hatched one year previously is depleted. Compiling the monthly catches from the EPO coastal countries helps elucidate the dynamics of Mahi Mahi in the coastal areas in the northern hemisphere (**Table 3.3.2**). In Panama and Costa Rica, the greatest catches of Mahi Mahi are taken during October-January, peaking in December, but with a secondary peak around May. In Colombia, the largest catches of Mahi Mahi are from December through March, with the peak in February. Further north, in Guatemala, Mahi Mahi is caught throughout the year, with the peak in November, while in Baja California Sur, Mexico, where Mahi Mahi is also caught throughout the year, catches are highest during September-November, with the peak in October.

Table 3.3.2. Monthly ratio of average Ecuadorian longline CPUE to average CPUE in October from 2009 to 2013. Avg.: Monthly average ratio for 2009-2013 (Valero et. al, 2019)

	2009	2010	2011	2012	2013	Avg. – Prom.
Oct	1.000	1.000	1.000	1.000	1.000	1.000
Nov	0.671	0.737	0.802	0.603	0.757	0.654
Dec	0.450	0.543	0.644	0.364	0.573	0.450
Jan - Ene	0.302	0.400	0.517	0.220	0.434	0.320
Feb	0.203	0.295	0.414	0.133	0.328	0.232
Mar	0.136	0.217	0.333	0.080	0.249	0.170
Apr - Abr	0.091	0.160	0.267	0.048	0.188	0.126

In conclusion, the available information does not provide strong evidence that there is more than one stock of Mahi Mahi in the EPO, although there are indications of some spatial structure (Figure 3.1.2). Current information indicates that the “core” area of the Mahi Mahi stock lies south of the equator, off Ecuador and Peru, where the adult fish move to spawn and feed. The fishery that operates in that area mainly exploits one annual cohort, aged between about 10 and 16 months. The distribution of catches throughout the year in different areas suggests that there may be two sub-stocks in the EPO, an oceanic sub-stock that migrates seasonally towards the coast, and a more resident sub-stock in the coastal region. Most of the catches and the available data are from the southern hemisphere, where a marked seasonality is evident, resulting from periodic encounters of tropical waters with the cold Humboldt Current. There are some indications of a similar seasonality in the northern hemisphere, under the influence of the California Current, but there are no data available for the areas off Mexico, north of 10^{o}N, that could be used to investigate this hypothesis. From about 5°N to 10°N, the dynamics of Mahi Mahi seem to be different, with the coastal (or “more resident”) sub-stock more available throughout the year.

3.3.3 Data used in the stock assessment

The fisheries exploiting Mahi Mahi in the EPO, and the data from those fisheries used in the assessment, are described below. After considering the quality of the different data sources available, it was decided that the stock assessment should cover 2007-2015, since the data sources available for this period are considered quite reliable. To better define the population dynamics of Mahi Mahi over time in the seasonal stock assessment model, it is advantageous to use a fishing year (FY), which in this case starts on 1 July and finishes on 30 June, rather than the calendar year (CY). Accordingly, the historic period of the assessment extends from month 1 of FY 2007 (July 2007) to month 12 of FY 2014 (June 2015).

The data used in the stock assessment model are shown in **Figure 3.3.3** by type, fishery, and fishing years included in the model.

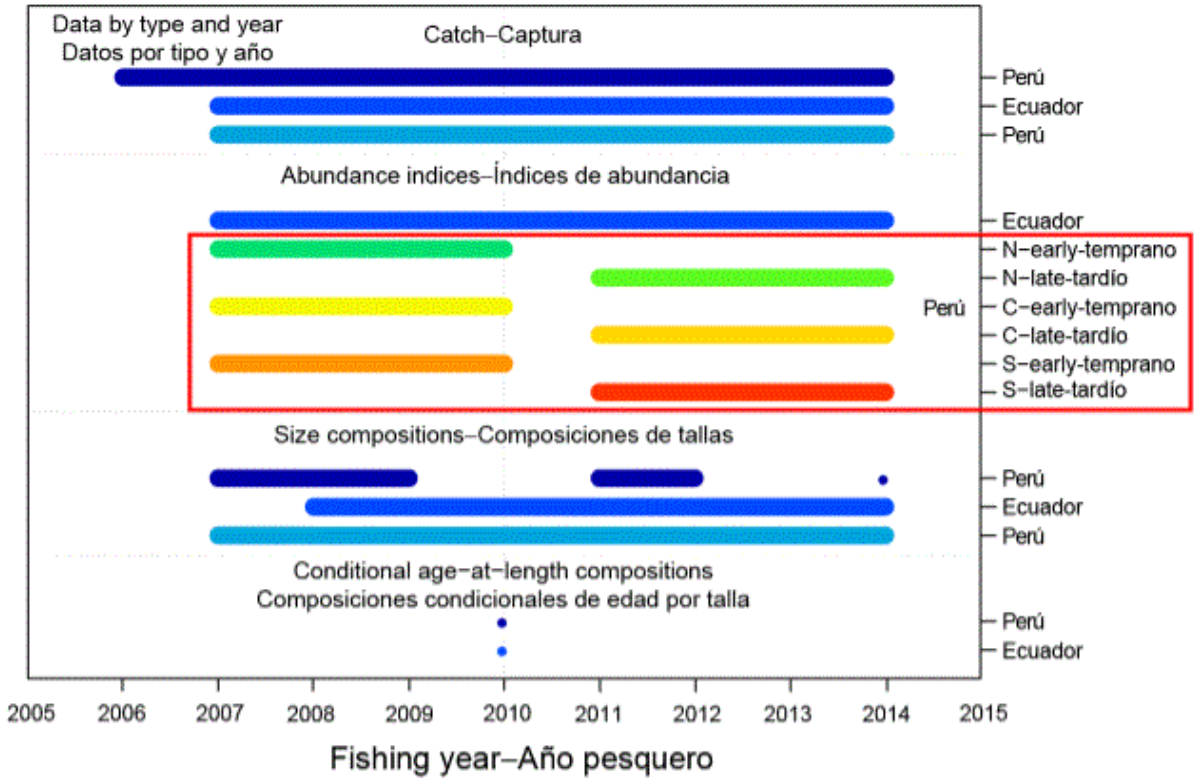


Figure 3.3.3. Types of data, by fishery and year, available for the assessment of Mahi Mahi in the South EPO. The abundance indices inside the red square are not used in the model; they are included for comparative purposes only. The historic period of the assessment covers the 2007-2014 fishing years (July 2007-June 2015).

Also presented are data sources collected for the period prior to 2007. Although these early data were not used in the assessment, they are presented to illustrate the construction of available time series of data for Mahi Mahi.

<u>Definitions of the fisheries:</u>

In the South EPO, Mahi Mahi are mainly subject to targeted artisanal longline fisheries by Peru and Ecuador, but the species is also caught incidentally (as bycatch) by the tuna purse-seine fisheries. The stock assessment model is not spatially-structured, in the sense that no

fisheries based on spatial considerations are defined, except as implicit in the spatial distribution of the Ecuadorian and Peruvian fisheries. However, these three fisheries are defined separately in this assessment, so that their catches are associated with separate size selectivity curves. No information on Mahi Mahi discards is available; therefore, in this report the term 'catch' refers to retained catch, and thus observed landings and unloadings.

Peru (Fishery F1)

Mahi Mahi is exploited by artisanal fisheries in coastal and oceanic waters off Peru. Availability of the resource is highly seasonal, usually occurring from September to March, and is associated with warm SSTs (21-30˚C). During these months, Mahi Mahi accounts for about 90% of the total volume of landings by the Peruvian artisanal fishery (Solano-Sare et al., 2008). The Instituto del Mar de Perú (IMARPE) has some landing records going back to the late 1980s, but the major expansion of the Peruvian fishery occurred in the early 2000s, following the increased availability of Mahi Mahi in 1998 that coincided with the strong El Niño event of that year. Although Peru has the greatest catches of Mahi Mahi in the EPO, it is second to Ecuador in terms of exports (filleted and fresh) to the United States (Aires-da-Silva et al., 2014). Information from various sources indicates that most of the Peruvian catch is consumed domestically. For this assessment, IMARPE made available official catch landings data, collected by the Statistics Office of the Ministry of Production (PRODUCE), for Mahi Mahi taken by the Peruvian artisanal fisheries from 2000 to 2015. For the 2000-2005 period only annual statistics are available, but after that they are available by month. Using this combination of annual and monthly data, an attempt was made to construct a historical monthly time series of Peruvian Mahi Mahi catches for the January 2000-December 2015 period. Monthly estimates for 2000-2005 were obtained by applying to the annual data the average monthly proportions of the catches available for 2006-2015

Ecuador (Fishery F2)

Mahi Mahi is exploited by Ecuadorian artisanal fisheries, mainly the multi-species longline fishery which shifts target among large pelagic fish species, including Mahi Mahi, tuna, billfishes, and sharks. This fishery (Fishery F2 in the assessment) began gradually in the mid-1970s, but underwent a great expansion during the 1990s and 2000s. The traditional fishing areas, which were initially within 40 nautical miles (nm) of the coast, have expanded gradually over the years to as far as 1,400 nm from the mainland coast west of the Galapagos Islands, establishing what is now known as the "oceanic-artisanal fishery" in Ecuador. As in Peru, there is a great seasonality in these fisheries: the longline fishery targeting Mahi Mahi operates mainly during October-February, with peak catches in December and January. Mahi Mahi accounts for more than 65% of the estimated landings of large pelagic fish species by artisanal fisheries in Ecuador, and 35 to 40% of the exports of pelagic fish to the United States (Martínez-Ortiz and Zúñiga-Flores, 2012). The longline fishery for tuna-billfish-shark (TBS) species takes place all year round. However, catches of TBS species decline greatly during the Mahi Mahi season because longline vessels change their gear in order to target Mahi Mahi, using the smaller doradero hooks. Martínez-Ortiz et al. (2015) provide an extensive description of the Ecuadorian artisanal fishery for large pelagics, including species composition and spatio-temporal dynamics. An attempt was made to construct a historical monthly time series of Mahi Mahi catches taken by Ecuadorian fisheries during the January 1987-June 2015 period (**Figure 3.3.4**).

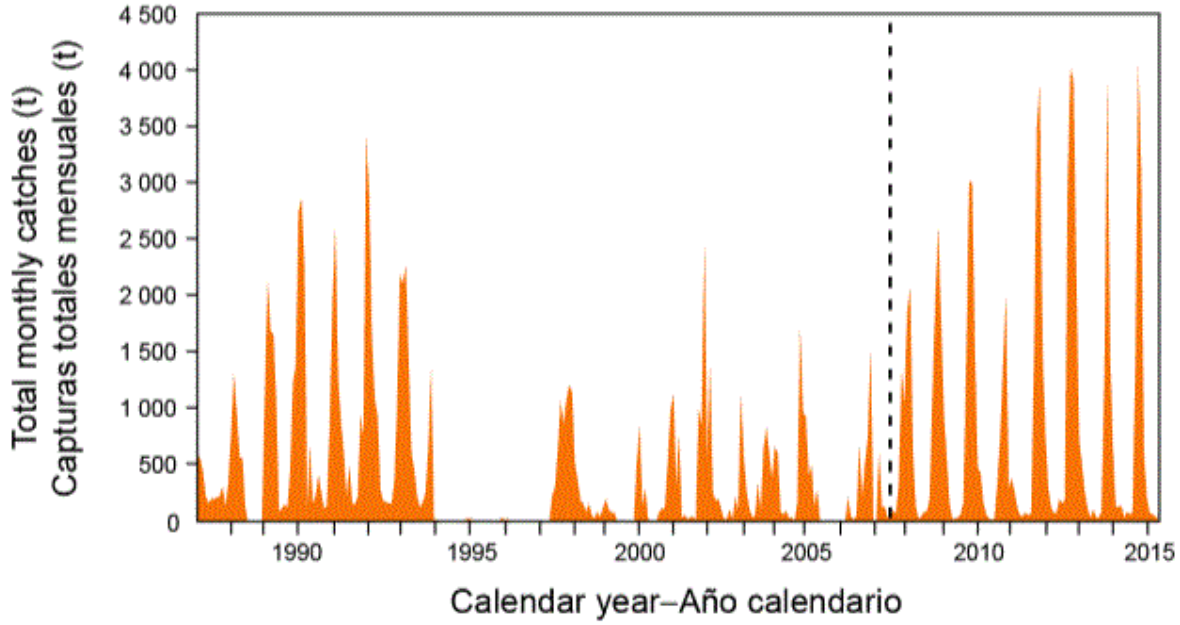


Figure 3.3.4. Total annual (top) and monthly (bottom) catches of Mahi Mahi by Ecuadorian artisanal fisheries, January 1987-June 2015, in tons.

For the most recent years (2008-2015), catch statistics were extracted from the databases of Ecuador's landings monitoring system for artisanal fisheries (Sistema de Control y Monitoreo; SCM), operated by the Undersecretariat of Fisheries Resources (SRP) (Martínez-Ortiz et al., 2015). Catch estimates for the early period were obtained from fishery statistics published by the National Fisheries Institute (INP)1.

Bycatch from tuna purse-seine fisheries (Fishery F3) Mahi Mahi are caught as bycatch in the tuna purse-seine fisheries in the EPO. There are three types of purse-seine sets for tuna (on tunas associated with dolphins, associated with floating objects, and unassociated tunas); Mahi Mahi are caught predominantly in floating-object sets (97% of total catch in weight). IATTC observers on large purse-seine tuna vessels have collected data on bycatches of Mahi Mahi since 1993, and the records available for the assessment cover the 1993 - 2015 period. Data on bycatches by smaller vessels (classes 1-5; carrying capacity less than 363 t) are not available, so they were estimated by applying the catch-per-set rates of large (Class-6) vessels to sets by the smaller vessels (23% of the total number of purse-seine sets).

Total annual catches of Mahi Mahi during the assessment period are shown in **Figure 3.3.5**. Annual catches averaged about 61,000 t during the assessment period, with 82%, 16%, and 2% of the catches taken by Peru, Ecuador, and as bycatch in the tuna purse-seine fisheries, respectively. While total annual catches peaked in FY 2009 at about 76,000 t, the lowest catch was about 39,000 t during FY 2010. Monthly catches of Mahi Mahi in the South EPO show a pronounced seasonal pattern, usually peaking in December (**Figure 3.3.6**).

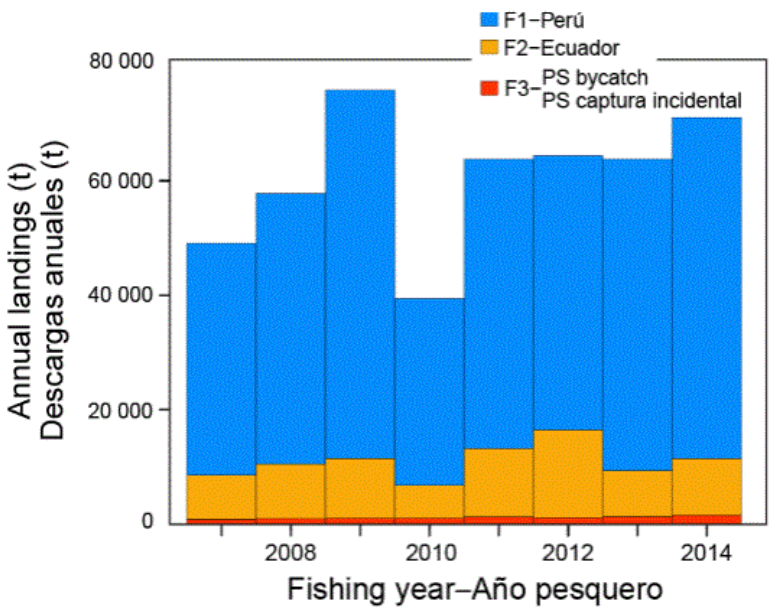


Figure 3.3.5 Total annual landings of Mahi Mahi in the South EPO, by fishery, fishing years 2007-2014 (July 2007-June 2015).

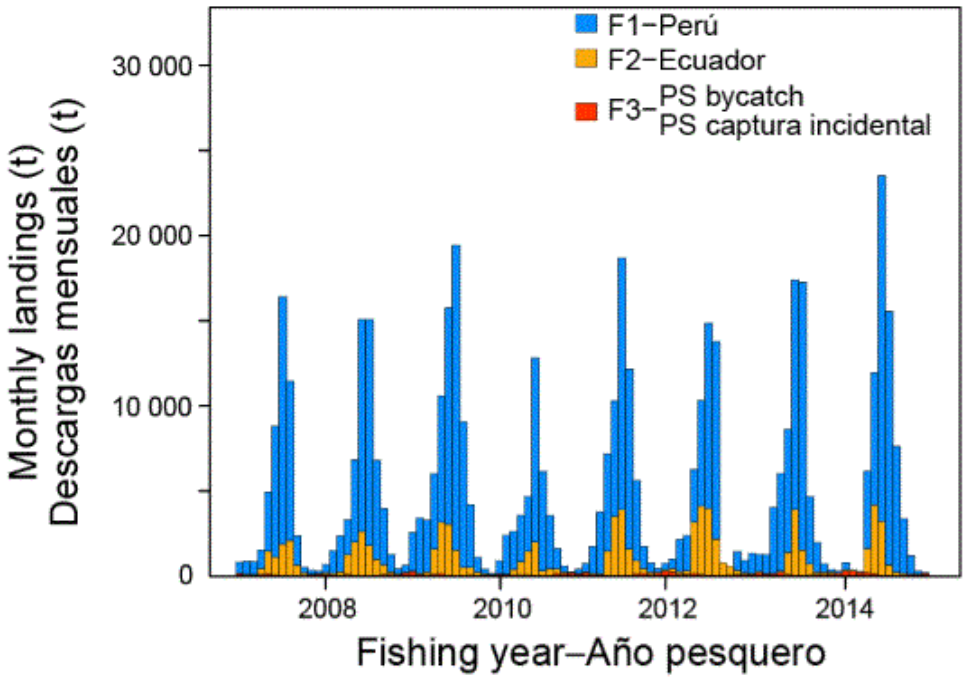


Figure 3.3.6. Total monthly landings of Mahi Mahi in the South EPO, by fishery, fishing years 2007-2014 (July 2007-June 2015).

Length-composition data:

Length-composition data from the Mahi Mahi catches were obtained from Peruvian, Ecuadorian, and IATTC sources. These data are typically considered to inform the stock assessment model about the selectivity of the different fisheries and cohort strength. The length-composition data from different fisheries are described below.

Peru Mahi Mahi length-composition data, collected by IMARPE at the principal ports where Peruvian artisanal fisheries unload their catches, are available for FYs 2004-2014, but not separated by sex. Sampling was mainly opportunistic, since it depends on the availability of Mahi Mahi and the logistics of access to the catches for sampling. Length frequencies of Mahi Mahi were taken in fork length to the next-lowest centimeter. For this stock assessment, only the length-composition data for which monthly information is available are used (FY 2007-2014). Although these data are very sparse over the years, they can be informative about the size selectivity of Mahi Mahi by the Peruvian fishery.

Ecuador Mahi Mahi length-composition data from Ecuadorian artisanal fisheries were collected at the ports of Esmeraldas, San Pablo de Manta, and Anconcito, mainly by SRP samplers, who record fork length, total weight, and sex (Martínez-Ortiz and Zúñiga-Flores, 2012). Some size data collected by fishery observers are also available. For this assessment, only monthly length-composition data for FYs 2008-2014, by sex, from artisanal fisheries targeting Mahi Mahi were used. The Ecuadorian length-composition data show the clear dominance and progression of a single cohort of Mahi Mahi over the months of each fishing year (**Figure 3.3.7**). The smallest sizes of Mahi Mahi (40-60 cm FL) are recruited to the fishery as early as June-July, and this new cohort is then targeted by the fishery until the end of the fishing season, around March-April. The mean length of the fish in the catches gradually increases as the fishing season progresses and the fishery targets an individual cohort growing in size (**Figure 3.3.7**). There is a sharp drop in the mean size of the fish in the catches at the end of the fishing season, as the recruits of the following cohort enter the fishery.

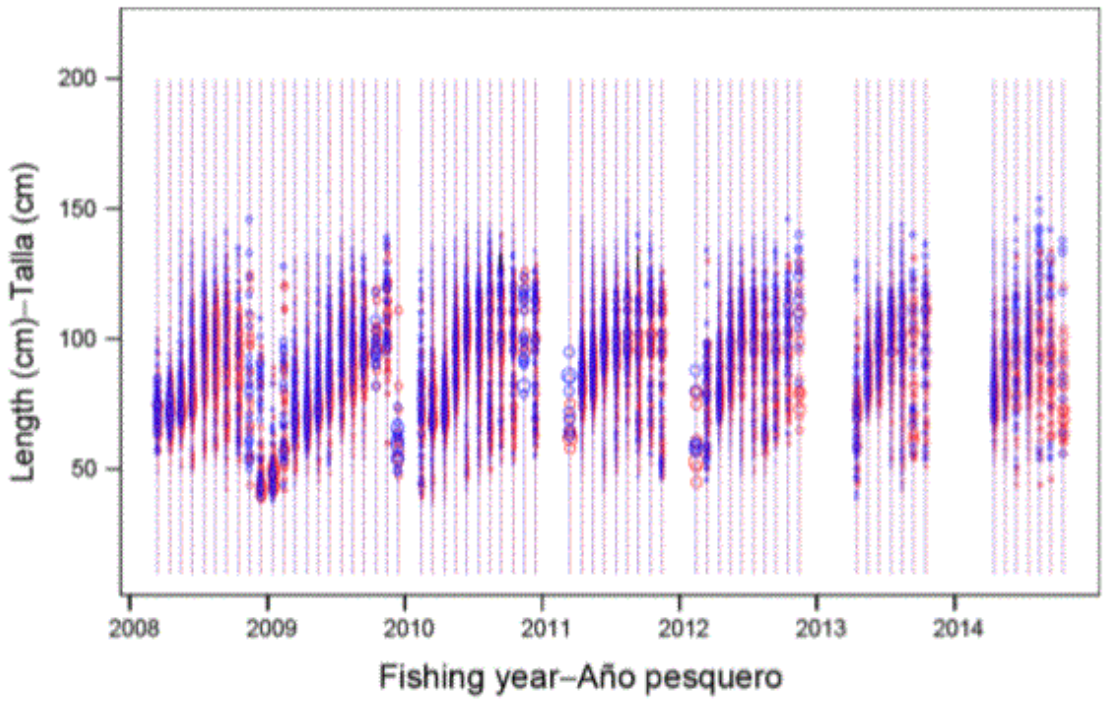


Figure 3.3.7. Size compositions of Mahi Mahi catches by Ecuadorian fisheries, by month, fishing years from 2008 to 2014. Red and blue circles represent females and males, respectively. The areas of the circles are proportional to the catches.

In the tuna purse-seine fishery, since 1993, IATTC observers have estimated the size composition of the bycatches of Mahi Mahi in the tuna purseseine fishery by classifying the fish into three size categories (0-30 cm, 31-60 cm, >60 cm). Although there are concerns about the reliability of these estimates, they were included in the assessment model as an approximation of the selectivity of Mahi Mahi by the tuna purse-seine fishery (FYs 2007-2014).

3.3.4 Indices of abundance

CPUE data from the Peruvian and Ecuadorian artisanal longline fisheries were used to produce a set of candidate indices of relative abundance. The real changes in Mahi Mahi abundance assumed to be represented in CPUE data may be confounded with changes over time in fishing practices and/or spatiotemporal effects. "Catch-effort (or catch) standardization" is the procedure which accounts for (i.e. removes) the impact on catch rates of changes over time of factors other than abundance (Maunder and Punt, 2004).

Generalized additive models (GAMs) were used for catch-effort standardization of the CPUE data for Mahi Mahi; the results are summarized below:
For Peru a GAM for the Mahi Mahi CPUE in weight that assumes a gamma error distribution was used to standardize the Peruvian CPUE data. The explanatory variables included in the GAM were year, month, and fish carrying capacity of the vessel. Information on geographical location (latitude and longitude) is not available in the Peruvian trip records at this stage. An attempt was made to account for spatial effects on the CPUE by producing separate indices of abundance for three main fishing regions, based on port of landing: North (Paita); Central (Chimbote-Pucusana); and South (Ilo). Since the CPUE data after FY 2010 may be of better quality than those for previous years, standardized CPUEs were computed separately for two time periods, FYs 2003-2010 and 2011-2014.

Ecuador GAMs were used to develop a standardized CPUE index for the Ecuadorian longline fishery targeting Mahi Mahi during FYs 2007-2014. Several different GAMs were explored for the catch data: a negative binomial (NB) GAM for counts of fish (taking effort into consideration), and two different GAMs for the CPUE in weight, one based on a gamma distribution with log link and the other based on a lognormal distribution. Judging by the generalized cross-validation score, the gamma distribution (**Figure 3.3.8**) was a better fit to the CPUE data than the lognormal distribution, but not by percent deviance explained or adjusted R2. The CPUE mainly reflects the decay of a cohort of Mahi Mahi over time (months) year after year.

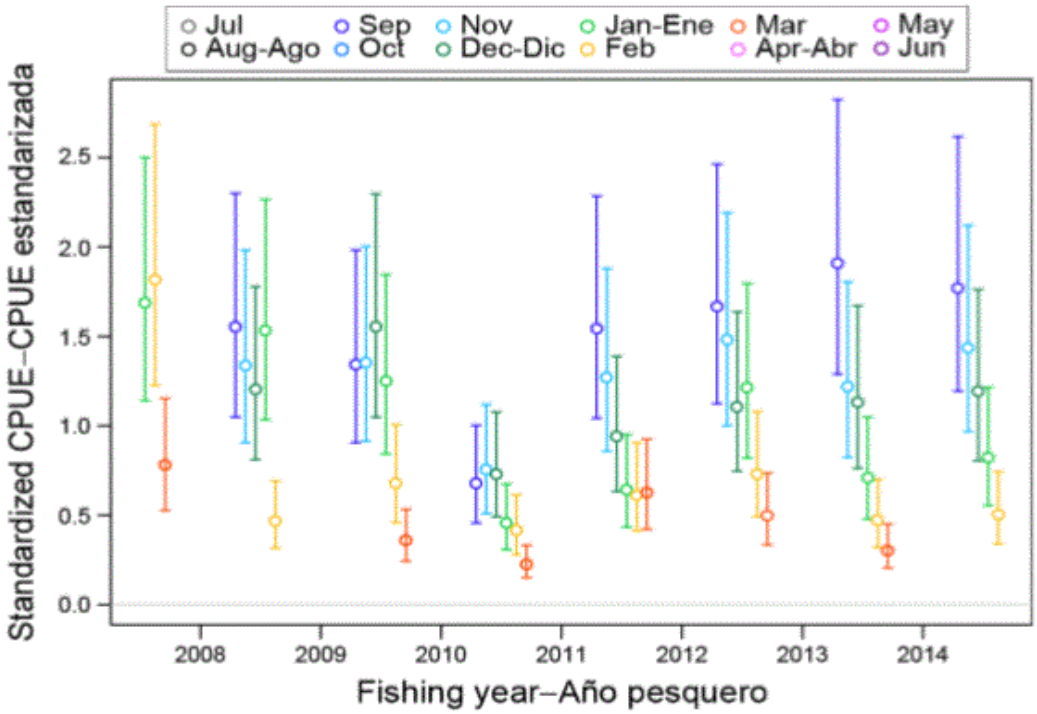


Figure 3.3.8. Standardized CPUE of Mahi Mahi from Ecuadorian artisanal fisheries, fishing years 2007-2014. The vertical lines represent the fixed confidence intervals (±2 standard deviations) around the CPUE values.

3.3.5 Exploratory stock assessment of Mahi Mahi in the South EPO

Assumptions and biological parameters

The biological assumptions defined in the Mahi Mahi stock assessment model are described below.

Growth Goicochea et al. (2012) was adopted as the best available study for defining the age and growth parameters for Mahi Mahi. According to this study, which used an age determination technique based on counts of microincrements in otoliths collected from Mahi Mahi caught in northern Peruvian waters, growth of Mahi Mahi is almost linear during the first year of life, reaching about 80 cm FL at 1 year of age. The asymptotic length parameter is estimated at 128 and 147 FL for females and males, respectively. Another important component of growth used in age-structured statistical catch-at-length models is the variation in length-at-age. Information on the variability of the length-at-age can be obtained from age-at-length data, which are available from Goicochea et al. (2012). The parameters that define the variation of the length-at-age were estimated from inspection of identifiable cohorts in the length-composition data. These estimates were fixed in the stock assessment model.

The length-weight relationships determined by Zúñiga-Flores (2014) were used to convert lengths to weights in the current stock assessment. The study presents length-weight relationships obtained from fish of both sexes sampled at different ports in Ecuador.

Estimates of natural mortality (M) for Mahi Mahi have been produced using indirect methods (Martínez-Ortiz and Zúñiga-Flores, 2012; Zúñiga-Flores, 2014). However, these estimates vary greatly (0.43-2.5 yr^{-1}) depending on the methodology used. An M value of 1 yr^{-1} is considered reasonable to use in the Mahi Mahi stock assessment.
The Mahi Mahi maturity ogive estimated by Zúñiga-Flores (2014) was used in the assessment. Recruitment is assumed to be independent of the spawning stock size because Mahi Mahi is a highly fecund pelagic spawner. In the parameterization of the Beverton-Holt stock-recruitment relationship used in the stock assessment model this assumption is defined by fixing the steepness parameter (h) at 1.

Model structure configurations

The Stock Synthesis model (SS - Version 3.24f; Methot and Wetzel 2013) was used to assess the status of Mahi Mahi in the South EPO. It consists of a catch-at-length, age-structured, integrated (fitted to many different types of data) statistical stock assessment model. It is fitted to the observed data (indices of relative abundance and size compositions) by finding a set of population dynamics and fishing parameters that maximize a penalized likelihood, given the amount of catch taken by each fishery.
The underlying concept of the model is that monthly declines in the CPUE are explained by the catch, and therefore provide information on absolute abundance, as assumed in standard depletion estimators (Maunder et al. 2015). The CPUE time series of the Ecuadorian artisanal fishery was chosen as the most reliable index of abundance to calibrate the stock assessment model. For this reason, its coefficient of variation (CV) was fixed at 0.2.
Female selectivity curves for the Peruvian and Ecuadorian fisheries, which catch larger Mahi Mahi, are assumed to be asymptotic. Males are allowed to have a lower selectivity than females and to have dome-shape selectivity. The selectivity of the purse-seine bycatch fishery was assumed to be asymptotic.
The following parameters were estimated:

a) Recruitment at age zero (post-larval) occurring during December-January of every year in the 2007-2014 period (includes estimation of virgin - or average - recruitment and monthly temporal recruitment anomalies).
b) Catchability coefficients for the Ecuadorian CPUE time series used as the main index of abundance. The availability of Mahi Mahi may be strongly linked to environmental conditions, which are very dynamic off Ecuador and Peru, where most of the Mahi Mahi catches are taken, and this may affect catchability of Mahi Mahi by the fishing fleets on a yearly basis. Therefore, catchability (Q) is assumed to be time-varying, with one catchability parameter estimated for each fishing year (which mainly applies to a single cohort).
c) Parameters defining the selectivity curves for the three fisheries defined in the model. Since length-composition data for Mahi Mahi caught by the Ecuadorian fisheries are available by sex, selectivity curves are estimated for both sexes separately. For Peru, sexes are pooled in the length-composition data, so there is no information on the sex composition of the catch; therefore, the selectivity of males is fixed at the offset between males and females as estimated for the Ecuadorian data from an exploratory run.
d) Initial population size and age structure. The starting conditions of the assessment cannot be considered as unfished because there is a history of

catch prior to the period modelled in the assessment. Stock Synthesis allows an initial fishing mortality to be estimated, so that the model takes into account catches before the model starts. In this assessment, one initial fishing mortality parameter is estimated (for Peru, which dominates the catches). This is not intended to describe any particular process in the dynamics of the fishery, or mean that all the early catch is assigned to Peru, it just provides a way to start the model parsimoniously from a fished condition.

An important decision that needs to be made in integrated statistical stock assessment models is the relative weighting assigned to the different data components. Francis (2011) argues that abundance information should primarily come from the indices of abundance (CPUE) and not from composition data. Following this approach, the size compositions of the different fisheries were down-weighted so that the Ecuadorian CPUE is the main dataset driving the population dynamics and defining absolute scale (R0) in the model. Multiplicative weighting factors (λ (lambda)) were applied to the likelihoods of the composition data, as follows: 0.05 for Peru, 0.5 for Ecuador, and 0.005 for the tuna purse-seine fishery. Thus, the highest weighting is given to the Ecuadorian sex-specific length-composition data, and the lowest to the IATTC length-composition data.

There is uncertainty in the results of the current stock assessment, because the observed data do not perfectly represent the population of Mahi Mahi in the South EPO, and also in the model, which may not perfectly represent the dynamics of the Mahi Mahi population or of the fisheries that operate in the EPO. Uncertainty is expressed as approximate confidence intervals and CVs, which were estimated under the assumption that the model does perfectly represent the dynamics of the system. Since it is unlikely that this assumption is satisfied, these values may underestimate the amount of uncertainty in the results of the current assessment. The model structure uncertainty is investigated in several sensitivity analyses.

The important aspects of the base case assessment (1) and the three sensitivity analyses (2-4) can be summarized as follows:

1) Base case assessment: steepness of the stock-recruitment relationship = 1 (no relationship between stock and recruitment); mean length-at-age, and the parameters that define the variability of the length-at-age, are fixed; fitted to CPUE time series for Ecuadorian artisanal fishery; asymptotic length-based selectivities for females caught by the Ecuadorian and Peruvian fisheries; down-weighted size composition data for all fisheries (λ = 0.05 for Peru, 0.5 for Ecuador, 0.005 for the tuna purse-seine fishery; see above).
2) Sensitivity to alternative natural mortality (M) values: M values between 0.1 yr-1 and 1.6 yr-1 were used as alternatives to the M of 1 yr-1 assumed in the base case. This range of alternatives is partially based on the wide range of reported M values for Mahi Mahi, from 0.43 yr-1 (Zúñiga, 2014) to 2.5 yr-1 (Hoening method applied to data from Zúñiga, 2009).
3) Sensitivity to time-varying catchability: The base case model estimates time varying catchability (Q) for Ecuadorian CPUE. An alternative analysis was conducted with catchability estimated as a single parameter with no time-varying deviates (Qnotv).

4) Sensitivity to alternative selectivity curves: The base case assumes that the selectivity functional form is asymptotic. We allowed selectivity to be dome-shaped in the Peruvian fishery, where selectivity is allowed to be lower for larger fish.

Results

The model produces a reasonably good fit to the Ecuadorian CPUE, which was chosen as the main index of abundance for calibrating the model. For all years, the model is able to capture the CPUE decline, which mainly measures the monthly decay of a single cohort due to natural mortality and fishery exploitation. In general, the model captures the high CPUE values at the start of the fishing season (around September), and follows its rapid decline as the season progresses before it tapers off around April. However, the quality of the model fit varies among years, particularly at the start and end of the fishing season. In some years (FYs 2011 and 2013, for instance), the model is unable to capture the high CPUE values at the start of the season. Likewise, it is unable to fit the lower CPUE values at the end of the season for most years. The CPUE trends observed in the three fishing regions exploited by the Peruvian fisheries in the late period (2011-2014) are reasonably consistent with the model fit to the Ecuadorian CPUE, but this is not surprising considering that both fisheries exploit the same Mahi Mahi stock and overlap in space, at least at some point during the fishing season.

The model fit to the length-composition data of the Peruvian fishery aggregated for all years is good. In general, the modal peaks for each cohort predicted by the model correspond very well to those observed in the data. This indicates consistency with the mean length-at-age predicted by the growth curve assumed in the model, which was derived from Mahi Mahi caught by the Peruvian fishery (Goicochea et al., 2012). The variability of the length-at-age as predicted by the model is very consistent with that observed in the data, particularly for the larger fish that are caught later in the season. However, the variability of the length-at-age estimated by the model is not consistent with the proportions observed for smaller fish (e.g. July-October 2007). The model fit to the sex-specific length-composition data of the Ecuadorian fishery aggregated for all years is good for both sexes. The fit to the monthly length-composition data for Ecuador is reasonably good for most months, particularly the months in which most of the catch is taken (September-February); however, in some years there are misfits to the main modes in the data. In addition, the model produces poor fits for other months, particularly between April and August. This could be the result of several processes. First, the model does not estimate growth, which is fixed at the growth curves for Mahi Mahi caught by the Peruvian fishery (Goicochea et al. 2012). Estimating growth inside the model could improve the model fits to the length-composition data for all fleets. Second, there could be intra-cohort differences in growth that are not accounted for in the model. Third, the poor fits at the beginning or end of the fishing season could be a result of changing availability or selectivity as the fish start to become available to the fishery or become dispersed at the end of the fishing season. There could be other processes, or a combination of processes, that are responsible for these misfits. However, the fact that fits are good when the data are aggregated for all years and both sexes, and also good for the months in which most of the catch is taken indicates that the model is removing fish at sizes consistent with the data.

In the stock assessment model, larval recruitment (at age zero) is estimated to occur during December-January, half-way through the fishing year (July-June). Therefore, the annual cohorts are mainly recruited to, and progress through, the fishery during the following fishing year. Accordingly, the highest and lowest recruitments were each followed by the highest and lowest annual catches observed, in FY 2009 and 2010, respectively. There are pronounced seasonal (monthly) fluctuations in the biomass of Mahi Mahi in the South EPO. On average, the annual summary biomass (the total biomass of fish over 1 month old) peaks late in the calendar year (September-December), and rapidly declines to its lowest values around May-June of the following year. This pattern generally represents the total weight of a cohort, which increases initially because growth rates are higher than total mortality, and then declines as the growth rates decrease and/or the mortality increases.

According to the base case, and while measured at the start of the spawning season (November, as defined in the model), the summary biomass of Mahi Mahi has remained quite stable during the historic period of the assessment, averaging about 90,000 t per year. Likewise, the spawning biomass, also measured at the start of the spawning season, has remained very stable over the historic period of the assessment, averaging about 18,000 t). The precision of the spawning biomass estimates is very high (average CV = 0.1). The base case estimates of the annual fishing mortality rate (F) varied from 0.53 to 0.85 during 2007-2014.

Management quantities

At present, there are no reference points (target or limit) defined for Mahi Mahi in the EPO. For tuna, the IATTC evaluates stock status on the basis of calculations based on spawning biomass and the maximum sustainable yield (MSY). In this exploratory stock assessment, some spawning biomass and MSY-related quantities are presented, and their potential applicability to managing Mahi Mahi in the EPO is discussed. The spawning biomass ratio (SBR; the ratio of the current spawning biomass to that of the unfished stock), has been used to define reference points in many fisheries. The sSBR estimates produced by the base case model are quite stable over the assessment period, averaging about 0.20 (**Figure 3.3.9**).

The maximum sustainable yield (MSY) is defined as the largest long-term average catch or yield that can be taken from a stock or stock complex with the constant fishing mortality under prevailing ecological and environmental conditions while maintaining recruitment at average levels. The base case estimate for the MSY is 89,211 t, which is about 17% higher the maximum recorded total annual catch of about 76,000 t. However, because the yield curve is flat, the fishing mortality needed to obtain MSY is three times greater than the current fishing mortality.

The results of an analysis of sensitivity to the configuration of the model were summarized in time series of quantities of interest (spawning biomass, SBR, recruitment; **Table 3.3.3.1**). Sensitivity to alternative natural mortality (M) values show that the base case model assumption of M =1 yr^{-1} does not give the best fit to the model as the CPUE and the length-composition data support lower values of M, around 0.6 yr^{-1} for the length data and around 0.24 yr^{-1} for the CPUE. Although values as low as 0.43 yr^{-1} have been reported for Mahi Mahi

(Zúñiga-Flores 2014), the values supported by the likelihood profile over M are suspect for several reasons. On the one hand, M is notoriously difficult to estimate (Lee et al. 2011), even in cases with informative data types (such as age compositions) and exploitation histories (long history of exploitation with varying levels of exploitation), neither of which are the case with Mahi Mahi. On the other hand, the M profile is conditional on the model being properly specified and, as discussed above, the R0 profile indicates some level of model misspecification.

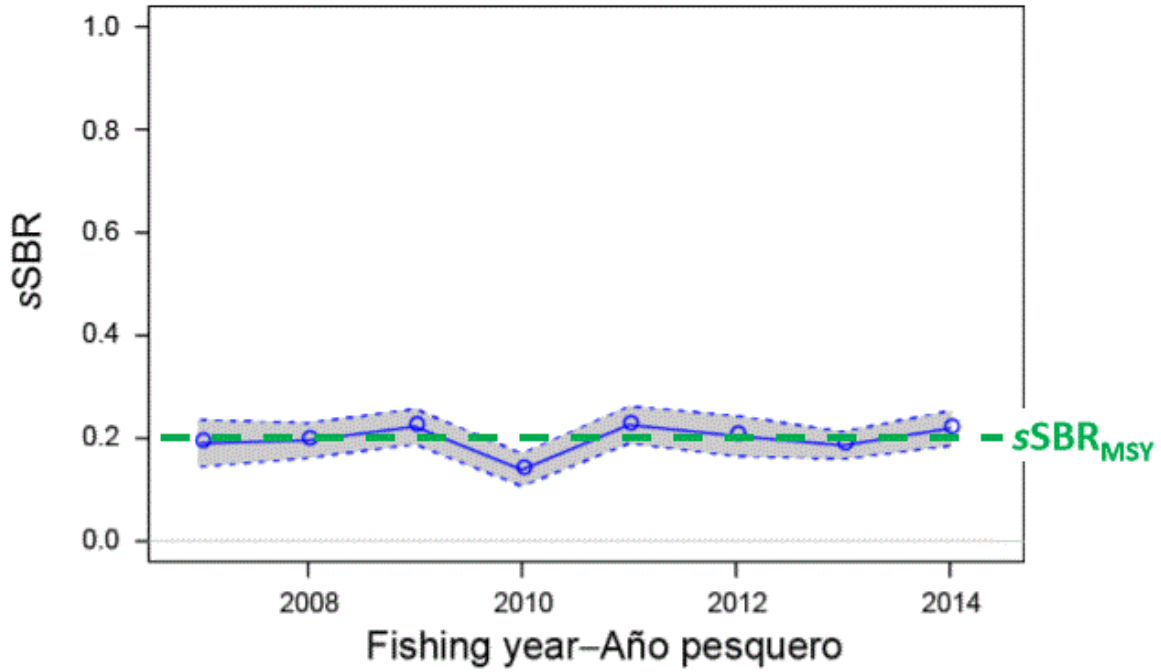


Figure 3.3.9. Estimated spawning biomass (2007-2014) around the level estimated to produce MSY

Table 3.3.3.1. Model summaries for main analyses of sensitivity to different configurations of the base case M: natural mortality; Qnotv: catchability, no temporal variation; Dome: dome-shaped size selectivity curve for the Peruvian fishery. S is the spawning stock biomass, and B is the summary biomass (defined as the biomass of fish 1+ months old), in metric tons (t). MSY is the estimated maximum sustainable yield, in metric tons.

	Base case Caso base	Sensitivity analyses - Análisis de sensibilidad			
		1		2	3
		*M*_0.43	*M*_1.6	*Q*_notv	Dome
S_0 (t)	90,045	205,001	62,015	85,577	89,952
B_0 (t)	254,687	545,880	192,791	242,067	254,429
S_{MSY}-S_{RMS} (t)	17,987	15,336	22,351	17,196	17,893
MSY-RMS (t)	89,211	79,502	100,530	84,490	89,010
S_{2014}/S_0	0.22	0.08	0.38	0.23	0.22
S_{MSY}/S_0-S_{RMS}/S_0	0.20	0.07	0.36	0.20	0.20
S_{2014}/S_{MSY}-S_{2014}/S_{RMS}	1.10	1.00	1.07	1.16	1.11

Estimating catchability (Q) as a single parameter with no time-varying deviates results in slightly higher recruitment variability, but the time series of age-0 recruitment, spawning biomass, and SBR, are not markedly different from the base case. Allowing the selectivity of the Peruvian fishery to be dome-shaped resulted in estimated domeshape selectivities, but the results were very similar to the base case model.

Yield-per-recruit analysis

A yield-per-recruit (YPR) analysis was carried out using the Stock Synthesis model, which makes the YPR analysis consistent with the stock assessment assumptions. The YPR analysis was used to investigate the impact of seasonal closures and minimum legal size (MLS) limits. To implement the YPR analysis, the Stock Synthesis model was first re-run using the fishing mortalities as parameters and checked to ensure that the results were the same as when using the hybrid approach (an efficient method of solving the catch equation) to implement fishing mortality. Using the fishing mortalities as parameters allows the fishing mortality rates to be fixed for the YPR analysis and manipulated to implement the MLS through a knife-edge retention curve. Likewise, the seasonal closures can be manipulated by changing the fishing mortality to zero for the closed months. We investigated MLS of 80, 90, 100, and 110 cm, with mortality rates (chosen arbitrarily for illustrative purposes only) of zero and 30% mortality rates for the fish discarded because they are under the MLS limit. Delaying the opening of the season and closing the season early has been investigated. The YPR analysis is conducted using the absolute yield, which is equivalent to MSY because the stock assessment assumes that recruitment is independent of stock size, and all scenarios use the same average recruitment. The yield curve resulting from the YPR analysis is very flat-topped, and the mortality rates that maximize YPR are about three times higher than the current fishing mortality rates (F multiplier ≈ 3). However, a fishing strategy aimed at maximizing the yield per recruit is not recommended because the yield curve is flat-topped, and increasing fishing mortality by a factor of three would result in small gains in yield. Analyses based on projections with effort remaining at current levels or on implementing management retrospectively might be more useful (see Valero et al. 2016). The maximum equilibrium yield could be increased by a moderate amount if an MLS is implemented, even with a discard mortality rate of 30% (**Table 3.3.3.2**). The discard mortality has a moderate influence on the maximum equilibrium yield. An MLS causes only a small increase in the SBR measured at the time of spawning (November). Seasonal closures have less impact on maximum equilibrium yield, but a larger impact on SBR, than the MLS (**Table 3.3.3.3**). Delaying the start of the fishing season is more beneficial in terms of both maximum equilibrium yield and the corresponding SBR.

Table 3.3.3.2. Results of the yield-per-recruit analysis with different minimum legal sizes (MLSs) and discard mortality rates.

MLS-TLM (cm)	Discard mortality rate Tasa de mortalidad de descartes	MSY RMS	% base MSY % de RMS base	SBR
None- Ninguna	0	89,770	100	0.18
80	0	105,791	118	0.19
80	0.3	99,241	111	0.18
90	0	115,300	128	0.20
90	0.3	101,948	114	0.19
100	0	116,348	130	0.21
100	0.3	98,942	110	0.19
110	0	108,835	121	0.21
110	0.3	94,924	106	0.19

Table 3.3.3.3. Results of the yield-per-recruit (YPR) analysis with different months of closure. (NOTE: these analyses were conducted using an early version of the base case assessment model, and therefore do not exactly match the results of the other YPR analyses).

Closure	Veda	MSY	% base MSY	SBR
		RMS	% RMS base	
None	Ninguna	72,326	100	0.17
Jan-May	Ene-May	75,138	104	0.25
Jan-Jun	Ene-Jun	76,882	106	0.25
Jan-Jul	Ene-Jul	78,169	108	0.24
Jan-Aug	Ene-Ago	77,756	108	0.22
Jan-Sep	Ene-Sep	74,653	103	0.19
Aug-Dec	Ago-Dic	71,647	99	0.15
Sep-Dec	Sep-Dic	72,285	100	0.16
Oct-Dec	Oct-Dic	72,540	100	0.17

3.4 Principle Two: Ecosystem Background

3.4.1 Eastern Pacific: context

The common dolphinfish or mahi mahi (*Coryphaena hippurus*, Linnaeus 1758) is a cosmopolitan species distributed through the tropical and subtropical regions of the Pacific, Indian and Atlantic Oceans (Palko et al., 1982), and it is generally common in most warm and temperate seas 21º to 30º C) (Varela et al., 2016) (Figure **3.4.1.1**).

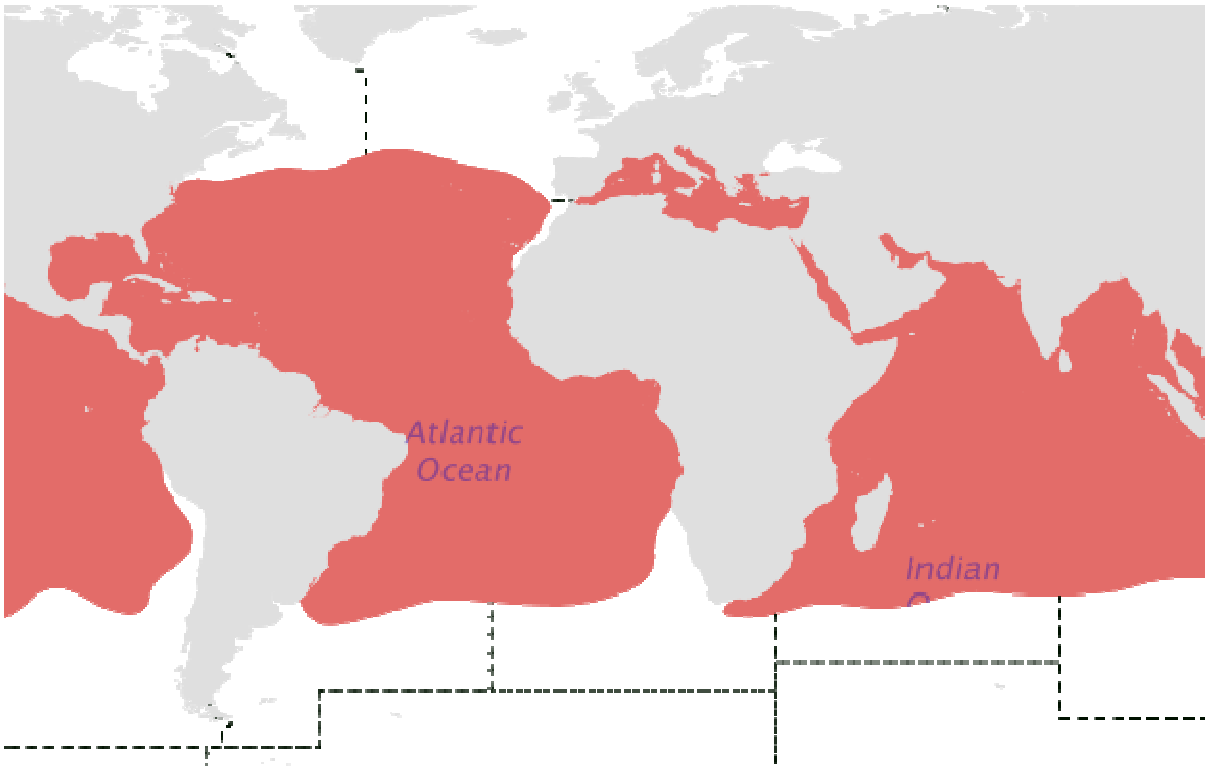


Figure 3.4.1.1. Mahi mahi distribution worldwide. (Source: FAO Species Fact Sheets – *Coryphaena hippurus* (Linnaeus, 1758), available at: http://www.fao.org/fishery/species/3130/en)

2.4.1.1. Location

The current UoA fishery under assessment, which is located between 05°00'N and 15°00'S, and as far west as the meridian of 100°00'W off the Galapagos Archipelago (Martínez-Ortiz et al., 2015), takes place in the South Eastern Pacific Ocean (**Figure 3.4.1.1.1** - blue squares), which corresponds to the Southeast Pacific FAO area 87, Subarea 87.1 – Northern Oceanic -, Division 87.1.4 (**Figure 3.4.1.1.2**).

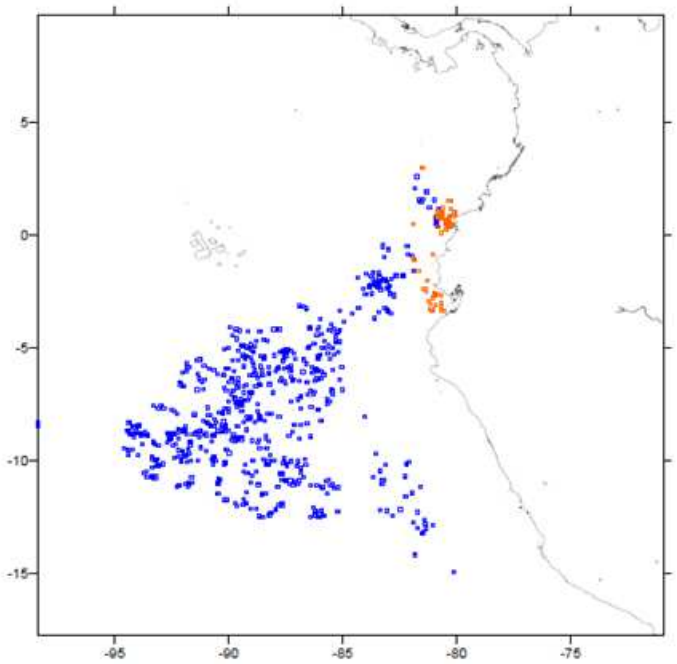


Figure 3.4.1.1.1 Mahi mahi's fishing activity from 2008 – 2011. Note: the blue squares are mother-ships (oceanic area), while the orange squares are independent fiberglass vessels (coastal area). (Source: Martínez-Ortíz & Zúñiga-Flores, 2012).

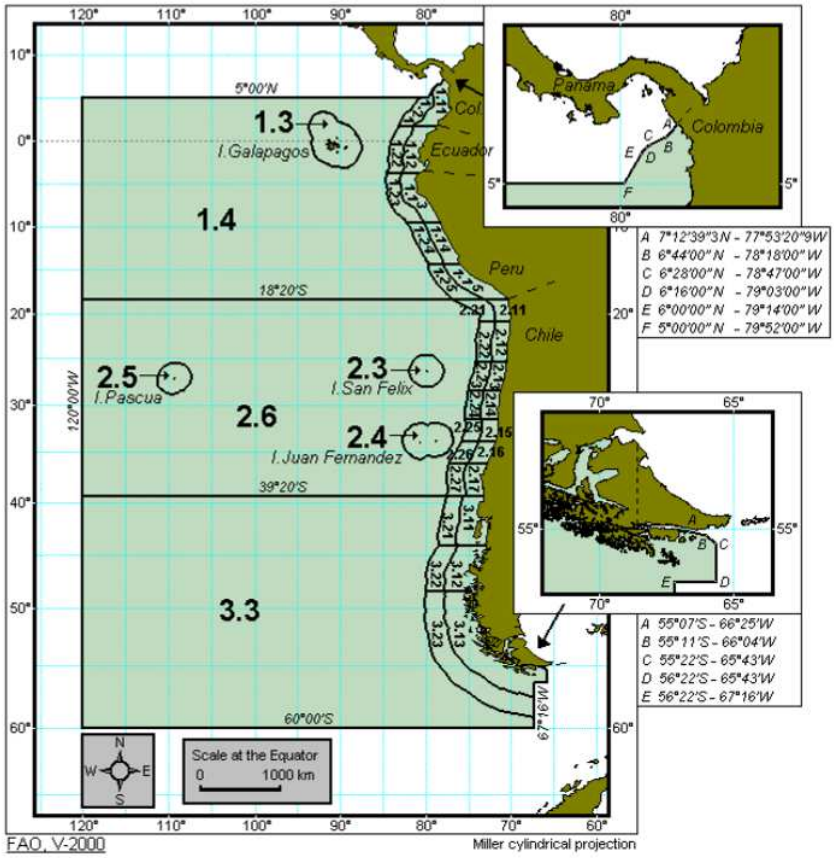


Figure 3.4.1.1.2 Southeast Pacific (FOA Major Fishing Area 87). (Source: FAO Major Fishing Areas http://www.fao.org/fishery/area/Area87/en)

2.4.1.2. Oceanographic features

Bathymetry

Figure 3.4.1.2.1 shows the general bathymetry for the southeastern Pacific in the approximate area where the fishery takes place (see **Figure 3.4.1.1.1**). As it can be observed, the continental shelf is narrow off Colombia and Ecuador, becoming wider (up to 100 km) off Peru.

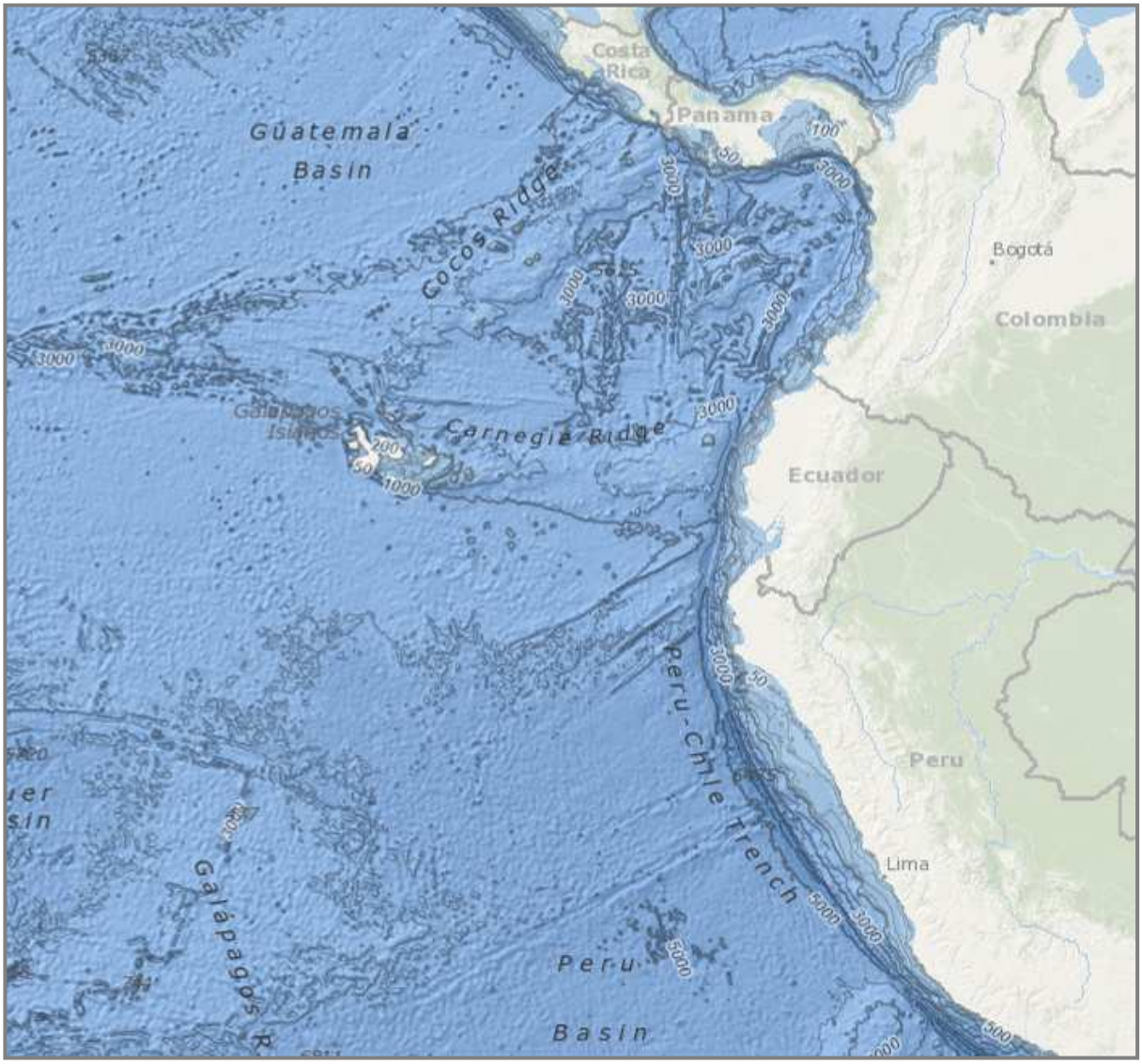


Figure 3.4.1.2.1 Southeastern Pacific bathymetry of the approximate area where the fishery takes place. (Modified from the following source: https://maps.ngdc.noaa.gov/viewers/bathymetry/)

Equatorial Pacific Ocean Circulation System

The equatorial zone presents a complex circulation system, which is variable in time and space, with zonal flows moving at high velocity in opposite directions and and regions of strong upwelling and downwelling (Kessler, 2006; Jiménez - Santistevan, 2008). These lateral transports give rise to upwelling of nutrient-rich waters along the equator and increased primary productivity in equatorial waters.

One of the most important features of the equatorial Pacific Ocean between the Galapagos Archipelago and the Ecuadorian mainland is the Equatorial Front (**Figure 3.4.1.2.2**), which is usually located between 0° and 3° S, separating the coldest, nutrient-rich waters of the Humboldt Current and its extension, the Equatorial South Current, from the warm and generally nutrient-poor surface waters from the north (Wooster, 1969; Jiménez - Santistevan, 2008). As inferred from SST, this front is a permanent upper-ocean feature, but its exact location varies seasonally (Martínez-Ortiz et al., 2015).

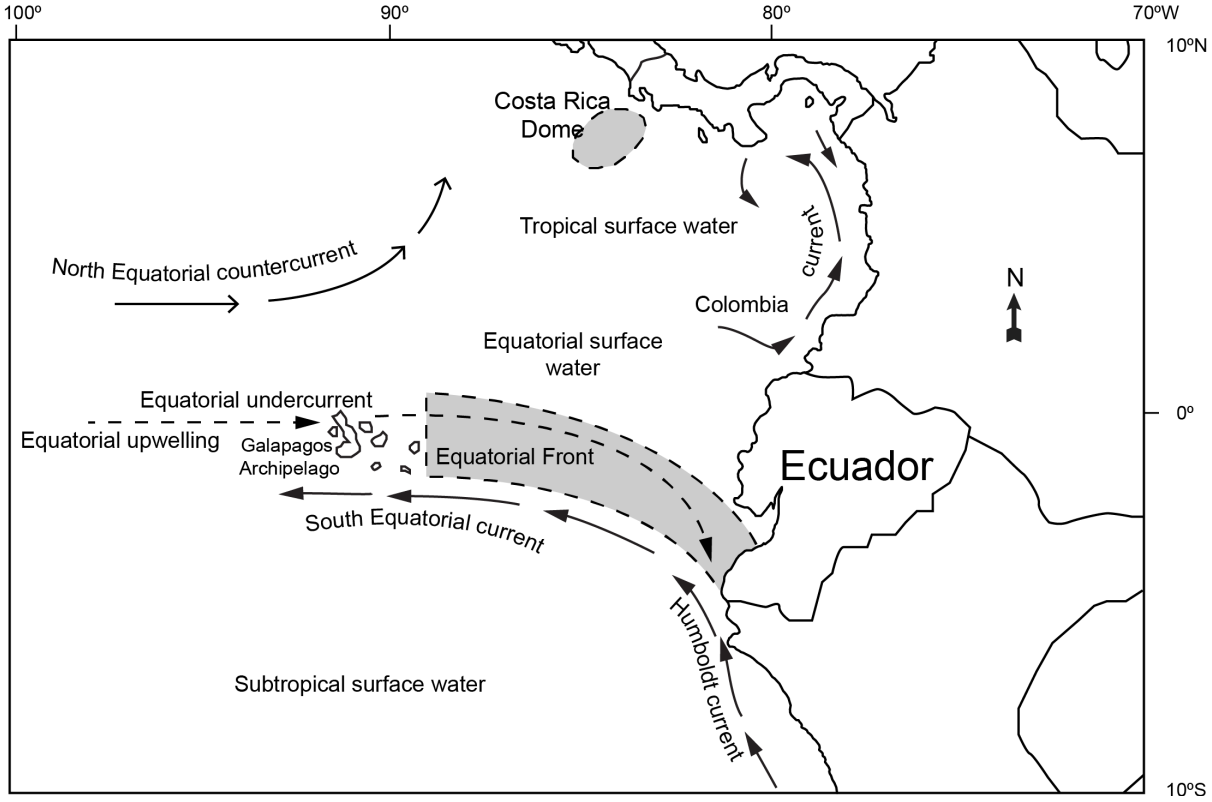


Figure 3.4.1.2.2 Main surface current systems of the eastern tropical Pacific Ocean. (Source: Martínez-Ortiz, et al., 2015).

Analyzing the monthly surface temperature averages, Wooster (1969) defined some general characteristics of the Front: 1) the Equatorial Front is a surface characteristic confined over the 100 m depth; 2) it is a permanent feature; 3) the location of the Front varies seasonally; 4) the Front is zonally oriented (west-east) between the Galapagos and 84° W, and meridionally (northeast-southeast) east of 83° W; and 5) the temperature gradient across the Front decreases from east to west, with higher temperatures in the southern hemisphere, during winter.

The dominant currents are those that move westward, such as the North and South Equatorial currents. The currents that move eastward are the Equatorial Countercurrent and the Equatorial Undercurrent or Cromwell Current. Over these lateral transports the vertical ascent of deep waters that give rise to the equatorial upwelling appears. This upwelling is considerably related to the system of powerful trade winds, whose intensity changes with the variability of the strength of the winds in space (longitudinal) and in time (seasonal, from year to year, El Niño, La Niña) (Jiménez - Santistevan, 2008).

In addition to the above, it has been suggested that fronts act as bordering areas for the distribution of organisms (plants and animals) in a manner similar to zoogeographic boundaries. It has also been noted that the frontal convergence zones determine the location of plankton and suspended material accumulation, which in turn determines other organisms' aggregation in the food chain such as flying fish (Family Exocoetidae), which is the preferred food of several pelagic animals, including the mahi mahi *Coryphaena hippurus* (Varela et al., 2016).

El Niño and La Niña effects

The ocean environment varies on a variety of time scales, from seasonal to inter-annual, decadal, and longer (e.g. climate phases or regimes) (IATTC, 2019b). The dominant source of variability in the upper layers of the Easter Pacific Ocean (EPO) is known as the El Niño-Southern Oscillation (ENSO), an irregular fluctuation involving the entire tropical Pacific Ocean and global atmosphere. El Niño events occur at 2- to 7-year intervals, and are characterized by weaker trade winds, deeper thermoclines, and abnormally high sea-surface temperatures (SSTs) in the equatorial EPO. El Niño's opposite phase, commonly called La Niña, is characterized by stronger trade winds, shallower thermoclines, and lower SSTs. The changes in the physical and chemical environment due to ENSO have a subsequent impact on the biological productivity, feeding, and reproduction of fishes, birds, and marine mammals (IATTC, 2019b).

Strong positive anomalies (e.g., El Niño events, 1982 – 1983) are known to produce great perturbations in composition, distribution and abundance of the pelagic fish community structure throughout the equatorial Pacific Ocean (Jiménez and Herdson, 1984; Lehodey et al., 1997). For example, great changes have been indicated in the distribution and abundance of mahi mahi (*C. hippurus*) associated with the circulation of El Niño warm water masses in the EPO during the second semester of 1982 (Jiménez, 1987).

Climate change effect

As exemplified by El Niño, the tropical Pacific Ocean strongly influences regional climates and their variability worldwide (Bjerknes, 1969; Trenberth et al., 1998; Dai and Wigley, 2000). It also regulates the rate of global temperature rise in response to rising greenhouse gases (GHGs) (Kosaka and Xie, 2013) 4. The tropical Pacific Ocean response to rising GHGs impacts all of the world's population. State-of-the-art climate models predict that rising GHGs reduce the west-to-east warm-to-cool sea surface temperature gradient across the equatorial Pacific (Coats, S. and Karnauskas, 2017) (see **Figure 3.4.1.2.3a**). In nature,

however, the gradient has strengthened in recent decades as GHG concentrations have risen sharply (Coats, S. and Karnauskas, 2017) (see **Figure 3.4.1.2.3b**). This stark discrepancy between models and observations has troubled the climate research community for two decades. Seager et al (2019) showed that the erroneous warming in state-of-the-art models is a consequence of the cold bias of their equatorial cold tongues. The failure of state-of-the-art models to capture the correct response introduces critical error into their projections of climate change in the many regions sensitive to tropical Pacific sea surface temperatures (Seager et al., 2019).

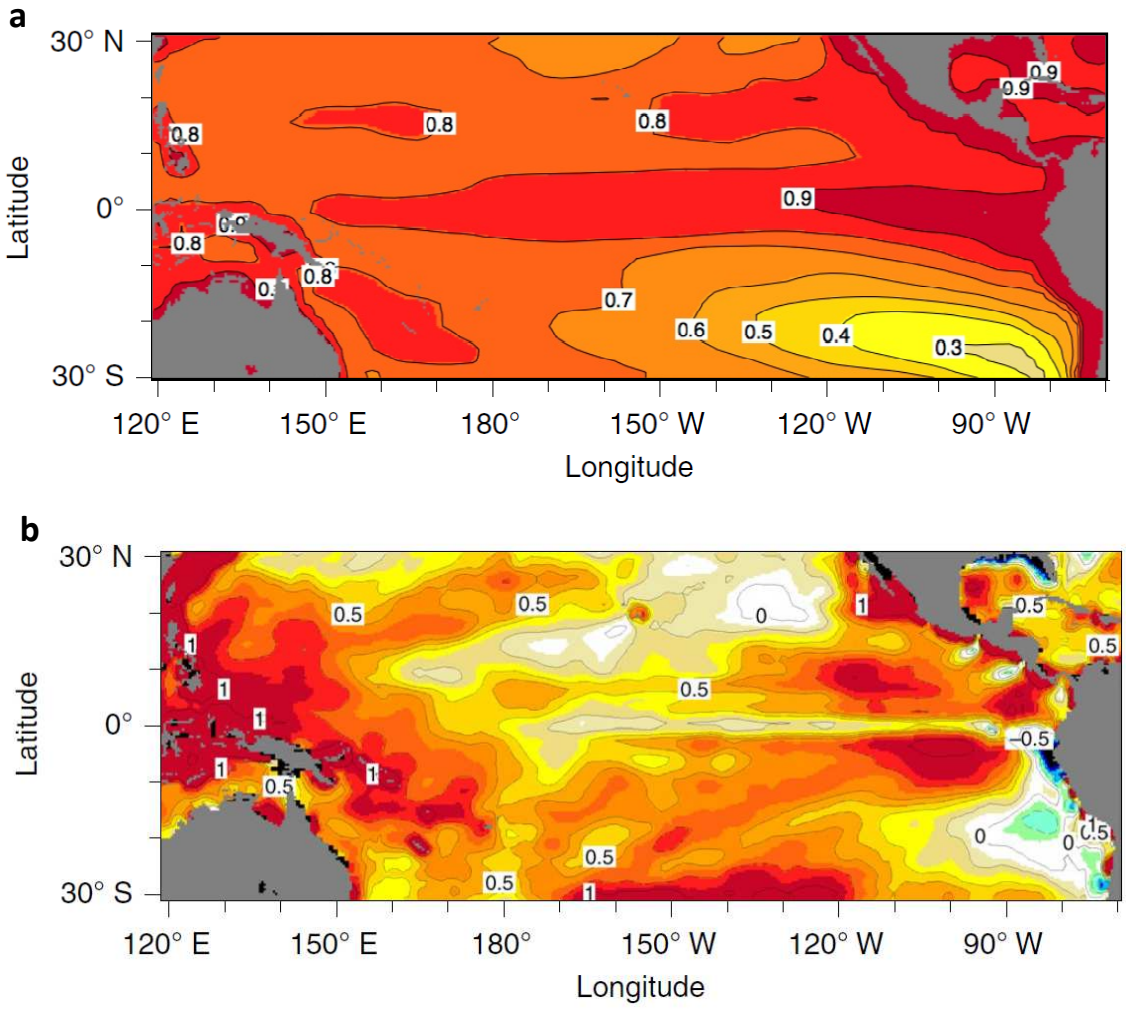


Figure 3.4.1.2.3 The tropical Pacific Ocean: (a) Prediction of the state-of-the-art climate models in response to rising GHGs (i.e., reduction of the west-to-east warm-to-cool sea surface temperature gradient across the equatorial Pacific with pronounced warming of waters along the equator); (b) The gradient in nature, which has strengthened in recent decades as GHG concentrations have risen sharply with equatorial waters remaining relatively cool. (Modified from: Seager et al., 2019).

The SST of the equatorial Pacific influences climate and its variability worldwide. Generally, warming of the atmosphere increases the amount of moisture the air can hold, and intensifies moisture transport. This tends to make subtropical dry zones drier and tropical and mid-latitude wet zones wetter.

In an interview (https://blogs.ei.columbia.edu/2019/06/24/pacific-ocean-cold-tongue/), Dr. Seager explained that if the cold tongue warms as the complex state-of-the-art climate models say it should, analogous to an El Niño event, it will create a wet tendency in some regions, to offset subtropical drying in southwest North America and South America. It will also create a wetting tendency in east Africa, but a drying tendency in equatorial South America and the Sahel. If, instead, they (Seager et al.) are right and the cold tongue will not warm as much, then drying in southwest North America, subtropical South America and east Africa could be more severe than the climate models project. At the same time, equatorial South America and the Sahel might see wetter conditions.

In particular, Ecuador, Peru, and Chile are under the influence of the Humboldt upwelling system and subject to high environmental variability caused by the ENSO (El Niño Southern Oscillation) and LNSO (La Niña Southern Oscillation). During recent decades, the Humboldt Current System has produced more fish by surface unit than any other marine system; however, according to FAO (2018), climate change could shift this system out of its current favorable state of productivity. This could mean significant changes for the countries that benefit the most from this system -Chile, Ecuador and Peru- since El Niño and La Niña events may become more frequent in a warming climate, with major regime shifts in fisheries and an overall decrease in plankton abundance (Cruz et al., 2003; Lutz et al., 2003; FAO 2018).

2.4.1.3. Marine habitat

According to MSC requirements (SA 3.13.1), the team shall assess the habitats component in relation to the effects of the UoA on the structure and function of the habitats impacted by the UoA. The habitat's structure and function (i.e., the ecosystem services that it provides), including abundance and biological diversity, is of concern in an MSC assessment. Thus, an assessment should look not only at the impact on the habitat but also the habitat's delivery of ecosystem services.

Prior to the assessment of the habitats component, the team shall determine and justify which habitats are commonly encountered, vulnerable marine ecosystems (VMEs), and minor (i.e., all other habitats).

Commonly encountered habitats

Commonly encountered habitats are defined by MSC Requirements (FCR GSA3.13.3.1) as those preferred by the target species, that the UoA's gear is designed to exploit, and/or make up a reasonable portion of the UoA's fishing area.

The mahi mahi fishery with the doradero gear takes place at around 9-14 m depth, therefore, the epipelagic habitat in the Southeastern Pacific Ocean is considered as the commonly encountered habitat for the purpose of this assessment.

The assessment team is not aware of any evidence of adverse impacts on the structure or functioning of the pelagic habitat by the doradero. The fishery doesn't change the characteristics of the water column, e.g., the temperature, salinity, or currents.

VMEs

According to MSC FCR GSA3.13.3.2, VMEs have one or more of the following characteristic, as defined in paragraph 42 of the FAO Guidelines: (i) Uniqueness or rarity; (ii) Functional significance of the habitat, (iii) Fragility; (iv) Life-history traits of component species that make recovery difficult; (v) Structural complexity.

The FAO Guidelines' Annex identifies the following species groups, communities, and habitat-forming species that may form VMEs and may be indicative of the occurrence of VMEs: (i) Certain coldwater corals and hydroids; (ii) Some types of sponge-dominated communities; (iii) Communities composed of dense emergent fauna where large sessile protozoans and invertebrates (e.g., hydroids and bryozoans) form an important structural component of habitat; (iv) Seep and vent communities comprised of invertebrate and microbial species found nowhere else (i.e., endemic).

The FAO Guidelines' Annex also lists various geographical features that are often associated with these communities.

Epipelagic habitats in open waters are not included in the definition of paragraph 42, subparagraphs (i)-(v) of the FAO Guidelines on Vulnerable Marine Ecosystems (VMEs), as described in MSC FCR GSA3.13.3.2. Therefore, no VMEs were identified in this assessment.

Minor habitats

Minor habitats are defined by MSC as those that do not fall within the classification of Commonly Encountered Habitats or VMEs (GSA3.13.3).

Taking into account that the whole fishing area described in Section **3.2.2** and observed in **Figure 3.4.1.1.1** is considered a commonly encountered habitat, no minor habitats have been identified in this assessment.

2.4.1.4. Marine Biodiversity/Food web/Ecosystem resilience

Large Marine Ecosystems (LMEs)

The Large Marine Ecosystem or LMEs (http://www.lme.noaa.gov/) are defined as ''areas of the ocean characterized by distinct bathymetry, hydrology, productivity and trophic interactions'' (**Figure 3.4.1.4.1**). As observed in **Figure 3.4.1.1.1**, the UoA fishing occurs within two LMEs, the Pacific Central-American Coast and the Humboldt Current (**Figure 3.4.1.4.1**, #11 and #13, respectively).

The Pacific Central-American Coastal LME (Heileman, 2009), extends along the Pacific Coast of Central America, from 22° N off Mexico down to 4° S (**Figure 3.4.1.4.1**, # 11). It is shared by Mexico, Guatelama, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia and Ecuador. The LME covers a surface area of nearly 2 million km^2, of which 1.42% is protected, and includes 0.22% of the world's coral reefs and 0.78% of the world's sea mounts (Sea Around Us, 2007). Re-circulating coastal currents and milder temperatures than those of the adjacent California Current and Humboldt Current LMEs characterize this LME (Bakun et al., 1999). Much of the Pacific Central-American Coastal LME is influenced by the seasonal movements of the Inter-tropical Convergence Zone (Bakun et al., 1999). The region is vulnerable to the ENSO phenomenon, which affects productive activities, infrastructure, natural resources and the environment in general. The climate varies from tropical to temperate, with a dry period during the winter months. During the rainy season from May to September, rivers discharge significant volumes of fresh wter and suspended solids into the coastal areas of this LME (Windevoxhel et al., 2000). Extreme ocean depths are reached very close to the coast due to a narrow and steep continental shelf.

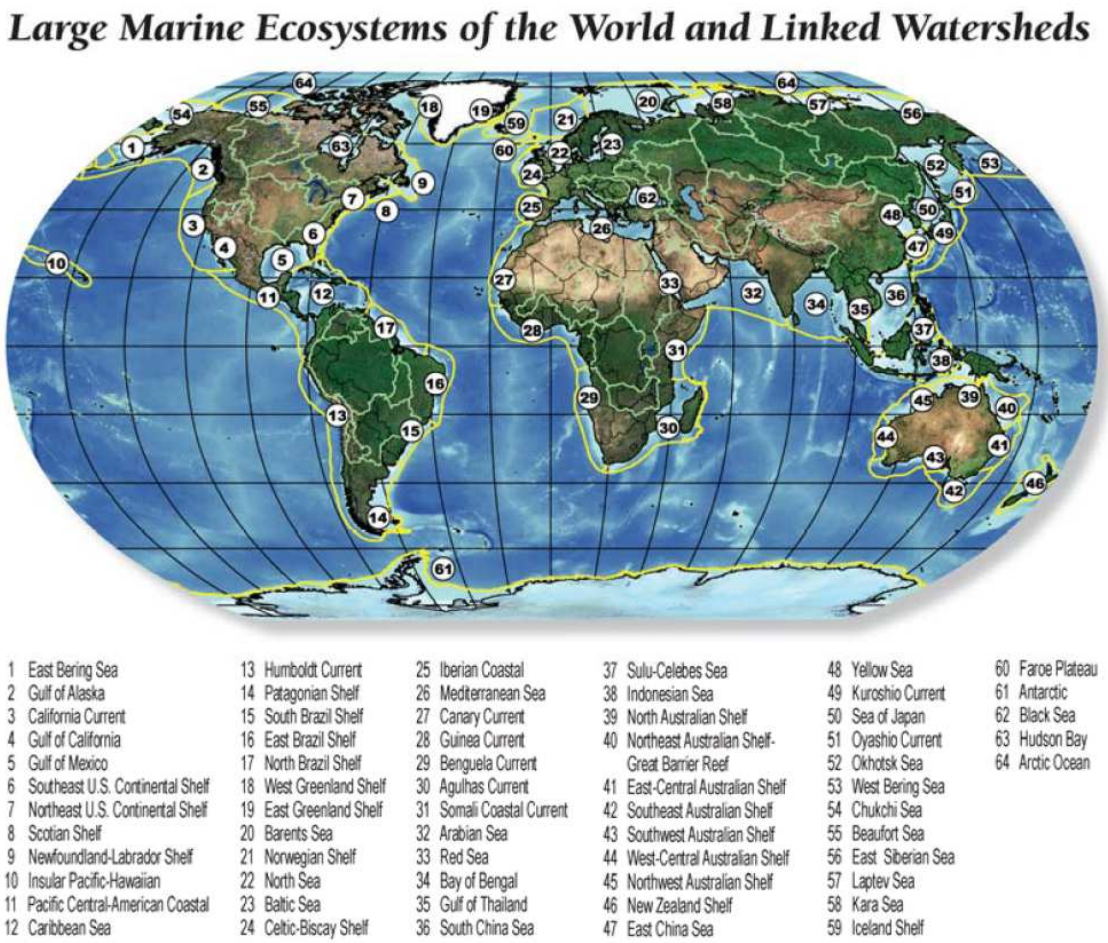


Figure 3.4.1.4.1 Map showing the 64 Large Marine Ecosystems (LMEs) of the world. LMEs in this map are numbered as they are on the LME website, www.lme.noaa.gov.

The Humboldt Current LME (Heileman et al., 2009), extends along the west coast of Chile and Peru (**Figure 3.4.1.4.1**, # 13). It has a surface area of 2.5 million km^2, of which 0.11% is protected, and contains 0.42% of the world's sea mounts and 24 major estuaries (Sea Around Us, 2007). The LME's circulation patterns are described by several authors including Wyrtki (1967), Alheit and Bernal (1993) and Wolff et al., (2003). Ekman offshore divergence due to the southerly trade winds gives rise to the world's largest coastal upwelling system that characterizes this LME. This system shows high climatic as well as oceanographic variability associated with seasonal, interannual, decadal and longer-term changes. Considerable interannual variability occurs when the normal seasonal upwelling is interrupted by ENSO, which results in intrusions of warm, clear oceanic waters from the west and north (Wolff et al., 2003, Alheit and Ñiquen, 2004).

The eastern tropical Pacific region, which encompasses the continental coasts of southern Central America (Costa Rica and Panama) and of northwestern South America (Colombia and Ecuador) is characterized by cliffs alternating with pocket beaches, alluvial and deltaic plains with extensive sandy beaches, well-developed mangrove forests, estuaries, lagoons, and, reefs (Miloslavich et al., 2011). It also includes important offshore island systems such as the Pearl and Galapagos islands (Cruz et al., 2003; Díaz & Acero, 2003). The Peruvian coast also is diverse with bays, cliffs, kelp and macroalgal beds, rocky shores and sandy beaches, islands, and peninsulas, as well as wetlands, which include the southernmost limit to the tropical Pacific mangrove ecosystem (Tarazona et al., 2003; Fernandez-Baca et al., 2007).

Marine Biodiversity

Regarding the marine biodiversity in the Tropical East Pacific (Miloslavich et al., 2011): Ecuador, Colombia, Panama, and Costa Rica, at least 6,714 species-level taxa were been reported in the Pacific coastal waters of Costa Rica, Panama, Colombia, and Ecuador, from four Protista groups, (Foraminifera, Radiolaria, Tintinnida, Dinoflagelata), two plant phyla (algae, angiospermae), and 30 animal phyla.

Analysis of the compiled data on the marine biodiversity in the Humboldt Current (Miloslavich et al., 2011), i.e., Chile and Peru, indicated three zones of high richness for this region (**Figure 3.4.1.4.2**): (a) the northern Peruvian coast between 5^o and 8^{o}S, with 501 species, 270 genera, and 193 families at the point of maximum diversity; (b) the northern Chilean coast between 22^o and 24^{o}S, with 431 species, 273 genera, and 159 families at the point of maximum diversity; and (c) the southern Chilean coast between 52^o and 56^{o}S, with 522 species, 324 genera, and 188 families at the point of maximum diversity. The current diversity of the HC includes 10,201 species. Amphipoda, Gastropoda, and Polychaeta are the taxa with the greatest number of described species.

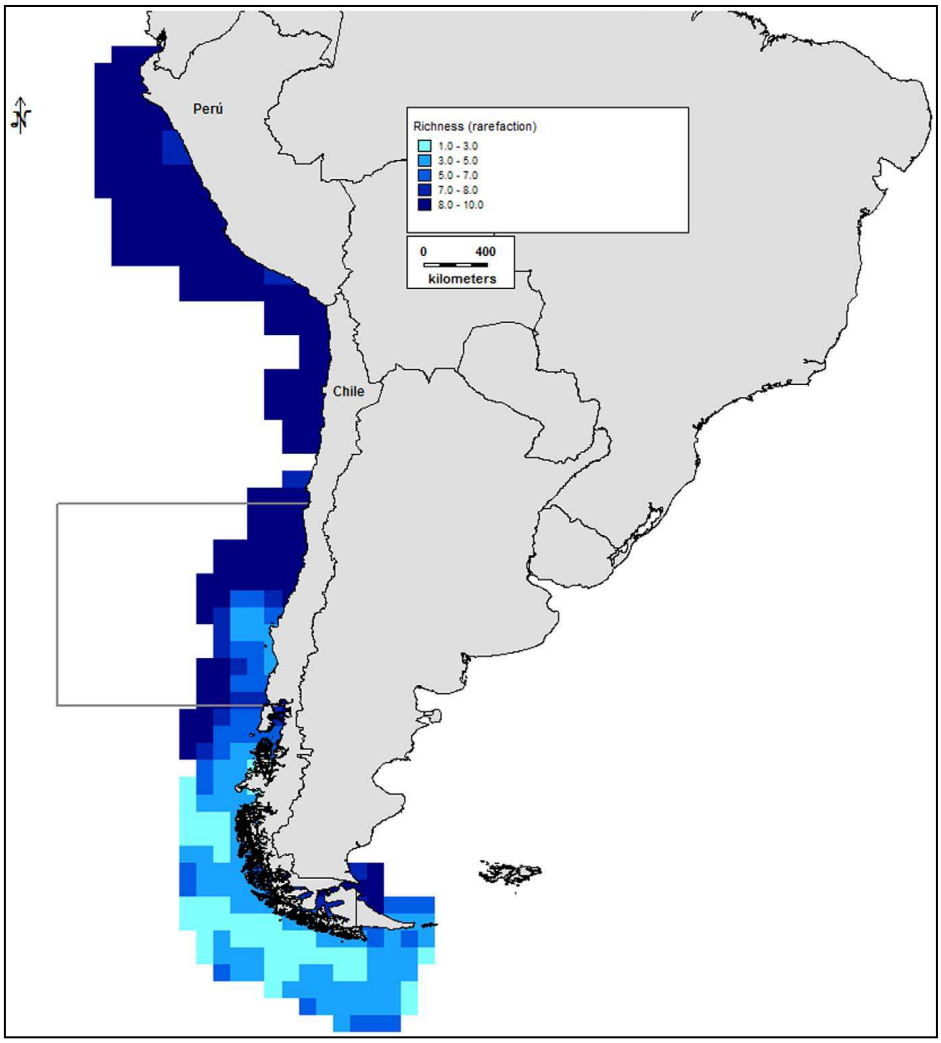


Figure 3.4.1.4.2 Species richness in the Humboldt Current subregion. Scale represents number of species. (Source: Miloslavich et al., 2011)

Food web

As species mostly interact through predation, the existence of top-down control (**Figure 3.4.1.4.3**), which means the regulation of lower food-web components by one or several upper-level predators, should be critical in the functioning of marine ecosystems (Cury et al., 2001).

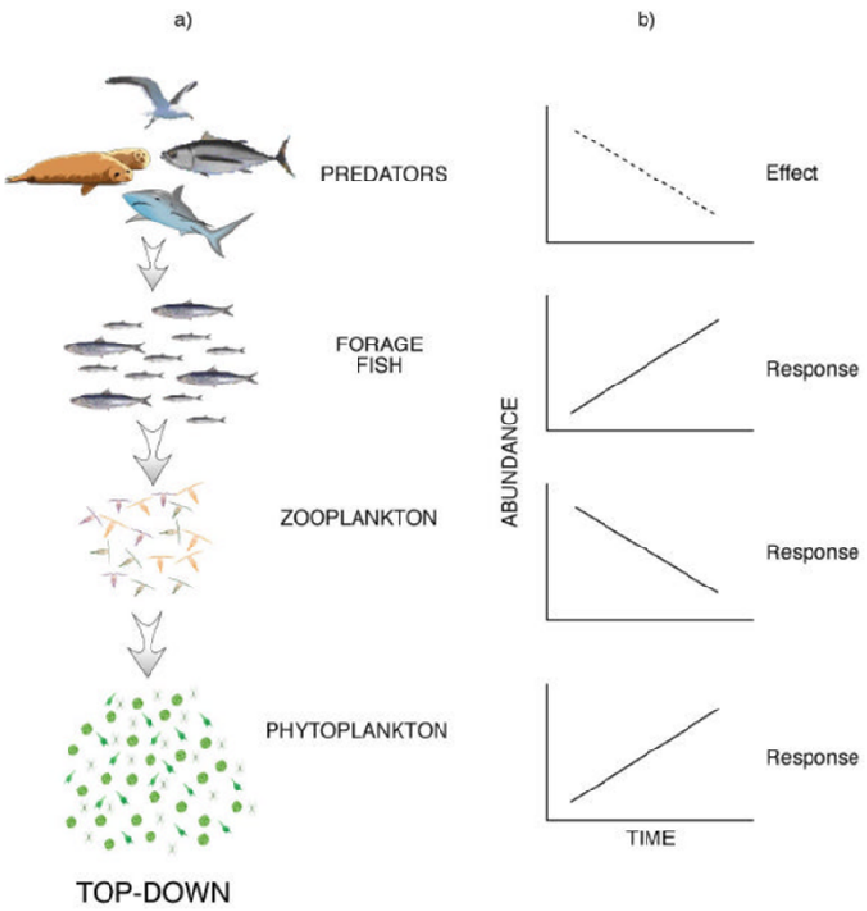


Figure 3.4.1.4.3 (a) Top-down control within a simplified four-level food web in a marine ecosystem. (b) The decreasing size of the top predator populations lead to a reduced predation on the prey that leadsto an increase in the abundance of the prey fish. The increased predation of the fish prey on thezooplankton lead to a decrease in the population size. The diminution of the zooplankton abundancereduces the grazing pressure on the phytoplankton, which consequently becomes more abundant. (Source: Cury et al., 2001)

Mahi mahi are usually confined to the upper 30 m of the water column, or between the surface and the thermocline (< 30 m) (Palko et al., 1982; Tripp-Valdez et al., 2015). Like other large pelagic fishes, this species plays an important role in epipelagic ecosystems, since it may delineate the structure of the food-webs by top-down controls. Previous trophic biology studies carried out in the Northern Pacific Ocean, Atlantic Ocean and Mediterranean Sea have revealed that *C. hippurus* feeds on a wide variety of fish and invertebrate pelagic organisms (Oxenford & Hunte, 1999; Tripp-Valdez et al., 2015), and so has been defined as a non-selective and generalist predator (Massutí et al., 1998; Castriota et al., 2007).

The diet and the feeding habits of mahi mahi (*Coryphaena hippurus*) in the Pacific coast of Ecuador was assessed by examining 320 stomachs of individuals ranging from 51 to 149 cm

in total length (Varela et al., 2016). Fish was the predominant prey group in the diet followed by cephalopods and crustaceans. Among the 17 prey items that made up mahi mahi's diet, the Exocoetidae family was the most important prey, *Dosidicus gigas* being the most abundant invertebrate species. The results of this study indicate that mahi mahi is an opportunistic feeder, which is capable of consuming a wide variety of schooling epipelagic organisms (Varela et al., 2016).

According to Varela et al (2016), in the Ecuadorian Pacific mahi mahi has a varying degree of specialization on different prey taxa (**Figure 3.4.1.4.4**). Thus, *Hippocampus hippocampus*, *Lagocephalus lagocephalus*, Gobiidae and *Argonauta* sp. showed low occurrence and low prey-specific abundance (lower left), suggesting that all these species are unimportant and rare prey. Scombridae, *Pleuroncodes planipes*, *Portunus xantusii* and *Opisthonema libertate* showed low occurrence and high prey-specific abundance (upper left), indicating they are predated by a low number of individuals. Exocoetidae, located in the upper central area of the graph, may be considered the most important prey species, since it was found in a high percentage of stomachs (i.e., 39.39%). In spite of the fact that some individuals predated on a small proportion of prey, many of them fed on the dominant taxa (Exocoetidae).

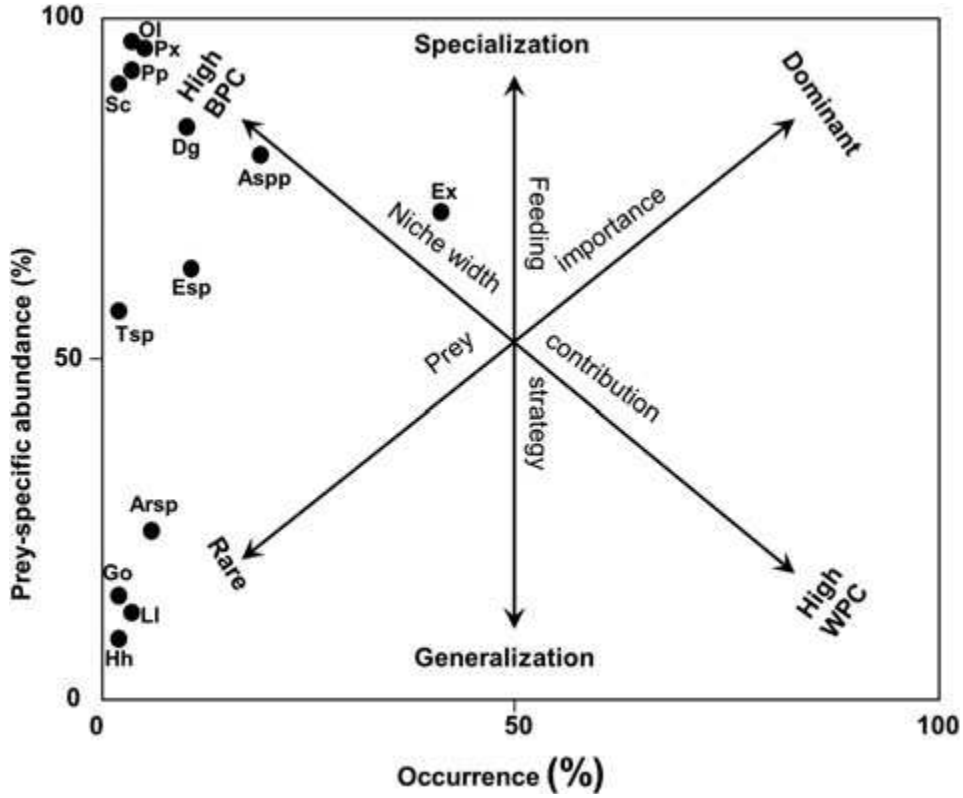


Figure 3.4.1.4.4 Prey-specific abundance plotted against frequency of occurrence of prey species for common dolphinfish from the Pacific coast of Ecuador. The two diagonal axes represent the importance of prey (dominant vs rare) and the contribution to the niche width (high between-phenotype vs high within-phenotype contribution); the vertical axis defines the predator feeding strategy (specialist vs generalist). Aspp, *Auxis* spp.; Arsp, *Argonauta* sp.; Dd, *Dosidicus gigas*; Esp, *Engraulis* sp.; Ex, Exocoetidae; Go, Gobiidae; Hh, *Hippocampus hippocampus*; Ll, *Lagocephalus lagocephalus*; Ol, *Opisthonema libertate*; Sc, Scombridae; Tsp, *Trachinotus* sp.; Pp; *Pleuroncodes planipes*; Px, *Portunus xantusii*. (Source: Varela et al., 2016.)

2.4.1.5. MPAs

Ministerial agreement 134 of July 24, 2007, declared the area from the shore of Ecuador's continental coast profile up to a nautical mile into the sea a Reserve Area for the production of bio-aquatic species. In this reserve area the following is allowed:

a) The collection, extraction or manual capture of crustaceans and molluscs by traditional artisanal fishers.
b) The use of traditional artisanal fishing gears such as the cast nets ("atarraya"), or hand lines.
c) Sport fishing with hand line and / or fishing rod.
d) Capture of oysters or other mollusks by freediving.
e) Non-extractive sport diving.
f) Extractive APNEA sport diving or freediving.
g) Extraction of existing resources under all fishing modalities, only for scientific purposes.

In addition, Ministerial Agreement 2305 RO #3 of August 6, 1984 and Ministerial Agreement 080 of march 19, 1990 declared a fishing area (within 8 nautical miles) reserved exclusively for artisanal fishers. Within this fishing area, artisanal fishers as well as the industrial shrimp (*Protrachypene precipua*) trawling fishing fleet are allowed to fish, subject to the Fishing Law and its Regulations.

Moreover, the country is part of the East Tropical Pacific Marine Corridor (CMAR), a regional initiative led by the governments of Costa Rica, Panama, Colombia and Ecuador. The CMAR has among its objectives, to promote the management and conservation of marine resources, improve and consolidate the management of Marine Protected Areas that make up the corridor, and establish a regional framework that facilitates the development and integral management of the corridor compatible with national policies and laws (León Cabrera, 2018; https://www.iucn.org/es/content/corredor-marino-del-pac%C3%ADfico-este-tropical-cmar).

The marine protected areas in the South Eastern Pacific Ocean in the area where the UoA fishery operates is shown in **Figure 3.4.1.5.1**. The characteristics of each of these areas can be consulted in websites such as the MPAtlas website (http://mpatlas.org/explore/) or the protected planet website (http://www.protectedplanet.net/).

By overlapping both figures (**Figure 3.4.1.5.2**), it can be observed that protected habitats susceptible to being affected by the fleet being assessed are either the Galapagos Islands or coastal habitats, which are unlikely to be impacted by the the doradero (thin surface longline), whose hooks are set around 6-13 m depth (Martínez-Ortíz & Zúñiga-Flores, 2012; Martínez-Ortiz et al., 2015) in oceanic waters as far as 100º W, west of the Galapagos Islands.

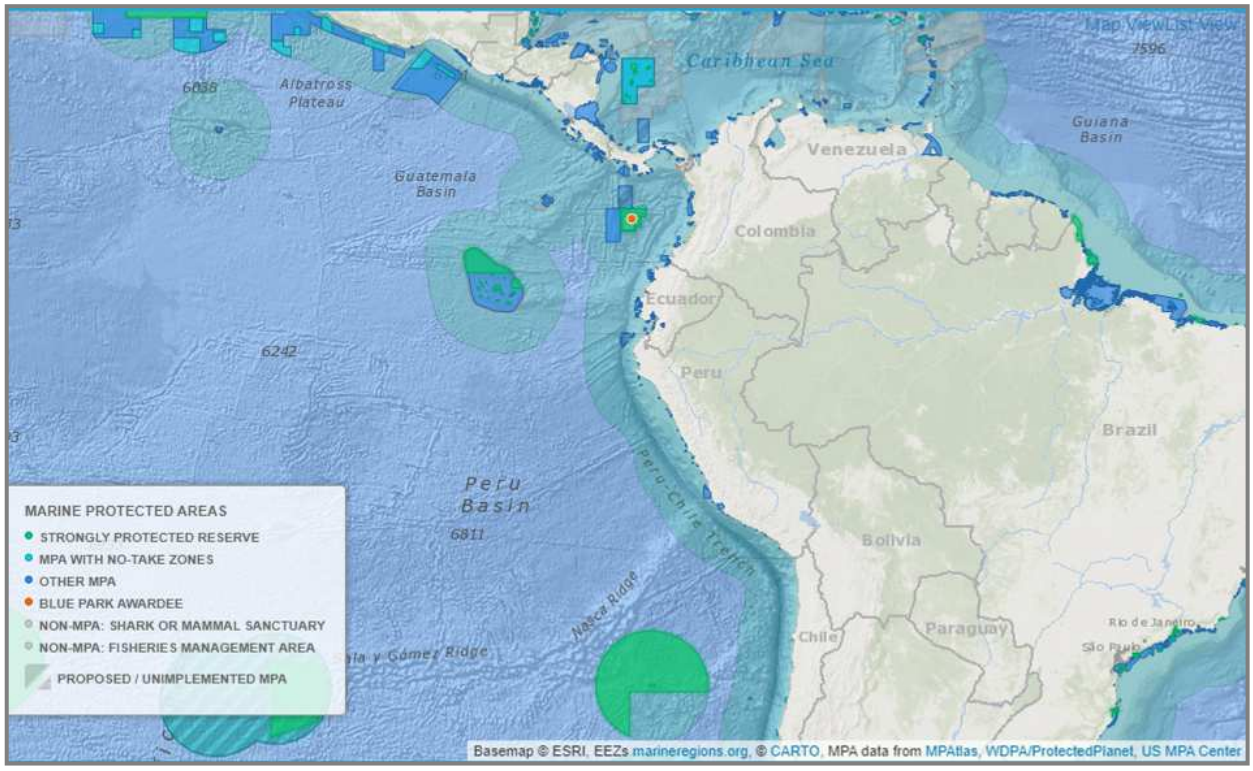


Figure 3.4.1.5.1 Marine protected areas in the Eastern Pacific Ocean, © Marine Conservation Institute 2019. Source: MPAtlas website (http://mpatlas.org/explore/).

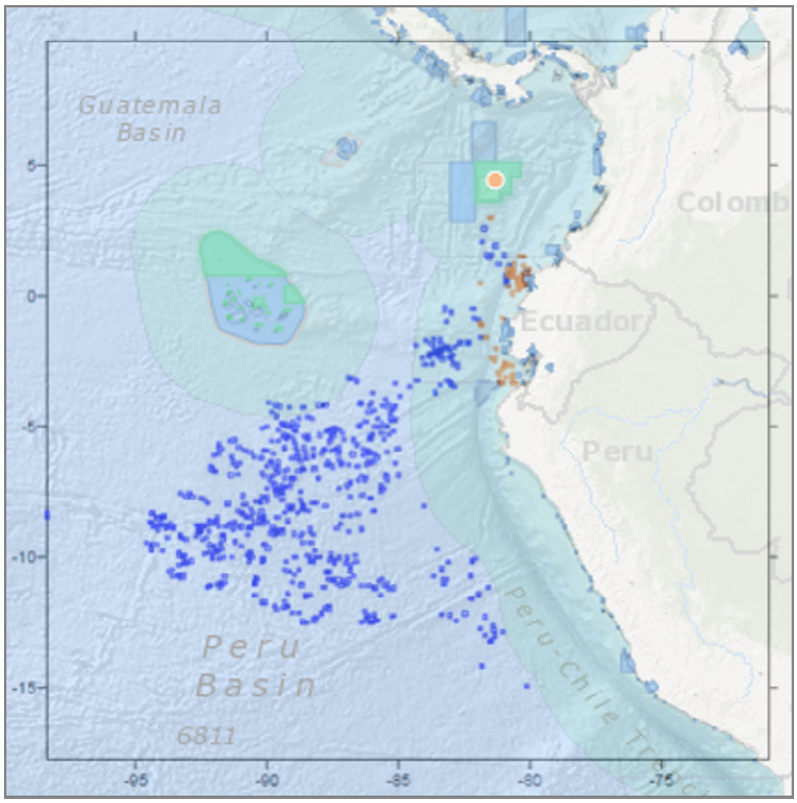


Figure 3.4.1.5.2 Map of the marine protected areas in the Eastern Pacific Ocean with the Mahi mahi's fishing activity from 2008 – 2011 overlapped. Note: the blue squares are mother-ships, while the orange squares are the independent fiberglass vessels.

3.4.2 UoC catch composition: species assigment to MSC P2 categories

The species assessed under P2 are those species in the catch that are not covered under P1. The assessment team considered each P2 species within only one of the primary species, secondary species or ETP species components, according to MSC FCRs SA3.1.3-3.1.5 and SA3.4.4-3.4.5.

3.4.2.1 Sources of information

Before categorizing P2 species is important to indicate the different sources of information used by the team to assess the species impacted by the fishery:

a. Data collected by the fleet

Ecuadorian fishing vessels have to record their catches in their logbooks, according to the Regulations to the Fisheries and Fisheries Development Law of Ecuador (Executive Decree 3198), i.e., "Industrial fishing shipowners must use the electronic journal (…), artisanal shipowners have the obligation to carry and submit to the Ministry of Agriculture, Livestock, Aquaculture and Fisheries the physical logbook".

From these logbooks, the obtained UoA catches are the ones presented above in **Table 3.1.2** from section **3.1.2** "Total Allowable Catch (TAC) and Catch Data" in metric Tons. The following table (**Table 3.4.2.1.1**) summarizes the catches (in metric Tons) and the percentages of the different species caught by the UoA while fishing for mahi mahi between 2013 and 2017.

Table 3.4.2.1.1. UoA catch composition in metric Tons and percentage from 2013 until 2017. Source: Subsecretaría de Recursos Pesqueros (SRP, Undersecretary of Fisheries Resources).

Species	Common name (EN)	Common name (ES)	2013	%	2014	%	2015	%	2016	%	2017	%
Osteichthyes												
Coryphaena hippurus	Mahi mahi	Dorado	6472,65	94,08	11355,72	88,42	4240,93	87,71	1255,26	28,38	5376,18	89,29
Acanthocybium solandri	Wahoo	Wahoo	5,99	0,09	7,75	0,06	4,80	0,10	16,54	0,37	2,12	0,04
Anisotremus taeniatus	Panama porkfish	Rayado	0,00	0,00	0,05	0,0004	0,00	0,00	0,00	0,00	0,00	0,00
Brotula clarkae	Pacific bearded brotula	Corvina de roca	0,00	0,00	0,03	0,0002	0,10	0,002	0,43	0,01	0,00	0,00
Caranx caballus	Green jack	Caballita	0,00	0,00	1,58	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Dissostichus eleginoides	Patagonian toothfish	Bacalao	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,21	0,003
Epinephelus analogus	Spotted grouper	Mero	0,00	0,00	0,06	0,0004	0,00	0,00	0,00	0,00	0,00	0,00
Epinephelus labriformis	Starry grouper	Cabrilla	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00
Epinephelus niphobles	Star-studded grouper	Murico	0,00	0,00	0,00	0,00	0,00	0,00	3,20	0,07	0,00	0,00
Euthynnus lineatus	Black skipjack	Bonito Pata seca	0,00	0,00	9,09	0,07	0,00	0,00	0,25	0,01	0,23	0,004

Species	Common name (EN)	Common name (ES)	2013	%	2014	%	2015	%	2016	%	2017	%
Istiompax indica	Black marlin	Picudo negro o plomo	0,00	0,00	0,00	0,00	0,00	0,00	0,23	0,01	0,11	0,002
Istiophorus platypterus	Indo-Pacific sailfish	Banderon	0,34	0,00	127,32	0,99	15,61	0,32	76,32	1,73	9,98	0,17
Kajikia audax	Striped marlin	Gacho	2,72	0,04	54,89	0,43	14,22	0,29	132,90	3,00	39,58	0,66
Katsuwonus pelamis	Skipjack tuna	Bonito	0,10	0,001	18,28	0,14	1,81	0,04	3,67	0,08	1,20	0,02
Lepidocybium flavobrunneum	Escolar	Miramelindo	1,14	0,02	15,89	0,12	12,60	0,26	46,80	1,06	55,18	0,92
Lepophidium negropinna	Specklefin cusk eel	Corvina culona	0,00	0,00	0,09	0,001	0,00	0,00	0,00	0,00	0,00	0,00
Makaira nigricans	Blue marlin	Picudo	3,24	0,05	440,90	3,43	51,68	1,07	640,05	14,47	70,49	1,17
Merluccius gayi	Peruvian hake	Merluza	0,00	0,00	0,06	0,0004	0,00	0,00	0,00	0,00	0,86	0,01
Mycteroperca xenarcha	Broomtail grouper	Cherna	0,00	0,00	0,00	0,00	0,00	0,00	0,66	0,01	0,06	0,001
Paraconger californiensis	Californian conger, Ringeye conger	Congre	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00
Paralichthys woolmani	Speckled flounder	Lenguado	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,001
Paranthias colonus	Pacific creole-fish	Selemba	0,00	0,00	0,00	0,00	0,00	0,00	0,003	0,0001	0,00	0,00
Ruvetus pretiosus	Oilfish	Piña	0,00	0,00	1,76	0,01	0,45	0,01	0,00	0,00	20,63	0,34
Sarda orientalis	Striped bonito	Bonito Sierra	0,00	0,00	0,10	0,001	0,00	0,00	0,05	0,001	0,00	0,00
Scarus perrico	Bumphead parrotfish	Pez loro	0,00	0,00	0,04	0,0003	0,00	0,00	0,00	0,00	0,00	0,00
Schedophilus haedrichi	Mocosa ruff	Ojo de Uva	0,00	0,00	0,00	0,00	0,10	0,002	1,01	0,02	0,45	0,01
Scomberomorus sierra	Pacific sierra	Sierra	0,14	0,002	0,00	0,00	0,02	0,0005	0,18	0,004	0,58	0,01
Selar crumenophthalmus	Bigeye scad	Caballa	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,002	0,00	0,00
Selene peruviana	Peruvian or Pacific moonfish	Carita	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,002	0,00	0,00
Seriola rivoliana	Longfin yellowtail/Almaco Jack	Huayaipe	0,00	0,00	0,01	0,00	0,00	0,00	0,03	0,001	0,00	0,00
Sphyraena ensis	Mexican barracuda	Picuda	0,00	0,00	0,00	0,00	0,01	0,0002	1,06	0,02	0,15	0,002
Tetrapturus angustirostris	Shortbill spearfish	Picudo Pico Corto	0,00	0,00	0,00	0,00	0,02	0,0003	0,05	0,001	0,00	0,00
Thunnus albacares	Yellowfin tuna	Albacora	32,08	0,47	54,73	0,43	50,08	1,04	169,66	3,84	18,15	0,30
Thunnus obesus	Bigeye tuna	Patudo	9,33	0,14	0,89	0,01	7,03	0,15	18,03	0,41	1,97	0,03
Tylosurus acus pacificus	Pacific agujon needlefish	Aguja	0,00	0,00	0,03	0,0002	0,02	0,0004	0,37	0,01	0,24	0,004
Xiphias gladius	Swordfish	Espada	28,46	0,41	71,53	0,56	58,74	1,21	176,96	4,00	119,66	1,99
Ariidae	Ariid catfish	Bagre	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,0001
Auxis sp.	Frigate tuna	Botella	0,00	0,00	1,59	0,01	0,36	0,01	0,03	0,001	0,00	0,00
Caranx sp.	Jack	Jurel	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,001
Caulolatilus sp.	Tilefish/Whitefish	Cabezudo	0,00	0,00	0,03	0,0002	0,06	0,001	0,12	0,003	0,00	0,00
Diplectrum sp.	Sand perch	Camotillo	0,00	0,00	0,01	0,00004	0,00	0,00	0,05	0,001	0,00	0,00
Hemanthias sp.	Splittail/Hookthroat bass	Ravijunco	0,00	0,00	0,05	0,0004	0,01	0,0003	0,00	0,00	0,18	0,003
Hipoglossina sp.	Sole/Flounder	Lenguado	0,00	0,00	0,00	0,00	0,00	0,00	0,005	0,0001	0,00	0,00
Lutjanus sp.	Snapper	Pargo	0,00	0,00	0,03	0,0002	0,00	0,00	0,06	0,001	0,07	0,001
Ophichthus sp.	Snake-eel	Anguila	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,002
Paralabrax sp.	Sand bass	Perela	0,00	0,00	0,05	0,0004	0,13	0,003	0,20	0,005	0,22	0,004
Pontinus sp.	Rockfish/Scorpionfish	Brujo	0,00	0,00	0,001	0,00001	0,00	0,00	0,00	0,00	0,00	0,00

Species	Common name (EN)	Common name (ES)	2013	%	2014	%	2015	%	2016	%	2017	%
Chondrichthyes												
Aetobatus laticeps	Spotted eagle ray	Raya pintada	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,0003
Alopias pelagicus	Pelagic thresher shark	Rabon bueno	145,07	2,11	266,03	2,07	106,96	2,21	1260,30	28,50	66,52	1,10
Alopias superciliosus	Bigeye thresher	Rabon amargo	2,95	0,04	11,72	0,09	3,36	0,07	38,83	0,88	3,68	0,06
Alopias vulpinus	Thresher	Rabon tramado	0,22	0,00	11,03	0,09	0,00	0,00	0,18	0,004	0,00	0,00
Carcharhinus falciformis	Silky shark	Mico	15,00	0,22	38,35	0,30	33,60	0,69	100,50	2,27	9,60	0,16
Carcharhinus galapagensis	Galapagos shark	Galapagos	0,00	0,00	0,06	0,0005	0,00	0,00	0,00	0,00	0,00	0,00
Carcharhinus leucas	Bull shark	Come perro	0,00	0,00	1,23	0,01	0,09	0,002	0,27	0,01	0,00	0,00
Carcharhinus limbatus	Blacktip shark	Punta negra	0,02	0,0003	7,09	0,06	0,05	0,001	0,26	0,01	0,05	0,001
Carcharhinus longimanus	Oceanic whitetip shark	Aleton	0,09	0,001	8,08	0,06	0,01	0,0003	0,23	0,01	0,02	0,0004
Carcharhinus obscurus	Dusky shark	Baboso	0,02	0,0003	0,00	0,00	0,04	0,001	0,25	0,01	0,20	0,003
Galeocerdo cuvier	Tiger shark	Tigre	0,00	0,00	0,68	0,01	0,02	0,0004	1,03	0,02	0,10	0,002
Galeorhinus galeus	Tope shark	Cazón	0,00	0,00	1,08	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Hypanus longus	Longtail stingray	Raya	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,0005
Isurus oxyrinchus	Shortfin mako	Tinto	11,68	0,17	21,73	0,17	9,52	0,20	10,87	0,25	9,18	0,15
Isurus paucus	Longfin mako	Tinto tramado	0,00	0,00	1,47	0,01	0,00	0,00	0,07	0,001	0,00	0,00
Mustelus lunulatus	Sicklefin smooth-hound	Vieja	0,00	0,00	0,00	0,00	0,05	0,001	0,00	0,00	0,00	0,00
Nasolamia velox	Whitenose shark	Lechoso	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,0004
Negaprion brevirostris	Lemon shark	Limón	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,002	0,00	0,00
Notorynchus cepedianus	Broadnose sevengill shark	Gata	0,00	0,00	0,40	0,003	0,00	0,00	0,00	0,00	0,00	0,00
Odontaspis noronhai	Bigeye sand tiger	Solrayo	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,002	0,00	0,00
Prionace glauca	Blue shark	Azul	136,06	1,98	301,76	2,35	219,41	4,54	460,99	10,42	208,20	3,46
Sphyrna lewini	Scalloped hammerhead	Cachuda roja	0,89	0,01	4,50	0,04	1,30	0,03	0,61	0,01	0,01	0,0002
Sphyrna mokarran	Great hammerhead	Cachuda Gigante	0,00	0,00	1,51	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Sphyrna tiburo	Bonnethead	Cachuda cabeza de pala	0,00	0,00	0,05	0,0004	0,00	0,00	0,01	0,0003	0,00	0,00
Sphyrna zygaena	Smooth hammerhead	Cachuda Blanca	11,66	0,17	4,18	0,03	1,68	0,03	3,51	0,08	0,81	0,01
Cephalopods												
Dosidicus gigas	Humbolt squid	Calamar	0,00	0,00	0,00	0,00	0,37	0,01	0,13	0,003	4,15	0,07

b. Data reported by SRP's observers

In Ecuador, three observers' programs took place on the same fleet and were directly related to projects of national interest: PAT-Ec (the National Action Plan for the conservation and management of Ecuador's sharks, established by the Executive Decree 902 of February 1, 2008), the PAN Dorado (the National Action Plan for the conservation and management of Ecuador's mahi mahi, established by Ministerial Agreement No. 023 of February 14, 2011) and the National Strategy for the conservation of marine turtles. From December 29, 2011, it was agreed (Ministerial Agreement No. 204) to establish a single observer's program for the long-line fleet of Ecuador. This program randomly monitors and collects data in real time of at least a 10% of the trips of longliners over 20 m lenght as well as the mothership fleet.

The data collected from this observers' program from 2008 until 2016 in number of individuals is presented in **Table 3.4.2.1.2**.

Table 3.4.2.1.2 Thin surface longline target species and indicdental catch composition reported from the observers' program in number of individuals and percentage from 2008 until 2016. Source: Subsecretaría de Recursos Pesqueros (SRP, Undersecretary of Fisheries Resources).

Scientific name	Common name (EN)	Common name (ES)	2008	%	2009	%	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%	2016	%
Osteichthyes																				
Coryphaena hippurus	Mahi mahi	Dorado	1125	99,29	406	97,83	21686	98,70	29904	98,09	125848	99,01	48209	97,70	158575	99,15	20438	96,95	7185	89,96
Acanthocybium solandri	Wahoo	Guanjú / Peto					3	0,01	10	0,03	53	0,04	30	0,06	60	0,04	22	0,10	4	0,05
Alepisaurus ferox	Long Snouted Lancetfish	Lanzón picudo											1	0,002						
Brama dussumieri	Lesser Bream	Japuta menuda					1	0,00												
Coryphaena equiselis	Pompano Dolphinfish	Dorado chato							2	0,01	5	0,004	2	0,004	7	0,004	4	0,02	3	0,04
Echiophis brunneus	Fangjaw/Pacific spoon-nose eel	Anguila pecosa															1	0,005		
Istiompax indica	Black marlin	Merlín negro											1	0,002						
Istiophorus platypterus	Indo-Pacific sailfish	Banderón / Pez vela							3	0,01	8	0,01	12	0,02	3	0,002	7	0,03		
Kajikia audax	Striped marlin	Gacho / Marlin rayado			1	0,24	5	0,02	4	0,01	23	0,02	12	0,02	26	0,02	20	0,09	4	0,05
Katsuwonus pelamis	Skipjack tuna	Bonito / Listado	1	0,09			9	0,04	11	0,04	10	0,01	3	0,01	21	0,01			1	0,01
Lagocephalus lagocephalus	Oceanic puffer	Tamboril/Botete/Pez globo									1	0,001								
Lepidocybium flavobrunneum	Escolar	Miramelindo / Escolar							1	0,003	4	0,003	4	0,01	21	0,01	140	0,66	2	0,03
Lobotes surinamensis	Tripletail	Berrugate							2	0,01			1	0,002						
Lutjanus argentiventris	Yellow snapper	Pargo blanco															1	0,005		
Makaira nigricans	Blue marlin	Picudo / Marlin azul							1	0,003	2	0,002			2	0,001	3	0,01		
Mola mola	Sunfish	Pez sol/pez luna					1	0,005	3	0,01	8	0,01	3	0,01	6	0,004	1	0,005	2	0,03
Naucrates ductor	Pilotfish	Pez piloto									2	0,002								
Sarda orientalis	Striped bonito	Bonito sierra											1	0,002			1	0,005		
Seriola lalandi	Yellowtail	Huayaipe											1	0,002						

Scientific name	Common name (EN)	Common name (ES)	2008	%	2009	%	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%	2016	%
	Amberjack																			
Sphyraena ensis	Mexican barracuda	Picuda							5	0,02										
Tetrapturus angustirostris	Shortbill spearfish	Marlín									5	0,004					1	0,005	1	0,01
Thunnus alalunga	Albacore	Atún sierra											1	0,002	2	0,001				
Thunnus albacares	Yellowfin tuna	Atún de aleta amarilla					5	0,02	4	0,01	5	0,004	1	0,002	15	0,01	12	0,06	1	0,01
Thunnus obesus	Bigeye tuna	Atún ojo grande			1	0,24			4	0,01	7	0,01			9	0,01			2	0,03
Trachinotus paitensis	Paloma Pompano	Pámpano							1	0,003										
Tylosurus acus pacificus	Pacific agujon needlefish	Aguja															3	0,01		
Xiphias gladius	Swordfish	Pez espada					56	0,25	38	0,12	102	0,08	151	0,31	65	0,04	25	0,12	45	0,56
Bramidae	Pomfrets	Brámidos							1	0,003										
Seriola spp.	Amberjacks	Medregales													1	0,001				
Tetradontidae	Pufferfish	Pez globo													1	0,001				
Tylosurus spp.	Needlefish	Pez aguja									1	0,001								
Unidentified fish													2	0,004						
Chondrichthyes																				
Alopias pelagicus	Pelagic thresher shark	Zorro pelágico / Rabón "bueno"					27	0,12	35	0,11	294	0,23	588	1,19	251	0,16	80	0,38	336	4,21
Alopias superciliosus	Bigeye thresher	Zorro ojón / Rabón "amargo"													3	0,002	3	0,01		
Carcharhinus falciformis	Silky shark	Tiburón mico					6	0,03	11	0,04	18	0,01	19	0,04	12	0,01	17	0,08		
Carcharhinus longimanus	Oceanic whitetip shark	Tiburón aleta blanca / Aletón									2	0,002			2	0,001	1	0,005		
Galeocerdo cuvier	Tiger shark	Tiburón tigre									1	0,001								
Isurus oxyrinchus	Shortfin mako	Mako / Tiburón tinto					35	0,16	24	0,08	47	0,04	15	0,03	79	0,05	17	0,08	64	0,80
Prionace glauca	Blue shark	Tiburón aguado					93	0,42	123	0,40	456	0,36	249	0,50	689	0,43	275	1,30	333	4,17
Pseudocarcharias kamoharai	Crocodile shark	Tiburón cocodrilo							1	0,003			7	0,01	34	0,02				
Pteroplatytrygon violacea	Pelagic Stingray	Raya látigo / Pastinaca	7	0,62	4	0,96	6	0,03	8	0,03	13	0,01	8	0,02						
Sphyrna lewini	Scalloped	Tiburón martillo /					3	0,01	1	0,003										

Scientific name	Common name (EN)	Common name (ES)	2008	%	2009	%	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%	2016	%
	hammerhead	Cachuda roja																		
Sphyrna zygaena	Smooth hammerhead	Tiburón martillo / Cachuda blanca					3	0,01	127	0,42	114	0,09			4	0,003	9	0,04		
Dasyatidae	Whiptail stingrays	Rayas látigo o Pastinacas											3	0,01						
Isurus spp.	Mako sharks	Marrajos o makos									1	0,001								
Turtles																				
Caretta caretta	Loggerhead Turtle	Tortuga boba					1	0,005					1	0,002						
Chelonia mydas	Green Turtle	Tortuga verde			1	0,24	16	0,07	35	0,11	25	0,02	12	0,02	15	0,01	1	0,005		
Dermochelys coriacea	Leatherback	Tortuga laúd							1	0,003	1	0,001			1	0,001				
Eretmochelys imbricata	Hawksbill Turtle	Tortuga carey							1	0,003										
Lepidochelys olivacea	Olive Ridley	Tortuga olivácea			2	0,48	15	0,07	124	0,41	48	0,04	9	0,02	23	0,01			4	0,05
Testudines	Turtles	Tortugas									1	0,001								
Cephalopods																				
Dosidicus gigas	Humbolt squid	Calamar de Humbolt/gigante													4	0,003				
Birds																				
Sula sula	Red-footed Booby	Piquero patas rojas							1	0,003										

3.4.2.2 P2 species classification following MSC requirements

According to the different sources of information presented above, the assessment team elaborated the most complete list of all species susceptible to interact with the UoC, and they were classified into primary (main/minor), secondary (main/minor) and ETP species according to MSC requirements.

Table 2.4.2.2.1. List of all species susceptible to interact with the UoC classified according to FCR SA3.1.3-3.1.5 and SA3.4.4.-3.4.5. Sources of information (see section 3.4.2.1) used for selecting each of the species is presented. Data deficient column was assessed against FCR7.7.6. Note: Main Primary species are highlighted in dark green; Minor Primary in light green; Main Secondary in dark grey; Minor Secondary in light grey; and ETPs in orange.

Scientific name	Common name (EN)	Common name (ES)	P2 Component	P2 Subcomp	ETP Reg	Sources of info	Data deficient
Osteichthyes							
Acanthocybium solandri	Wahoo	Wahoo	Secondary	Minor	N/A	(a) & (b)	Yes
Alepisaurus ferox	Long Snouted Lancetfish	Lanzón picudo	Secondary	Minor	N/A	(b)	Yes
Anisotremus taeniatus	Panama porkfish	Rayado	Secondary	Minor	N/A	(a)	Yes
Brama dussumieri	Lesser Bream	Japuta menuda	Secondary	Minor	N/A	(b)	Yes
Brotula clarkae	Pacific bearded brotula	Corvina de roca	Secondary	Minor	N/A	(a)	Yes
Caranx caballus	Green jack	Caballita	Secondary	Minor	N/A	(a)	Yes
Coryphaena equiselis	Pompano Dolphinfish	Dorado chato	Secondary	Minor	N/A	(b)	Yes
Dissostichus eleginoides	Patagonian toothfish	Bacalao	Secondary	Minor	N/A	(a)	Yes
Echiophis brunneus	Fangjaw/Pacific spoon-nose eel	Anguila pecosa	Secondary	Minor	N/A	(b)	Yes
Epinephelus analogus	Spotted grouper	Mero	Secondary	Minor	N/A	(a)	Yes
Epinephelus labriformis	Starry grouper	Cabrilla	Secondary	Minor	N/A	(a)	Yes
Epinephelus niphobles	Star-studded grouper	Murico	Secondary	Minor	N/A	(a)	Yes
Euthynnus lineatus	Black skipjack	Bonito Pata seca	Secondary	Minor	N/A	(a) & (b)	Yes
Istiompax indica	Black marlin	Picudo negro o plomo	Secondary	Minor	N/A	(a) & (b)	Yes
Istiophorus platypterus	Indo-Pacific sailfish	Banderon	Secondary	Minor	N/A	(a) & (b)	Yes
Kajikia audax	Striped marlin	Gacho	Primary	Minor	N/A	(a) & (b)	No
Katsuwonus pelamis	Skipjack tuna	Bonito	Primary	Minor	N/A	(a) & (b)	No
Lagocephalus lagocephalus	Oceanic puffer	Tamboril/Botete/ Pez globo	Secondary	Minor	N/A	(b)	Yes
Lepidocybium flavobrunneum	Escolar	Miramelindo	Secondary	Minor	N/A	(a) & (b)	Yes
Lepophidium negropinna	Specklefin cusk eel	Corvina culona	Secondary	Minor	N/A	(a)	Yes
Lobotes surinamensis	Tripletail	Berrugate	Secondary	Minor	N/A	(b)	Yes
Lutjanus argentiventris	Yellow snapper	Pargo blanco	Secondary	Minor	N/A	(b)	Yes
Makaira nigricans	Blue marlin	Picudo	Primary	Main	N/A	(a) & (b)	No
Merluccius gayi	Peruvian hake	Merluza	Secondary	Minor	N/A	(a)	Yes
Mola mola	Sunfish	Pez sol/pez luna	Secondary	Minor	N/A	(b)	Yes
Mycteroperca xenarcha	Broomtail	Cherna	Secondary	Minor	N/A	(a)	Yes

Scientific name	Common name (EN)	Common name (ES)	P2 Component	P2 Subcomp	ETP Reg	Sources of info	Data deficient
	grouper						
Naucrates ductor	Pilotfish	Pez piloto	Secondary	Minor	N/A	(b)	Yes
Paraconger californiensis	Californian conger, Ringeye conger	Congre	Secondary	Minor	N/A	(a)	Yes
Paralichthys woolmani	Speckled flounder	Lenguado	Secondary	Minor	N/A	(a)	Yes
Paranthias colonus	Pacific creole-fish	Selemba	Secondary	Minor	N/A	(a)	Yes
Ruvetus pretiosus	Oilfish	Piña	Secondary	Minor	N/A	(a)	Yes
Sarda orientalis	Striped bonito	Bonito Sierra	Secondary	Minor	N/A	(a) & (b)	Yes
Scarus perrico	Bumphead parrotfish	Pez loro	Secondary	Minor	N/A	(a)	Yes
Schedophilus haedrichi	Mocosa ruff	Ojo de Uva	Secondary	Minor	N/A	(a)	Yes
Scomberomorus sierra	Pacific sierra	Sierra	Secondary	Minor	N/A	(a)	Yes
Selar crumenophthalmus	Bigeye scad	Caballa	Secondary	Minor	N/A	(a)	Yes
Selene peruviana	Peruvian or Pacific moonfish	Carita	Secondary	Minor	N/A	(a)	Yes
Seriola lalandi	Yellowtail Amberjack	Huayaipe	Secondary	Minor	N/A	(b)	Yes
Seriola rivoliana	Longfin yellowtail/Almaco Jack	Huayaipe	Secondary	Minor	N/A	(a)	Yes
Sphyraena ensis	Mexican barracuda	Picuda	Secondary	Minor	N/A	(a) & (b)	Yes
Tetrapturus angustirostris	Shortbill spearfish	Picudo Pico Corto	Secondary	Minor	N/A	(a) & (b)	Yes
Thunnus alalunga	Albacore	Atún sierra	Primary	Minor	N/A	(b)	No
Thunnus albacares	Yellowfin tuna	Albacora	Primary	Minor	N/A	(a) & (b)	No
Thunnus obesus	Bigeye tuna	Patudo	Primary	Minor	N/A	(a) & (b)	No
Trachinotus paitensis	Paloma Pompano	Pámpano	Secondary	Minor	N/A	(b)	Yes
Tylosurus acus pacificus	Pacific agujon needlefish	Aguja	Secondary	Minor	N/A	(a) & (b)	Yes
Xiphias gladius	Swordfish	Espada	Primary	Minor	N/A	(a) & (b)	No
Chondrichthyes							
Aetobatus laticeps	Spotted eagle ray	Raya pintada	Secondary	Minor	N/A	(a)	No
Alopias pelagicus	Pelagic thresher shark	Rabon bueno	Secondary	Main	N/A	(a) & (b)	No
Alopias superciliosus	Bigeye thresher	Rabon amargo	Secondary	Minor	N/A	(a) & (b)	No
Alopias vulpinus	Thresher	Rabon tramado	Secondary	Minor	N/A	(a)	No
Carcharhinus falciformis	Silky shark	Mico	Primary	Main	N/A	(a) & (b)	Yes
Carcharhinus galapagensis	Galapagos shark	Galapagos	Secondary	Minor	N/A	(a)	
Carcharhinus leucas	Bull shark	Come perro	Secondary	Minor	N/A	(a)	
Carcharhinus limbatus	Blacktip shark	Punta negra	Secondary	Minor	N/A	(a)	
Carcharhinus longimanus	Oceanic whitetip shark	Aleton	Secondary	Minor	N/A	(a) & (b)	
Carcharhinus obscurus	Dusky shark	Baboso	Secondary	Minor	N/A	(a)	
Galeocerdo cuvier	Tiger shark	Tigre	Secondary	Minor	N/A	(a) & (b)	
Galeorhinus galeus	Tope shark	Cazón	Secondary	Minor	N/A	(a)	
Hypanus longus	Longtail stingray	Raya	Secondary	Minor	N/A	(a)	
Isurus oxyrinchus	Shortfin mako	Tinto	Secondary	Minor	N/A	(a) & (b)	
Isurus paucus	Longfin mako	Tinto tramado	Secondary	Minor	N/A	(a)	
Mustelus lunulatus	Sicklefin smooth-hound	Vieja	Secondary	Minor	N/A	(a)	

Scientific name	Common name (EN)	Common name (ES)	P2 Component	P2 Subcomp	ETP Reg	Sources of info	Data deficient
Nasolamia velox	Whitenose shark	Lechoso	Secondary	Minor	N/A	(a)	
Negaprion brevirostris	Lemon shark	Limón	Secondary	Minor	N/A	(a)	
Notorynchus cepedianus	Broadnose sevengill shark	Gata	Secondary	Minor	N/A	(a)	
Odontaspis noronhai	Bigeye sand tiger	Solrayo	Secondary	Minor	N/A	(a)	
Prionace glauca	Blue shark	Azul	Secondary	Main	N/A	(a) & (b)	
Pseudocarcharias kamoharai	Crocodile shark	Tiburón cocodrilo	Secondary	Minor	N/A	(b)	
Pteroplatytrygon violacea	Pelagic Stingray	Raya látigo / Pastinaca	Secondary	Minor	N/A	(b)	
Sphyrna lewini	Scalloped hammerhead	Cachuda roja	Secondary	Minor	N/A	(a) & (b)	
Sphyrna mokarran	Great hammerhead	Cachuda Gigante	Secondary	Minor	N/A	(a)	
Sphyrna tiburo	Bonnethead	Cachuda cabeza de pala	Secondary	Minor	N/A	(a)	
Sphyrna zygaena	Smooth hammerhead	Cachuda Blanca	Secondary	Minor	N/A	(a) & (b)	
Cephalopods							
Dosidicus gigas	Humbolt squid	Calamar de Humbolt/gigante	Secondary	Minor	N/A	(a) & (b)	No
Turtles							
Caretta caretta	Loggerhead Turtle	Tortuga caguama	ETP	N/A	IUCN CR[I], CITES App I	(b)	Yes (for S. Pacific)
Chelonia mydas	Green Turtle	Tortuga verde	ETP	N/A	IUCN EN[II], CITES App I	(b)	No
Dermochelys coriacea	Leatherback	Tortuga laúd	ETP	N/A	IUCN CR[III], CITES App I	(b)	No
Eretmochelys imbricata	Hawksbill Turtle	Tortuga carey	ETP	N/A	IUCN CR[II], CITES App I	(b)	No
Lepidochelys olivacea	Olive Ridley	Tortuga golfina	ETP	N/A	IUCN VU[II], CITES App I	(b)	No
Birds							
Sula sula	Red-footed Booby	Piquero patas rojas	Secondary	Minor	N/A	(b)	No

(I): South Pacific subpopulation
(II): Global population
(III): East Pacific Ocean subpopulation

3.4.3 Primary species impacted by the UoC

According to the different sources of information presented above, the assessment team elaborated the most complete list of all species susceptible to interact with the UoA, and they were classified into primary (main/minor), secondary (main/minor) and ETP species according to MSC requirements (**Table 3.4.2.2.1**) .

The difference between 'Primary' and 'Secondary' species lies on whether management is based on biological reference points (primary) or not (secondary) (FCR SA3.1.3-SA3.1.4).

Eight species were identified as 'Primary' based on FCR SA3.1.3 (green shaded in **Table 3.4.2.2.1**): seven osteichthyes (i.e., *Kajikia audax* – striped marlin -, *Katsuwonus pelamis* – skipjack tuna -, *Makaira nigricans* – blue marlin -, *Thunnus alalunga* – albacore -, *Thunnus albacares* – yellowfin tuna -, *Thunnus obesus* – bigeye tuna -, and *Xiphias gladius* – swordfish), and 1 condrichthyan (i.e., *Carcharhinus falciformis* – silky shark).

According to MSC requirements (FCR SA3.4.2), a species shall be considered 'main' if:

- The catch of a species by the UoA comprises 5% or more by weight of the total catch of all species by the UoA, or;
- The species is classified as 'Less resilient' and the catch of the species by the UoA comprises 2% or more by weight of the total catch of all species by the UoA.

In addition, all other primary species not considered 'main' shall be considered 'minor' species (FCR SA3.4.5).

Six of the seven fish species annual contribution to the total UoA catch from 2013 to 2017 was below 5%, therefore, they were assessed as a 'Minor Primary' species. The blue marlin (*Makaira nigricans*), however, as it accounted for almost 14.5% of total UoA catch in 2016, it was assessed as a 'Main Primary' species.

Regarding sharks, as they are considered 'Less resilient', and the silky shark's annual contribution to the total UoA catch in 2016 was above 2%, it was also assessed as a 'Main Primary' species.

3.4.4 Secondary species impacted by the UoC

A comprehensive list of species with recorded interactions with the assessed fleet is presented in **Table 3.4.2.2.1**. A total of 68 species were identified as 'Secondary' (based on FCR SA3.1.4).

As explained in Section 3.4.3, according to FCR SA3.4.2-3.4.5 and SA3.7.1 (for Secondary species), and based on each species contribution to the UoA catches and the observers' records, the following species were assigned to main or minor subcomponents:

- Main secondary species (dark grey shaded in **Table 3.4.2.2.1**): Pelagic thresher shark (*Alopias pelagicus*) and Blue shark (*Prionace glauca*).
- Minor secondary species (light grey shaded in **Table 3.4.2.2.1**): 1 bird, 1 cephalopod, 24 condrichthyes and 40 osteichthyes.

Both, the pelagic thresher shark and the blue shark accounted for over 2% of the total UoA catch in all years but one. As it can be observed in **Table 3.4.2.2.1**, the catch of the pelagic thresher was over 2% in all years but 2017, while the blue shark was over 2% in all years but 2013, being the highest for both of them in 2016 (i.e., 28.5% and 10.42%, respectively), hence its assignation as 'Main' species.

As these species are identified as 'Main Secondary', an RBF should have been triggered in order to assess them. However, at the time of the site visit, the team had only the UoA catch data from 2013 to 2015. With those data, both species were classified as 'Minor'. They were only reclassified as 'Main' during the assessment process, when the team received the UoA catch data from 2013 up until 2017 and in metric tons (and not just from 2013 to 2015 in number of individuals, as it was originally received). The assessment for these two species, therefore, had to be carried out as a "desk-approach", using only the information available to the team, and not being able to take into account the multi-stakeholder approach of the RBF. The results obtained for these two species, therefore, are preliminary.

3.4.5 ETP species impacted by the UoC

According to MSC requirements (SA 3.1.5), the team shall assign ETP species as follows:

a. Species that are recognized by national ETP legislation.
b. Species listed in binding international agreements given below:
    - Appendix 1 of the Convention on International Trade in Endangered Species (CITES), unless it can be shown that the particular stock of the CITES listed species impacted by the UoA under assessment is not endangered.
    - Binding agreements concluded under the Convention on Migratory Species (CMS).
c. Species classified as 'out-of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CR).

According to these requirements, five species (all sea turtles) where identified as ETPs (orange shaded in **Table 3.4.2.2.1**): the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*), and the olive ridley (*Lepidochelys olivacea*).

The UoA average percentage catch of all seaturtle species reported by the observers from 2009 to 2016 in number of individuals was 0.2%, being always below 0.8% (**Table 3.4.5.1**). From these by-catches, 4.78% were released dead, 2.69% are of an unknown fate, and the rest were released alive with different degrees of injuries (i.e., 36.42% released with the hook on, 30.45% released alive with no injuries, 20% released with minor injuries, 5.67% released with major injuries) (**Table 3.4.5.2** and **Figure 3.4.5.1**).

Moreover, as it can be observed in **Table 3.4.2.2.1**, a single interaction with a bird species (*Sula sula*) that was released alive and unharmed was registered for 2011. The species is listed as Least Concerned in the IUCN Redlist, therefore it is not classified as ETP.

Table 3.4.5.1 Percentage of seaturtles (in number of individuals) incidentally caught by the UoA between 2009 and 2016. Source: Subsecretaría de Recursos Pesqueros (SRP, Undersecretary of Fisheries Resources).

Species	Common name (EN)	Common name (ES)	2009	2010	2011	2012	2013	2014	2015	2016
Caretta caretta	Loggerhead Turtle	Tortuga caguama		0,005			0,002			
Chelonia mydas	Green Turtle	Tortuga verde	0,24	0,07	0,11	0,02	0,02	0,01	0,005	
Dermochelys coriacea	Leatherback	Tortuga laúd			0,003	0,001		0,001		
Eretmochelys imbricata	Hawksbill Turtle	Tortuga carey			0,003					
Lepidochelys olivacea	Olive Ridley	Tortuga golfina	0,48	0,07	0,41	0,04	0,02	0,01		0,05
TOTAL			**0,72%**	**0,15%**	**0,53%**	**0,06%**	**0,04%**	**0,02%**	**0,005%**	**0,05%**

Table 3.4.5.2 Number of seaturtles incidentally caught by the UoA between 2009 and 2016. Source: Subsecretaría de Recursos Pesqueros (SRP, Undersecretary of Fisheries Resources).

FATE	2009	2010	2011	2012	2013	2014	2015	2016	TOTAL	%
Dead	4	1	6	4	1				**16**	**4,78**
Released alive	1	14	21	26	5	31	1	3	**102**	**30,45**
Minor injuries		3	44	10	6	4			**67**	**20,00**
Major injures		1	15	2		1			**19**	**5,67**
Released w hook	2	3	79	26	9	3			**122**	**36,42**
Unknown fate		7	1		1				**9**	**2,69**
TOTAL N. indivs	**7**	**29**	**166**	**68**	**22**	**39**	**1**	**3**	**335**	**100,00**

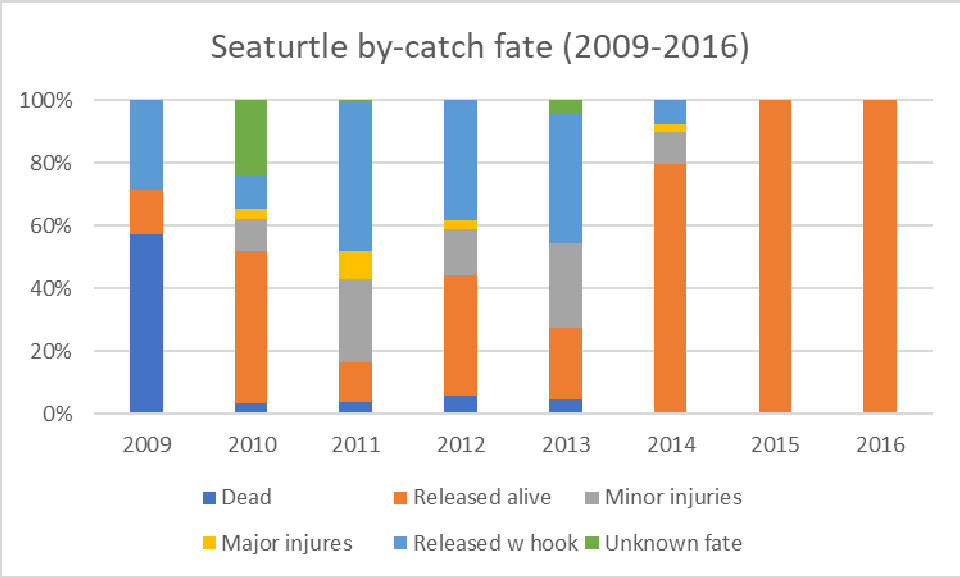


Figure 3.4.5.1 Fate of the seaturtles caught incidentally by the UoA between 2009 and 2016. Source: Subsecretaría de Recursos Pesqueros (SRP, Undersecretary of Fisheries Resources).

ETP threats

As abovementioned, the five species identified as ETPs were all seaturtles.

Seaturtles face several threats, including the harvesting of their eggs, coastal development, predation of females and juveniles by domestic and feral animals, and climate change (Andraka, et al., 2013). In addition, longline fisheries in the Eastern Pacific Ocean overlap with the migratory routes and habitats of these animals. They can become entangled in fishing lines, and can be hooked by hooks aimed at catching other species of commercial interest, such as tunas, billfishes and mahi mahi, causing serious injuries and mortality of sea turtles. Therefore, these fisheries are also considered to contribute significantly to the threats that sea turtles face in the EPO (Andraka et al., 2013), being these species the main bycatch problem for these fisheries (Gillett, 2011).

In response to the problematic situation of the sea turtles, the Sea Turtle Bycatch Reduction Program began operating in Ecuador in 2003. At that time, a group of actors including WWF, the IATTC, and representatives of the fishing and processing industry in Ecuador, got together to create a project composed of actions to address the problem of incidental capture of sea turtles in the large pelagic longline fishery in the EPO (Sondheimer et al., 2013).

Later on, for the development of the National Plan for the Conservation of Sea Turtles (MAE, 2014), it was found that the main factors threatening the survival of seaturtles in Ecuador were the following:

- **Degradation of nesting beaches**

The beaches are very dynamic and are impacted by natural and anthropogenic factors. Baquero et al. (2008a) reported that in the nesting beaches, the main problems associated with the degradation of these beaches were caused by: domestic animals, garbage or logs on the beach, presence of houses and artificial lighting (**Figure 3.4.5.2**).

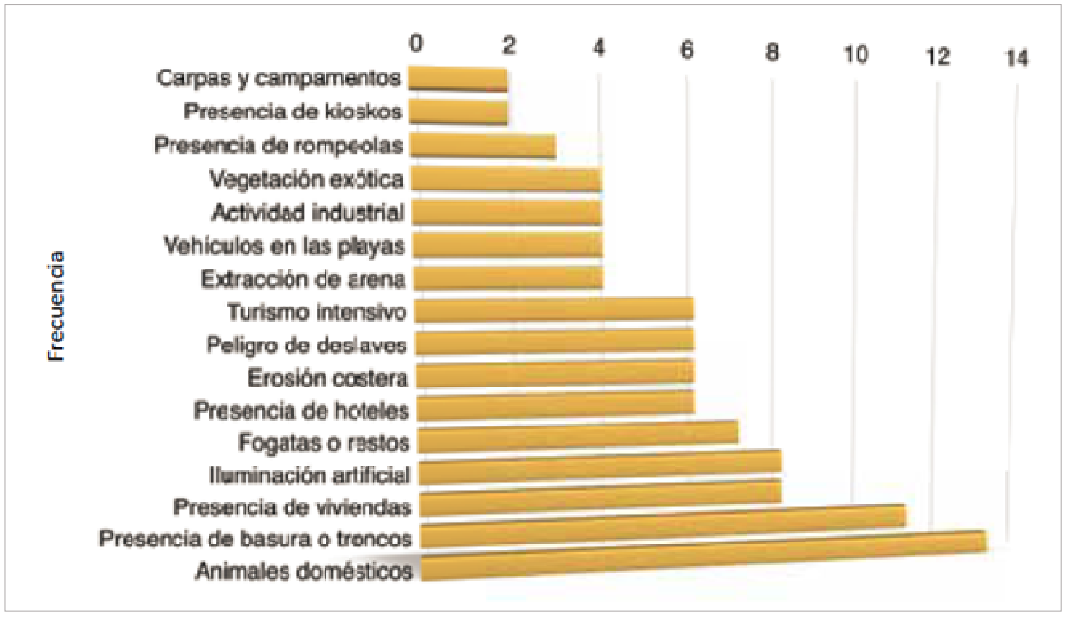


Figure 3.4.5.2. Main threats identified in the nesting sites, according to Baquero et al. (2008a).

- **Sand extraction**

Sand extraction negatively impacts sea turtle nesting at various points on the coast.

- **Lightning**

In Galapagos, the growth of populated areas generates impacts such as light pollution and alteration of nesting sites. Tourism also causes impacts. The lights of the anchored vessels generate light pollution in the Galapagos.

On the continent, this threat has also been reported in several nesting beaches (Baquero et al., 2008a).

- **Vehicle use in beaches**

The circulation of vehicles along the beach negatively impacts the nesting of sea turtles in various parts of the coast.

- **Beachfront construction and coastal strip reduction**

The Ecuadorian continental coast has undergone a process of urbanization that negatively affects the nesting of sea turtles, by altering beaches and generating light pollution, which discourages the arrival of mothers and disorients turtles at birth (Witherington, 1992; Witherington and Martin, 2000; Nicholas, 2001)).

The construction of seawalls is very common in coastal municipalities, as part of the process of tourism promotion and / or coastal protection, and these are generally installed on the areas where turtles nest.

- **Marine habitat degradation**

Exploration, production, refining and transportation of oil, gas and minerals

These types of platforms for gas and oil extraction have been identified as aggregators of marine fauna, including sea turtles.

Pollution

Chemical pollution

It is known that pollutants from land sources affect sea turtles health, that they can accumulate pesticides and heavy metals, and that some pollutants depress their immune system, making them susceptible to infectious agents and diseases such as fibropapillomatosis (Witherington, 1992; MAE, 2014 and references therein), although this disease has not been reported in Ecuador.

Waste on the beach

Marine litter

Plastic covers and gillnet remains are the main source of marine litter. Turtles swallow them or become entangled and then suffocate. Additionally, the intake of plastic pieces obstructs their digestive tract. It has also been reported that turtles absorb chemical pollutants from plastic, which can alter their reproduction (Juárez et al., 2000; Moore, 2008).

Harmful algal blooms

It is known that red tides can cause sea turtle mortality.

- **Fishing activities**

Interaction between sea turtles and the following fisheries has been recorded:

Trawling fisheries

White/brown shrimp

Turtles can get trapped in shrimp trawling nets.

Titi Shrimp

This fishery has the obligation to use TEDs (Turtle Excluder Devices) in its fishing operations, but its possible impact on sea turtles has not been recently evaluated (Coello and Herrera, 2010).

Hake

In 2013, in the inter-institutional project between MAGAP (Ministry of Agriculture, Livestock, Aquaculture and Fisheries), INP (National Fisheries Institute) and MAE (Ministry of Environment), a monitoring of incidental fishing was carried out, which resulted in 24% of the sets (n=75) with sea turtles captured, that were released alive.

Longline fisheries

The interaction with fisheries and the incidental mortality that this generates has raised most of the attention in recent decades (Alverson et al., 1994; Lewison and Crowder, 2007; ICAPO, 2008). The interaction with artisanal fisheries occurs mainly with gillnets and longlines. The interference of longlines depends on multiple factors, but mainly on the type of hook and bait, and the depth at which the hooks are set (Beverly and Chapman, 2007; CIAT, 2004b). Sea turtles can also get entangled with the buoy rope or the leader, which can choke them or can hurt them when the fishing gear is lifted. Moreover, the fishing gear material is very important; the number of turtles entangled per nautical mile is relatively high when polypropylene is used and minimum when monofilament is used.

Gillnet fisheries

The information available on bycatch in Ecuador is scarce and scattered, and is mainly focused on longlines. In general, there is little data on measures to reduce the impact of gillnets (Eckert et al., 2009; FAO, 2009; Gilman et al., 2010).

Purse seine fisheries

Occasionally, turtles are caught in purse seine operations that catch small pelagic fish and tuna. But there is no exact information regarding the possible incidence of Ecuadorian purse seiners that catch small pelagic fish.

In tuna vessels, turtles can be caught during the closing operation of the seine, mainly when it is set on floating objects (Arenas and Hall, 1992). Turtles can also get caught in the nets hanging from the FADs.

Dip-net fisheries

Jellyfish

The Undersecretary of Fisheries Resources, through Ministerial Agreement 042, authorized the fishery of the jellyfish, *Stomolophus meleagris*, for the artisanal fishermen in the Gulf of Guayaquil. Although this does not imply a direct interaction with sea turtles, the potential reduction of jellyfish biomass can impact the sea turtle population, due to its prey-predator relationship.

- **Other possible impacts**

Boat collisions

Collision with boats causes wounds, injuries and mortality of sea turtles (Lutcavage et al., 1997; Hazel y Gyuris, 2006; Calabuig y Liria-Loza, 2007).

Human presence

Tourism can negatively affect nesting beaches.

Seaturtle observation tourism

It is an activity that sensitizes the community about the conservation of sea turtles and at the same time generates economic income, but the presence of tourists can disturb the nesting of these animals and scare them off the beach.

Direct capture

According to Coello and Herrera (2010), in Ecuador the consumption of blood, fat, meat and eggs of sea turtles is part of the cultural heritage, mainly in coastal populations where these products are given a healing power. Sea turtle eggs, like meat, have been used for food, especially in those hard-to-reach fishing communities.

Trade of products and by-products

Currently, there are no exports of fat or turtle meat, but there is an internal trade that has been maintained over time in coastal communities.

Interaction with other species

Predation

La Botada beach, located in the province of Manabí, is a sea turtle nesting area made up of cliffs. This constitutes a barrier to human settlements, but there are trails that are used by feral animals, mainly opossums (known locally as "foxes").

Domestic and feral animals

Predation of nests by stray animals on the beaches has also been reported (Fernández, 2010; Vinueza, 2010). The presence of domestic animals, occurring in the vast majority of nesting beaches, is the most common threat (Baquero et al., 2008a).

Other natural and anthropogenic factors

Climate change and ocean acidification

It is known that climate change will affect the nesting of sea turtles through changes in the morphology of the coasts, as a result of sea level rise and beach warming (Hawkes et al., 2009; Poloczanska et al., 2009). Given this, general actions have been recommended for an adaptation (Fish and Drews, 2009). There are, however, no specific studies on the possible impact on Ecuadorian coasts.

Natural events

In Galapagos, the changes caused during El Niño events have been analyzed, finding that in 1982-1983 there was a drastic decrease in the number of nesting females (Zárate, 2007).

Mariculture

In the coming years, mariculture projects will be developed in Ecuador; the location of cages and the methods used to protect (e.g., nets) and to scare away predators (acoustic deterrents) could affect sea turtles (Moore y Wieting, 1999).

ETP management

In order to manage and protect ETP species, Ecuador has the following measures/legislation:

- **Seaturtles:**

a. **Ministerial Agreement 212, RO No. 581, of December 12, 1990**, which states that all seaturtle species in Ecuadorian waters are considered protected by the State. Their capture, processing and internal or external trade is prohibited.

b. The **National Plan for the Conservation of Sea Turtles** (MAE, 2014), whose general objective is to identify the necessary actions to ensure the conservation of sea turtles in Ecuador, such as protecting their nesting, reproduction and feeding areas in Ecuador, reducing the impact of interaction with fisheries, or involving citizens in the protection of turtles, among others. Specifically, in its Line of Action 5 “Reduction of bycatch”, three actions are identified to reduce sea turtle capture: (i) to adopt the use of circle hooks, (ii) to modify the fishing gear to avoid catching mahi mahi juveniles and sea turtles, and (iii) to promote the national industry to make tools to release sea turtles

c. The **Sea Turtle Bycatch Reduction Program**, which includes a series of different activities: workshops with fishermen on good fishing practices, turtle handling workshops, exchange of fishing gears (e.g., circular hooks), project “T” (designing a new type of buoy or buoy rope for longline artisanal fishing), donation of equipment to reduce bycatch, or the observer program to monitor activities on board artisanal vessels (including turtle interaction).

d. Ecuador is a contracting party of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (**CITES**). In recognition of their global plight, sea turtles were among the first species listed on the CITES Appendices when the treaty came into force in 1975, and CITES protection over

the past 35 years has been critical to ensuring their survival by having all species listed in Appendix I (meaning no trade is allowed, or trade is allowed only with permits under exceptional circumstances) by 1981.

e. Ecuador is a member country of the Inter-american Convention for the Protection and Conservation of the Sea Turtle (**CIT**). The CIT is an intergovernmental treaty which provides the legal framework for countries in the American Continent to take actions in benefit of these species. The Convention addresses the need to implement concerted measures between nations, coordinate multilateral conservation and protection actions, and ensure the implementation of a regional agenda that will lead to the recovery of these species. It promotes the protection, conservation, and recovery of sea turtle populations and those habitats on which they depend, based on the best reliable data available and taking into consideration the environmental, socioeconomic and cultural characteristics of the Parties (Article II, Text of the Convention). These actions shall cover both nesting beaches and the Parties' territorial waters.

- **<u>Sharks</u>:**

a. **Executive Decree 486**, of July 30, 2007, on Shark Fishing, Trade and Export, amended by **Executive Decree 902**, of Feburary 15, 2008:

   i. Art 2, establishes the conservation and management of sharks as a a policy of the Ecuadorian State, through the implementation of the **National Action Plan for the Conservation and Managemtne of Sharks (PAT-Ec)**; prohibits any fishery specifically targeting sharks as well as specific fishing gears to catch sharks (e.g., "palangre tiburonero" or longline for sharks).

   ii. Art 4, prohibits the use of steel or metallic cable "huaya", in the terminal part of the main longline before its union with the hook, in the longline that is used to catch mahi mahi (*Coryphaena hippurus*), big eye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), billfishes of the Istiophoridae family, swordfish (*Xiphias gladius*) and related species. This cable or metallic wire shall be replaced by monofilament polyamide material.

   iii. Art 9, prohibits the retention on board of whale sharks (*Rhincodon typus*), basking sharks (*Cetorhinus maximus*), white sharks (*Carcharodon carcharias*), and sawfish (*Pristis* spp.).

b. **Ministerial Agreement 116**, of August 26, 2013, which states that it is prohibited the retention on board, transhipment, unloading, storage, and sale of hammerhead sharks (whole or in pieces), of the Scalloped hammerhead (*Sphyrna lewini*) and Smooth hammerhead (*Sphyrna zygaena*) on industrial fishing vessels (purse seiners, longlines, gillnets and/or trammel, trawls), motherships, and on sport or recreational fishing boats.

c. **Ministerial Agreement 001**, of January 8, 2008, which establishes the payment by way of shark bycatch authorizations, rights of action, and trade and export in Continental Ecuador.

d. **IATTC Resolution C-16-05** on the Management of Shark Species (https://www.iattc.org/PDFFiles/Resolutions/IATTC/_English/C-16-05-Active_Management%20of%20sharks%20species.pdf). Art 4, states "CPCs shall prohibit longline vessels flying their flag and targeting tuna or swordfish in the Convention Area from using "shark lines" (individual lines attached to the floatline or to the floats directly, and used to target sharks)".

e. **CITES**:

   i. At its CoP16 (in 2013), the following species were included in Appendix II: *Carcharhinus longimanus*, *Sphyrna lewini*, *Sphyrna mokarran*, *Sphyrna zygaena*, *Lamna nasus*, *Manta* spp., giving 18 months for its entry into force.

   ii. At its CoP17 (in 2016), the following species were included in Appendix II: thresher sharks (*Alopias superciliosus*, *Alopias vulpinus* and *Alopias pelagicus*), silky shark (*Carcharhinus falciformis*) and *Mobula* spp., granting a year for its implementation, which ended on October 4, 2017.

f. Ecuador is a Party of the **Convention on the Conservation of Migratory Species (CMS)** since 2004. In addition, it signed the Memorandum of Understanding on the Conservation of Migratory Sharks in 2017. According to the CMS, the Parties that are Range States of migratory species listed in Appendix II shall endeavour to conclude Agreements covering the conservation and management of migratory species included in Appendix II (such as the silky shark, *Carcharhinus falciformis*, which entered in the CMS' Appendix II in 2014).

- **Cetaceans:**

a. **Ministerial Agreement 196**, RO No 458, of June 14, 1990, protects cetaceans stating that all species of whales present in territorial waters are considered protected by the State; declaring that these territorial waters are their natural refuge; and prohibiting any activity that threatens the life of these marine mammals.

- **Observers program:**

a. Ministerial Agreement 204, of December 29, 2011:

   i. Art 1, to establish a Single Observer Program for the Longline Fleet of Ecuador

   ii. Art 2, that states that at least 10% of the trips carried out by vessels over 20 m and the motherships fleet shall be monitored.

   iii. Art 3, the Single Observer Program of the Longline Fleet of Ecuador will work under the Directorate of Fisheries Control, which will be responsible for overseeing the operation; the program shall be linked to other projects of national interest such as the National Action Plan for the Conservation and Management of the mahi mahi (PAN Dorado), and the National Action Plan for the Conservation and Management of Sharks (PAT-Ec).

3.5 Principle Three: Management System Background

3.5.1. Jurisdictional category applied to the management system of the UoA

In accordance with the area of operations of the fleet, indicated in the Overview of the Fishery section, and that the stock is defined in accordance with that presented in section XXX on P1, it is considered that the jurisdictional categories that apply in this complete assessment for the target species are straddling stocks ('SSS') and highly migratory species ('HMS') and, therefore, it is a UoA subject to international cooperation to manage the target stock.

According to FAO, Peru and Ecuador are the two main countries catching this species in the indicated area. However, Peru is the main producer country of this species with almost 48% of the world catch in 2014 while Ecuador is at 10% of the total. Therefore, it is necessary for this evaluation to consider both the elements of the management system of Ecuador and those of Peru.

3.5.2. Particulars of the recognised groups with interests in the UoA.

There are 220 mother ships of which 99 are industrial (with active fishing permits) and the rest are artisanal mother ships in the UoA that catch dorado.

Most of these mother ships operate from Manta and adjacent ports. The main association is ASOAMAN (Asociación De Producción Pesquera De Armadores De Manta) with a total of 170 fibres. Many other fishermen are not associated and are considered as independent.

The area of Manta that includes the landing points of San Mateo, Manta and Jaramijó, is the most important in the unloading of this resource with approximately 90% of them. Other Ecuadorian ports, such as Esmeraldas, have a lower specific weight and most of their fleet unloads in Manta since it is the place where the fish processing and exporting companies in the country are concentrated.

3.5.3. Details of consultations leading to the formulation of the management plan.

The PAN Dorado is the product of a participatory process through national workshops and consultation meetings held in the country, where problems were identified, objectives were set, and priority lines of action were structured.

The objective of this council is to advise the Ministry in charge of fishing policies "in the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the productive chain of the dorado resource".

3.5.4. Details of other non-MSC fishery users or activities, which could affect the UoA, and arrangements for liaison and co-ordination.

As mentioned above, the number of vessels entering the mahi-mahi fishery amounts to about 220 suckers and 4,000 fibres of which 98 and approximately 1,000 fibres would be included in the UoA.

In addition to the above-mentioned FENACOPEC, there is the Asociación De Producción Pesquera De Armadores De Manta (ASOAMAN) which represents the interests of the owners of industrial dorado fisheries.

During the drafting process of the PAN Dorado, ASOAMAN was organizing itself as an entity and FENACOPEC was the one who participated in the initial consultations of the Plan, but not so much once it was approved. Currently, ASOAMAN is the entity that plays the most relevant role in the participatory processes related to the PAN Dorado. With the revision of the Plan, which is currently underway, the intention is to incorporate the participation of the artisanal fleet, especially the fiberglass vessels, which are mostly represented in FENACOPEC.

3.5.5. Regulatory framework for the assessed fishery.

International cooperation for management of the target stock

The dorado is a highly migratory species with a wide global distribution as shown in **Figure 3.2.2.1**. Ecuador captures 5,400 tons of the total species in this area (SRP, 2017). Peru, with 39,000 tons landed in 2018-19 (IMARPE, 2019) season represents close to 11% of the total volume of catches, for this reason, given that these two bordering countries are the most important in relation to the catches of this species, the situation of the fishery in Peru must be taken into account, in addition to the international component and management in Ecuadorian waters.

The Republic of Ecuador has been a Contracting Party to the Inter-American Tropical Tuna Commission (IATTC) since 2004, as well as to the Agreement on the International Dolphin Conservation Program (AIDCP), organizations whose fundamental objective is the conservation and management that ensures the long-term sustainability of tuna stocks and other marine resources associated with the tuna fishery in the Eastern Pacific Ocean (EPO).

The objective of the Antigua Convention is to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention, in accordance with the relevant rules of international law.

Regarding the dorado, although it is not a tuna species, in June 2012, during the 83rd Annual Meeting of the IATTC, the parties agreed that the Commission's scientific staff should begin the stock assessment of the dorado resource, in the Convention area.

During the Fifth Meeting of the IATTC Scientific Advisory Committee, held on 12-16 May 2014 in La Joya, it was considered appropriate for the IATTC staff to study the species in order to determine the impact of the fishing activity and recommend appropriate conservation measures if necessary.

In this context, the IATTC organized the First Technical Meeting on Dorado on October 14-16, 2014, in Manta, Ecuador, with the objectives of promoting regional research on the perico or dorado in the EPO; reviewing its status in relation to the knowledge that was available on the species and identifying the scientific data available on it and formulating a plan for future research.

In 2015, the 2nd Technical Meeting worked on defining the assumptions about stock structure and identifying potential indicators of stock status for the dorado in the eastern Pacific Ocean. The 3rd Meeting, held in 2016, worked on the evaluation of data requirements and assessment methods for data-restricted dorado fisheries in the eastern Pacific Ocean.

In addition, an exploratory assessment of dorado in the IATTC area was carried out in that year with the participation of scientists from the Commission and from the main countries in the area with interests in this 'fishery.

In relation to Ecuador, the National Council for Fisheries Development in Resolution No. CNDP-001-2000 published in Official Register No. 22 of February 22, 2000, authorized the Undersecretary of Fisheries Resources to implement, in the most appropriate manner, when the cases so warrant, the resolutions of the IATTC, and of the rules contained in the AIDCP, through ministerial and/or instructive agreements, without the need for a prior opinion of that Council. By means of this procedure, Ecuador incorporates into its national regulations / applies, directly, the IATTC resolutions. Thus, there is an extensive compendium of Ecuadorian rules and resolutions in which the closures, the observer programs emanating from the IATTC, are applied.

On the other hand, Peru has been a Contracting Party of the Inter-American Tropical Tuna Commission (IATTC) since 2003, having ratified its membership in October 2018. (LEGISLATIVE RESOLUTION NO. 30785). At present and in the framework of the 94th Meeting of the Inter-American Tropical Tuna Commission (IATTC), Peru was elected to the Presidency of this entity.

Despite being a pelagic resource considered as transzonal and/or highly migratory, up to now IATTC has not adopted specific management measures for mahi-mahi, unlike fisheries directed at tunas and tuna-like species. However, mahi-mahi is targeted by longline fleets and caught incidentally by purse seine fleets fishing in waters managed by the IATTC. Therefore, this body is working on improving the scientific knowledge of the species, although now it has not addressed its management and the only existing measures are those adopted by coastal countries. While, as an incidental species of the purse-seine fleet, IATTC through Resolution C-04-05 (Rev 2) agrees to require the release of non-target species (including mahi-mahi) as soon as possible and if possible unharmed.

The Antigua Convention incorporates, inter alia, the following issues:

i. The new international agreements established in recent decades on fisheries and biodiversity conservation.

ii. The concept of ecosystem management.

iii. Urges the IATTC to collect statistical information not only on tunas but also on other species; and,

iv. May establish management measures for both target and non-target species

These last two points are relevant for the dorado resource since, although it is not a tuna, IATTC has begun to analyze the status of the dorado stocks in the area. It has not yet issued direct management measures for dorado, but it has issued a set of resolutions on bycatches that affect this species.

In June 2012, during the 83rd Annual Meeting of the IATTC, the parties agreed that the Commission's scientific staff should begin the stock assessment of the Dorado resource, in the Convention area.

During the Fifth Meeting of the IATTC Scientific Advisory Committee, held on 12-16 May 2014 in La Joya, it was considered appropriate for the IATTC staff to study the species in

order to determine the impact of the fishing activity and recommend appropriate conservation measures if necessary.

In this context, the IATTC organized the First Technical Meeting on Dorado on October 14-16, 2014, in Manta, Ecuador, with the objectives of promoting regional research on the perico or dorado in the EPO; reviewing its status in relation to the knowledge that was available on the species and identifying the scientific data available on it and formulating a plan for future research.

Subsequently, in 2015 and 2016, the 2nd and 3rd technical meetings on the species were held

Peru is the country with the highest proportion of catches of this species in the region, well ahead of Ecuador, which would be in second place. Although both Peru and Ecuador apply some management measures on this resource (minimum sizes, closed periods, number of fiberglass vessels per mother vessel) there are no joint management mechanisms for this fishery.

On the other hand, Ecuador is a signatory and has ratified, through Executive Decree No. 1166 of 22 August, the "Agreement on the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks".

In application of this Agreement, ratified by Ecuador, there is an obligation to cooperate with RFMOs under the above terms. Therefore, despite the non-ratification of the Accession, it is part of it and applies all its resolutions. It should not be forgotten that ratification is an internal legal process of the countries and that, therefore, it does not directly affect the implementation of the resolutions agreed within the IATTC.

Ecuador and Peru are signatories to the Agreement on the International Dolphin Conservation Program (AIDCP) and to the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC).

Both countries cooperate in an institutional manner in the management of the resource. Thus, there is a Framework Agreement for Technical Cooperation between the Instituto del Mar of Peru (IMARPE) and the Instituto Nacional de Pesca of Ecuador (INP), signed on 29 February 2012 and renewed since 19 February 2018. Under this agreement, four binational workshops on the perico/dorado resource have been held between Ecuador's INP and Peru's IMARPE, the last of which was held at IMARPE's Coastal Laboratory in Tumbes on November 28, 2018. These binational workshops between the INP of Ecuador and IMARPE of Peru allow for updating data on landings, distribution areas and other biological aspects of the Perico/Dorado resource. Likewise, the exchange of this information allows the identification of data and models for the assessment of the stock of this resource at the regional level.

This Agreement is part of the Framework Agreement on Cooperation in Fisheries and Aquaculture signed with the Republic of Ecuador, whose objective is to carry out integral cooperation in fisheries and aquaculture matters, as well as the execution of periodic evaluations that allow for the rational and sustainable use of the hydrobiological resources of the Parties.

Ecuador

The international agreements are complemented by the Law on Fisheries and Fisheries Development, published in 1974 and amended in 1985 by the Ministry of Agriculture and Livestock. This law is in force. The General Fisheries Regulations of the Law were issued in July 2002 (Decree No 3198) and amended in 2016.

In recent years, there have been significant changes in the configuration of the Ecuadorian fisheries administration. Thus, by Executive Decree No. 6 of 24 May 2017, the Vice-Ministry of Aquaculture and Fisheries was separated from the Ministry of Agriculture, Livestock, Aquaculture and Fisheries, and the Ministry of Aquaculture and Fisheries was created as a public law body with its own legal capacity, assets and administrative and financial regime. However, in 2018, through Executive Decree No. 559 of November 14, 2018, the following institutions were merged into the Ministry of Foreign Trade and Investment: Ministry of Industry and Productivity, Institute for the Promotion of Exports and Foreign Investment and the Ministry of Aquaculture and Fisheries. Once this process was concluded, the name of the Ministry of Foreign Trade and Investment was changed to "Ministerio de Producción, Comercio Exterior, Inversiones y Pesca - MPCEIP".

By Executive Decree No. 636 of 11 January 2019, the Vice-Ministries of Production and Industries, Export and Investment Promotion, and Aquaculture and Fisheries were created. Through the Ministerial Agreement MPCEIP-DMPCEIP-2019-0034, the Undersecretary of Fisheries Resources of the Vice Ministry of Aquaculture and Fisheries is delegated the exercise of the powers, functions, powers and responsibilities legally established to the highest authority, to continue signing the administrative regulatory acts and authorizations for the implementation of fisheries activity in its various phases.

The SRP has, among other attributions, the responsibility to apply and supervise the national fishing policy, to guarantee the fulfilment of the fishing laws and regulations, to elaborate the plans and programs for the development of fishing, to coordinate the activities of the public and private sectors, to manage the financial credit of fishing, to approve the reports and plans of the companies of the fishing sector and the studies on the activity of the commissions and, to manage the development of the fishing sector. In addition, the SRP represents Ecuador in international fisheries forums including the IATTC. On the other hand, the National Council for Fisheries Development, created under the Law on Fisheries and Fisheries Development of 1974, is responsible for the development of the national fisheries policy, the approval of fisheries development plans and programs and the annual evaluation of results in order to enable the authorities to make the necessary changes. The Council also participates in the preparation of draft laws and regulations for the implementation of the national policy, sets prices and percentages for the quantity of fish and fishery products to be allocated to the national market, determines which aquatic species may be exploited in accordance with the technical reports of the National Fisheries Institute (INP), and the related issues of the reports required by the Law and its Regulations. The following table shows the organization chart of the MPCEIP:

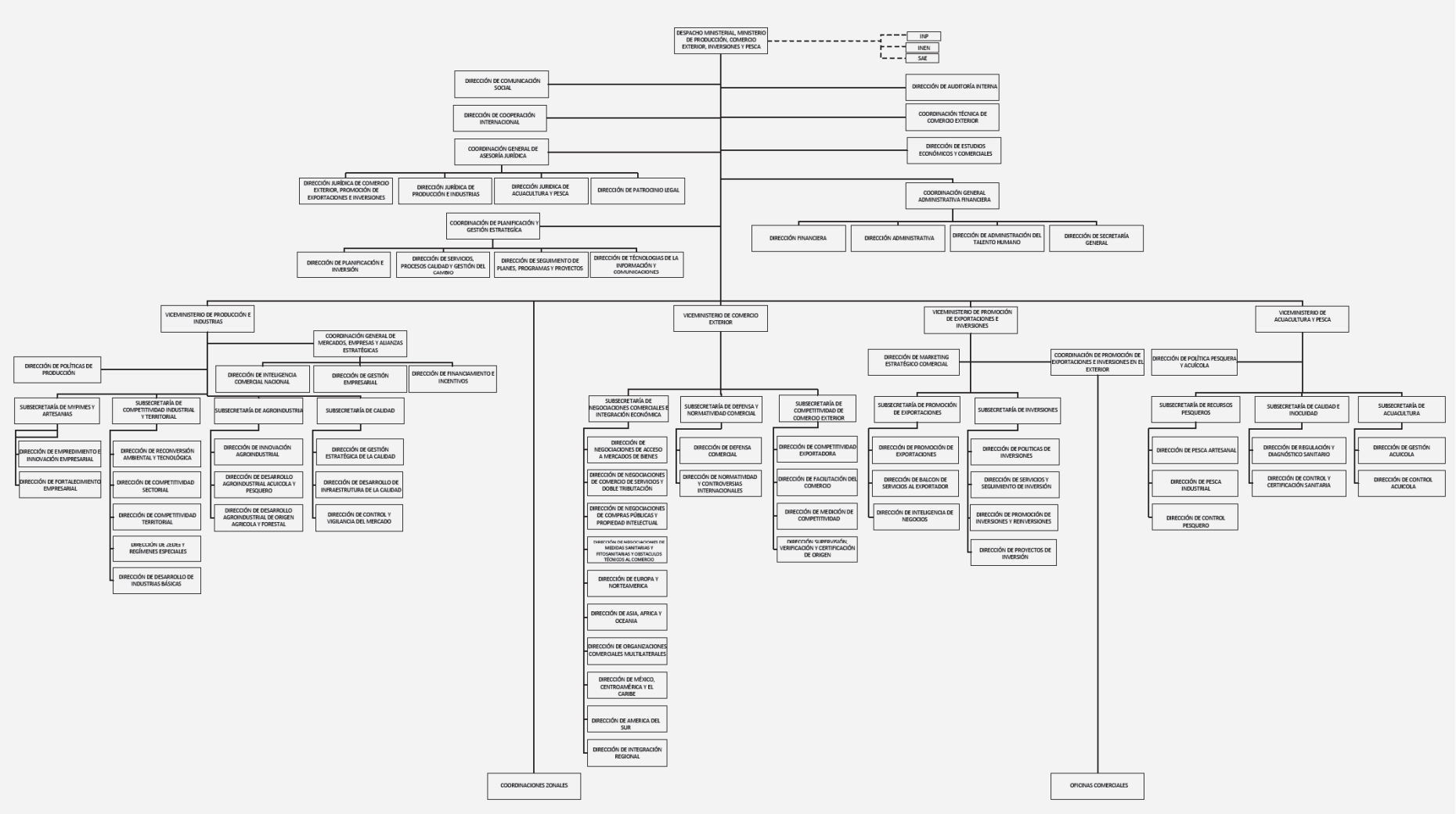


Figure 3.5.5.1 Organization chart of the Ministry of Production, Foreign Trade, Investment and Fisheries - MPCEIP.

Through the Ministerial Agreement No. 023 of February 14, 2011, the National Action Plan for the Conservation and Management of the Mahi mahi resource in Ecuador-PAN Dorado is established as a tool of guidelines for the conservation, management and eco-certification of the Mahi mahi resource. In addition, the Ministerial Agreement No. 055 of April 2011 establishes the so-called Advisory Council of the Mahi mahi resource (CCRD) whose mission is to advise the Ecuadorian Administration in relation to fisheries management and establish mechanisms for consultation between the public and private sectors to work together for sustainability and seeking certification of the fishery.

The management system includes different consultation mechanisms with the different stakeholders of the fishery that are used for decision making. Thus, in the National Fisheries Development Council and the Advisory Council for the Mahi mahi resource, the Administration and the industry can discuss the situation of the fisheries (the latter specifically for dorado) and make proposals for changes in the management processes.

The CCRD initially included FENACOPEC and ASOEXPEBLA as part of the fisheries sector and has as advisory bodies WWF and INP and is open, at the discretion of the presidency, to the specific participation of other governmental and non-governmental organizations, individuals and related institutions.

The objective of this council is to advise the Ministry in charge of fishing policies "in the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the productive chain of the mahi mahi resource".

Ecuador, as a member of the IATTC, maintains a constant exchange of information with the tuna sector that allows it to have coordinated responses and a joint strategy for meetings and decision-making in the IATTC. However, this does not occur for other fisheries such as the dorado.

Peru

The General Fisheries Law and its Regulations in force since January 1994, establish the legal framework for the exercise of fishing activity in the country. These regulations establish mechanisms for the management and extraction of fishing resources in waters under Peruvian jurisdiction and differentiate access for industrial and artisanal fishing, providing the legal framework for the management of any fishery.

The Regulations of the General Fisheries Law establish that the fisheries management at national level is approved by means of regulations, the purpose of which is to establish principles, standards and regulatory measures applicable to the fisheries resources to be managed as distinct units

There is a Ministry of Production to which the Vice-Ministry of Fisheries and Aquaculture depends and different public bodies related to fisheries such as the Instituto del Mar del Peru (IMARPE) in charge of scientific research on Peruvian fisheries and of providing scientific advice to the Vice-Ministry for better management decisions.

There is also a National Action Plan for the Conservation and Management of the Parrot Resource in Peru (PAN-Perico). This Plan is a medium- and long-term planning and management tool for the Peruvian fishery and includes relevant objectives and activities aimed at conserving and managing the fishery in an integrated manner. The main management measures include closure periods and a minimum size.

Peru has not ratified the United Nations Convention on the Law of the Sea (UNCLOS) or the Agreement of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. However, the Perico Plan of Action refers to the fact that Peru takes its decisions on the bases and obligations of States in relation to international law.

3.5.6. Objectives for the fishery (referring to any or all of the following if relevant):

Ecuador

In Ecuador, based on the interest of certifying the dorado fishery and through the processes and results of the FIP, improvements have been made in the management and decision-making processes of the fishery in recent years. Most of the existing management mechanisms come from the implementation of the National Action Plan for Dorado (PAN Dorado) in force since 2011 and which should be considered as the basis for a set of medium- and long-term management tools for this fishery. Although, prior to the publication of the NAP, several management measures already existed and were included in it.

The PAN Dorado has the following specific objectives

a. To establish regulations based on good science that will improve administration and ensure the conservation of the resource.

b. Establish a control system that incorporates a traceability scheme for the resource.

c. Involve the communities in matters related to education, awareness and dissemination that allow the conservation and good management of the resource.

d. Generate priority scientific information for the management of the resource.

e. Reduce bycatch of non-target species.

In order to achieve these objectives, a set of rules (Ministerial Agreements) have been published which regulate, on the one hand, the dorado fishery and, on the other hand, rules of a general nature. In relation to dorado, these Agreements include direct management measures (minimum sizes, closures, size and types of hooks, characteristics of permitted vessels, observer programme) and decision-making systems (Advisory Councils, Action Plan) among others.

This Action Plan is currently being reviewed externally through the contracting of a consultancy. The main objective of this evaluation is to ascertain the degree of effectiveness of the actions in the Plan and to propose new management elements to be incorporated into it.

All these measures listed below are in force and applied in the dorado fishery:

Minimum sizes

Ministerial Agreement No. 070 of 19 May 2011 (Article 5) A minimum catch size of 80cm in total length is established for catches made during the normal fishing period. A margin of 10%, both for directed and incidental fishing, of less than 80cm in total length is allowed of the volume of fish landed.

Closures

Ministerial Agreement No. 070 of 19 May 2011 (art. 1) establishing a total ban on fishing for the Mahi mahi resource from 1 July to 7 October each year. The landing of by-catches of dorado of a total length of not less than 80 cm is allowed. Article 4, paragraphs 2 and 3, establish the percentages of bycatch allowed during the closure period.

Ministerial Agreement No. MAP-SRP-2018-0157-A amending MFA No. 070 in its article 4, paragraphs 2 and 3, by increasing the percentages of incidental fishing for dorado:

- Up to 10% of the volume (by weight) of the landing of the species (Dorado), per vessel, per fishing trip, for tuna purse seiners, small pelagic fish purse seiners and all those vessels that use purse seine nets.

- Up to 15% of the volume (by weight) of the landing of the species (Dorado). Per vessel per fishing trip, for vessels, longliners and fibre boats (independent) using as main fishing gear longline, spinel (Long line), surface gillnets (trammel net) and other similar gears.

Other Management Measures Dorado

Ministerial Agreement No. 070 of 19 May 2011 (Article 6) regulates the type and size of hooks allowed for the capture of dorado with spinel (see section xxx for a description of the gear used).

National Action Plan for the Dorado Resource

Ministerial Agreement No. 023 of February 14, 2011 establishing the National Action Plan for the Conservation and Management of Ecuador's Mahi mahi resource This Plan is conceived as a tool of guidelines for the conservation, management and eco-certification of the mahi mahi resource.

Advisory Council of the Mahi mahi resource

Agreement No. 055 establishes the Consultative Council of the Mahi mahi resource (Coryphaena hippurus), as an instrument of consultation between the public and private sectors, related to the conservation, management, sustainable use and ecocertification of the Mahi mahi resource, as well as, to analyze and generate alternatives for the development of the chains, in the production and productivity of this bio aquatic resource

Observer Program

Ministerial Agreement No. 407 of 12 October 2011 which defines the characteristics of a longline mother vessel and that, in its Article 10, the Undersecretariat of Fisheries Resources shall establish an on-board observer program, on a rotating and permanent basis on the longline mother vessels, covering 10% of its active fleet.

Ministerial Agreement No. 204 of 28 December 2011, through which a Single Program of observers for the Ecuadorian longline fleet is established. Art. 2. states that this program will provide a system of random monitoring and real-time data collection on at least 10% of the trips made by longline fishing vessels over 20 meters in length, as well as the fleet of mother ships

Regulation of mother ships

Ministerial Agreement No. 407 of 12 October 2011 defining the characteristics of a longline mother ship intended, among other species, for the capture of dorado. Article 3 sets at 10 the maximum number of small boats towed by each mother ship for fishing this species. In addition, all catches made by small boats must be stored in the mother ship. All wet mother ships must have a Ministerial Agreement empowering them to carry out the activity and a valid annual fishing permit issued by the Ecuadorian fisheries authority and must have the MSY system installed (articles 4 and 6).

Satellite monitoring

Agreement No. MAP-SRP-2018-0104-A – of 22 May 2018. Rules and regulations for the operation of satellite monitoring systems for fishing vessels.

This agreement establishes rules and regulations for the operation of satellite monitoring systems directed at fishing vessels. Industrial fishing vessels and mother ships must install and maintain operational satellite monitoring devices (SMD), regardless of gross registered tonnage (GRT), in compliance with the technical and operational specifications issued by the National Directorate of Aquatic Spaces (DIRNEA). Fishing vessels may not fish without having installed and operational satellite monitoring device

Sharks

There is a 2006 National Plan of Action for the Conservation and Management of Sharks in Ecuador (PAT-Ec) that has just been revised in 2019. The main objective of this Plan is to have an integral management framework for shark species in Ecuadorian fisheries, through the improvement of scientific knowledge by means of data collection and analysis, minimizing the incidental catches of these species and improving the systems of control and reporting of catches, among others.

Agreement No. 116 of 13 September 2013 on management measures and management of hammerhead sharks. The Agreement provides for the management and management measures of bycatches of hammerhead sharks of the family Sphyrnidae, of the species known as Redhead (Sphyrna lewini) and Whitehead (Sphyrna zygaena).

Peru

In relation to Peru, there is, similarly to Ecuador, a National Action Plan for the Conservation and Management of the Perico resource in Peru (PAN-Perico). This Plan is a medium- and long-term planning and management tool for the Peruvian fishery and includes relevant objectives and activities aimed at conserving and managing the fishery in an integrated manner.

The objectives of this plan are the following:

- To promote the implementation of effective frameworks for biological, ecological and fisheries research on the Peruvian resource.

- Design and implement an information, follow-up, monitoring and evaluation system for the production chain of the parakeet resource.

- Strengthen the regulatory framework through the development of fisheries management measures for the parakeet resource.

- Reduce the incidental capture of parakeets in non-target fisheries.

- Contribute to the protection of biological diversity and the structure and function of the ecosystem.

- Identify and assess threats to the parakeet population, as well as determine and protect its habitats.

- Encourage the development of education, training and technical assistance programs that promote the conservation and sustainable use of the parakeet resource

The 2 main tools for the management of the parakeet in Peru are the minimum catch size and the establishment of fishing seasons

Ministerial Resolution No. 209-2001-PE, amended by Ministerial Resolution No. 249-2011-PRODUCE establishes the minimum catch sizes and maximum tolerance of juvenile specimens, for the extraction of parakeets Coryphaena hippurus at 70 cm in length at the fork and 10% maximum tolerance of juveniles.

Ministerial Resolution No. 245-2014-PRODUCE: Establishes the fishing season for the parakeet or dorado resource (Coryphaena hippurus) at the national level, in the period from October 1 to April 30 of each year; it is prohibited to carry out extraction activities of the aforementioned resource from May 1 to September 30 of each year

A pre-evaluation of the parakeet fishery in Peru was carried out in 2012 and a PIF for the improvement of the fishery in relation to the MSC standard was launched in 2013. This FIP has not been updated since 2015 so the status of implementation of the actions formulated in the Action Plan and affecting indicators of the three principles of the MSC is not known.

Inter-American Tropical Tuna Commission (IATTC)

Regarding the IATTC, since 2014, scientists of this organization have been working to improve the scientific information on the stock of mahi-mahi in the EPO, based on data from the countries where the catch of this species is most important (mainly Peru and Ecuador). According to the exploratory stock assessment of mahi-mahi carried out by IATTC in 2016, it is above the IRP and close to reaching the MSY.

However, beyond the scientific collaboration on the dorado assessment and the bycatch resolutions that include dorado as one of them, IATTC has not issued any resolution or management recommendation for the species, except those related to bycatch that include this species. The existing management measures in the UoA are those issued by Ecuador and Peru

4 Evaluation Procedure

4.1. Harmonised Fishery Assessment

In accordance to FCR PB3.1 CABs assessing overlapping fisheries shall ensure consistency of outcomes so as not to undermine the integrity of MSC fishery assessment.

Although there are management measures within the framework of the IATTC that affect mahi mahi, these only refer to the accidental catch that can be taken by tuna purse-seine vessels. There are no specific management measures for this species under the IATTC.

Nevertheless, there are no certified fisheries that overlaps with the current Unit of Assessment. In the IATTC area there is only one Mexican purse-seine fishery for tuna on free school and dolphins and two fisheries for albacore tuna using lines and hooks.

Therefore, there are no overlapping fisheries to carry out the harmonization in this assessment.

4.2. Assessment Methodologies

MSC states that all "first assessments that commence after the effective date (1st April 2015) shall be conducted in accordance with the new standard requirements in FCR v2.0 in addition to using the new processes". Therefore, the Ecuador mahi mahi longline fishery was assessed against Version 2.0 of the MSC Fisheries Certification Requirements (1st October 2014). The assessment team used the default assessment tree (SA) without adjustments. The MSC Full Assessment Reporting Template V2.0 (issued by MSC on the 8th October 2014) was used as basis for this report.

4.3. Evaluation Processes and Techniques

4.4.1 Site Visits

The team, with the help of the client, identified and contacted the most relevant stakeholders in order to elaborate a comprehensive agenda for the site visit. Meetings were scheduled and carried out in Manta and Puerto Pesquero Artesanal de San Mateo between May 21 and 24, 2019. Also, in those cases where face to face meetings where not possible, conference calls were organized during the site visit. The resulting agenda, including institutions visited and people met, is presented **Table 4.4.1**. A closing meeting with the client was held before finishing the surveillance audit as required by ISO 19011.

The 3 members of the assessment team took part in all meetings held during the site visit. Also, an ASI auditor (Sergio Cansado) attended all audit activities (meetings, conference calls and pre-scoring meetings) as part of the witness assessment to the CAB performance. As part of the ASI audit an opening meeting with the BV team was held right before starting with the site visit. Also, a closing meeting with the BV team was held straight after finishing the site visit.

Table 4.4.1. Details of the interviews maintained during the site visit.

Fecha	Hora local	Lugar	Participantes	Temas a tratar
20/05	*Llegada a Manta del equipo evaluador excepto Carola que se llegará el día 21 a las 7:00 am*			
21/05	9:00	Hotel Balandra, Manta	Reunión equipo de evaluación con Sergio Cansado ASI	- Review, and refresh plans/process for thesite visit and stakeholders consultation
	10:00-12:00	Hotel Balandra	Representantes del cliente y Guillermo Morán: Propemar S.A. Mardex MARISCOS DE EXPORTACION S.A. FRIGORIFICO Y LABORATORIO SAN MATEO, FRIGOLAB SAN MATEO CIA. LTDA. Ocean Fish Transmarina C.A. FRESH FISH DEL ECUADOR CIA. LTDA. FRIGOLANDIA S.A.	- Documento adjunto_Cuestiones a discutir con el cliente.
	13:00	Almuerzo	Equipo de evaluación	-
	15:30-17:30		Reunión con Armadores y Capitanes de Pesca de Dorado	-
	18:00-19:00		- *Reunión equipo evaluador y final de la jornada*	
22/05	7:00	Terminal Pesquero y de Cabotaje de Manta	- Subsecretaría de Recursos Pesqueros (SRP). - Jonathan Pincay de la Dirección de Política Pesquera y Acuícola	- Visita a Puerto Pesquero para ver posible descarga y entrevista a inspectores de pesca que realizan el Control, Monitoreo y Vigilancia.
	12:00	Skype Hotel Balandra	- INP: Esteban Elias, Manuel Peralta Skype username: **Skype_inp**	- Documento adjunto_cuestiones a discutir con INP.
	15:00	Hotel Balandra	- WWF: Pablo Guerrero	- Documento adjunto_cuestiones a discutir con WWF.
	17:00-18:00		- *Reunión equipo evaluador y fin de la jornada*	
23/05	10:00-14:00	Oficinas del Viceministerio de Acuacultura y Pesca, Puerto Pesquero Artesanal de San Mateo	- Subsecretaría de Recursos Pesqueros (SRP). Reunión con representantes de Direcciones: - Dirección de Política Pesquera y Acuícola - Dirección de Control de Recursos Pesqueros - Dirección de Pesca Artesanal - Dirección de Pesca Industrial - Dirección de Patrocinio Legal	- Documento adjunto_Cuestiones a discutir SRP - visita a Centro de Monitoreo Satelital (mismas instalaciones del Puerto de San Mateo)

	14:30-15:30	Almuerzo	Equipo de evaluación	
	16:00-17:00	Hotel Balandra	Equipo de evaluación	- Tiempo de trabajo para el equipo.
	17:15-18:30	Hotel Balandra	Cliente	- Reunión de cierre con el cliente para un resumen rápido de los hallazgos y compilación de la información que se enviará al equipo de evaluación.
	18:30	*Fin de la jornada*		
24/05	10.00	Skype Hotel Balandra	- IATTC: Juan Valero, Alexandre Aires da Silva & Martin Hall Skype usernames: **juan_luis_valero** ; **martin_hall**	- Documento adjunto cuestiones a discutir con IATTC.
	12.00-13:30	Hotel Balandra	Equipo de evaluación	- Reunión para la pre-evaluación.
	13:30-14:30	*Reunión equipo de evaluación con Sergio Cansado ASI y fin de la site visit*		

4.4.2 Consultations

The announcement of the fishery entering the MSC assessment process was made publicly available at the MSC website on February 26, 2019. This announcement detailed that the site visit to Ecuador was scheduled for the week of the 20th of May 2019, and encouraged those stakeholders interested in scheduling a meeting to get in contact with the assessment team. Furthermore, BV also encouraged stakeholders to share with the team, at any time throughout the process, any information they might consider relevant to the assessment.

A specific email informing about the announcement of the fishery and encouraging participation was sent to a comprehensive list of stakeholders which was elaborated by the CAB with the assistance of the client. This list included the administrations from Ecuador (SRP, MAE, MAGAP), Colombia (AUNAP), Guatemala (Ministerio de Agricultura, Ganadería y Alimentación), and Panamá (Autoridad de los Recursos Acuáticos de Panamá) ; IATTC scientists; Ecuador (INP), Peru (IMARPE, and Smithsonian Institution - Peru), Mexico (CICIMAR), Costa Rica's (INCOPESCA), El Salvador's (Centro de Desarrollo de la Pesca y la Acuicultura), and Chile's (IFOP) research centres; Universities of Colombia (Universidad de los Andes), and Chile (Universidad Católica del Norte); Fishing companies and associations, and shipowners (Propemar S.A., Mardex MARISCOS DE EXPORTACION S.A.,FRIGORIFICO Y LABORATORIO SAN MATEO, FRIGOLAB SAN MATEO CIA. LTDA., Ocean Fish, Transmarina C.A., FRESH FISH DEL ECUADOR CIA. LTDA., FRIGOLANDIA S.A., EPESPO, FENACOPEC, Cooperativa pesquera Santa Rosa de Salinas, ASOEXPEBLA); and environmental NGOs (Animal Welfare Institute, Birdlife International, Bloom, CEDEPESCA, CMS, Conservation International, FoodsFenners Chambers (World Wise Foods), FUNDAECO – Guatemala, Greenpeace, ISSF, NAMMCO, OCEANA, OSPESCA – Argentina, Seo-Birdlife, The Billfish Foundation, The Ocean Foundation, World Wise, WWF).

A delay in the assessment process has motivated the CAB to open a new 30-day stakeholder's consultation period on November 26, 2019, in accordance to FCR 7.3.4.1.

Apart from the information collected by the team during the site visit, no further comments were received from other stakeholders. However, since the site visit and after having been requested by the team, the SRP has been sending new information. Moreover, and even though several attempts were made to contact the Peruvian administration and their scientific center, no response has been received from them. Due to these reasons, the new 30-day consultation was opened.

As described in the previous section, the assessment team performed a site visit which included meetings with relevant fisheries managers, scientists, client's representatives, and NGOs (see **Table 4.4.1**). Feedback obtained from all the interviewed stakeholders allowed the team to collect information on different details of the fishing operations at sea (bait, handling, storage), offloading, selling (sales forms), MCS system and activities, observers program, scientific monitoring, and other relevant issues. Information collected was used to elaborate **Section 3** (Description of the fishery) and **Section 5** (Traceability), and also to evaluate and score the assessed fishery using the default tree (Annex SA) as shown in **Appendix 1**.

BV submitted a request to the MSC's Peer Review College to assign peer reviewers to this assessment process. The College compiled a shortlist of 4 potential experts to undertake the peer review for the PRDR. This list, including a summary of the experience and qualifications of the reviewers was published at the MSC website on August 29, 2019.

4.4.3 Evaluation Techniques

The full assessment was publicly announced on February 26, 2019 at the MSC website and supplemented by emailing a list of relevant stakeholders (see **Section 4.4.2**). This was also the method used for consultation on subsequent steps (e.g. peer reviewers announcement…). See **Section 4.4.2** for a detailed list of all consultations that took place at different stages along the process. However, meetings and conference calls held during the site visit constituted the main tool in guaranteeing the participation of relevant stakeholders.

Additionally, the assessment team has reviewed all the documents sent by the client and the Ecuadorian administration (e.g., catch data; bait data, logbooks' forms; observers' forms; examples of fishing permits, administrative records, or vessels tracking; scientific reports on genetic analyses, otholit analyses, reproduction, growth; reports on National Action Plans, Traceability, Landings; the Action Plans on mahi mahi, sharks or sea turtles; several ministerial agreements and other legislation related to mahi mahi; or the programs to educate fishermen on bycatch reduction), WWF (i.e., National Bycatch Report, a UNDP program on Coastal Fisheries in the Southeast Pacific, or the MoU between the Ministry of Aquaculture and Fisheries and WWF), and IATTC documents and presentations (e.g., Exploratory Stock Assessment, Exploratory Management Strategy Sssessment, document on Dorado in the EPO, or the Potential Reference Points and Harvest Control Rules), as well as other scientific publications.

Scoring was performed according to the procedure established in Certification Requirement 7.10 (MSC FCR v2.0). The assessment team held preliminary scoring meetings along the site visit where the Performance Indicators of the fishery were evaluated jointly by the team in order to assess whether there was still information needed to be communicated to the client. After the site visit, each expert got in charge of finishing its part of the report before proceeding to a joint evaluation of every PI and the pertaining scoring systems through scoring meetings which took place via conference calls.

As a result of assessing the **Ecuador Mahi mahi** (C**oryphaena hippurus**) **Longline Fishery** against the MSC-Fishery Requirements Version 2.0**,** it was found that **P2 and P3 do not reach a score of 80**. Scores allocated to default performance indicators are enclosed in section 6.2. **Thus, the FISHERY FAILS**.

As 14 PIs do not reach a score of 80 (see section 6.2), and in accordance to FCR 7.21.2, 14 conditions (see section 6.3 and Appendix 1.3) would have had to be opened to provide an indication of the actions that may have been required should the fishery have been certified..

4.4.4 Risk Based Framework

The Risk Based Framework (RBF) was adopted by the MSC to enable scoring of fisheries in data deficient situations, and it is designed to allow the assessment of specific PIs (1.1.1, 2.1.1, 2.2.1, 2.3.1, 2.4.1 and 2.5.1) using the default assessment tree.

During the assessment process (prior and post the site visit), a couple of issues regarding the use of RBF for PI 1.1.1 and PI 2.2.1 were raised:

RBF for PI 1.1.1
During the pre-assessment (January 2010) of the Ecuador Mahi Mahi it was noted that there was little known about the biology and the fishery of this species (MRAG, 2010):

- There was insufficient data on spawning periods, recruitment and behaviour;
- The length at which the species reaches sexual maturity was not determined;
- Growth of this species has not been determined
- The number of immature fish that are caught and landed have not been recorded.
- At stage Mahi mahi was landed without gonads and therefore fecundity was not determined.
- There was no size-age data;
- Population levels of the stock(s) were not known;
- There was no joint research with other countries in the region that have a mahi mahi fishery.
- Information was insufficient to allow analysis of the population dynamics of the species and establish scientific criteria to support implementation of regional management measures.

For this reason, the assessment team (MRAG, 2010) found that the status of the mahi mahi stock was unknown in relation to limit reference points or proxy values. Even though a significant amount of new, then recent, information had been collected on the biological characteristics and fishing operations of the Ecuador fleet, the data was not sufficient to be used in a formal stock assessment and therefore the risked based approach was conducted.

For the full assessment, considering the above and following MSC rules (PF2.1.1) the Bureau Veritas team was uncertain whether the RBF should be followed and, therefore, announced the "Use of the RBF in a fishery assessment form" on the MSC website on the 26th of February, 2019, to ensure at least 30 days for stakeholder consideration.

Since then, after a desk top research analysis, it was found that a formal stock assessment had been conducted in 2016 and that although no formal reference points had been adopted, certain management quantities (B0, MSY, Bsp) had been estimated, therefore, proxy reference points could be determined. Also, following the FIP, the collecting of biological characteristics and data on fishing operations continued to be collected, therefore, it cannot be said that this fishery is data deficient and, therefore, no longer qualifies to be evaluated using the RBF approach.

RBF for PI 2.2.1

At the time of the site visit (21-24 May, 2019), the team had only the UoA catch data from 2013 to 2015 in number of individuals. With those data, two of the shark species (the pelagic thresher shark, *Alopias pelagicus* and the blue shark, *Prionace glauca*) were classified as 'Minor'.

However, during the assessment process, once the team received the UoA catch data from 2013 up until 2017 and in metric tons (and not just from 2013 to 2015 in number of individuals, as it was originally received) they were reclassified as 'Main' (see **Table 3.4.2.2.1**).

Since stock status reference points are not available (either derived from analytical stock assessments or using empirical approaches) for neither of these two species to be assessed against P2, the fishery was considered to be data-deficient with respect to PI.2.2.1, according to FCR7.7.6 and Table 3 of MSC FRC v2.0. Therefore, the use of the RBF tool was recommended and announced on the MSC website on 26th of November, 2019. Thus, as per MSC FCR 7.3.4.1 Bureau Veritas Certification opened a 30 calendar day consultation period to provide stakeholders the opportunity to submit any new information in relation to this fishery.

The team was going to conduct the RBF (either onsite or offsite), however, due to the decision of the client to not continue with the certification process, the RBF was never carried out. Therefore, and in order to be able to have a preliminary score for P2, the assessment for these two species was carried out as a "desk-approach" RBF, using only the information available to the team, and not being able to take into account the multi-stakeholder approach of the RBF. The results obtained for these two species, therefore, are preliminary.

5 Traceability

5.1. Eligibility Date

FCR 7.6.1 states that "*The CAB shall nominate a date from which product from a certified fishery is eligible to be sold as MSC certified or bear the MSC ecolabel (the eligibility date). This shall be either: (7.6.1.1) the date of certification of the fishery; or (7.6.1.2) the publication date of the first Public Comment Draft Report*".

However, since the team recommends to not award the certification and fail the fishery, there is no eligilibity date applicable.

5.2. Traceability within the Fishery

1. The report shall include a description of factors that may lead to risks of non-certified fish being mixed with certified fish prior to entering Chain of Custody, using Table 4 below. For each risk factor, there shall be a description of whether the risk factor is relevant for the fishery, and if so, a description of the relevant mitigation measures or traceability systems in place.
2. The report shall include:

a. A description of the tracking, tracing and segregation systems within the fishery and how these systems will allow any products sold as MSC certified to be traced back to the UoC.

b. An evaluation of the robustness of the management systems related to traceability.

(Reference: FCR 7.12.1.1, 7.12.1.3, 7.12.1.4)

According to MSC requirements (FCR7.12.1.1, 7.12.1.3, 7.12.1.4), **Table 5.2** includes a description of factors that may lead to risks of non-certified fish being mixed with certified fish prior to entering CoC. For each risk factor, there is a description of whether the risk factor is relevant for the fishery, and if so, a description of the relevant mitigation measures or traceability systems in place.

Table 5.2 Traceability Factors within the Fishery.

Traceability Factor	Risk Factor and Mitigation Measures
Potential for **non-certified gear/s to be used within the fishery**	Although there is a seasonal closure, which prohibits mahi mahi fishing (i.e. from 1 July to 7 October each year), there is no obligation to report when the type of hook is changed to fish for species other than mahi mahi. Given the potential for changing the longline depending on how catches evolve, and due to the amount of mahi mahi being caught outside the UoC fleet, there is a high risk for mixing catches. It has not been possible to determine what mitigation measures the client has in place to avoid this problem.
Potential for **vessels from the UoC to fish outside the UoC** or in different geographical areas (on the same trips or different trips)	As they all fish either in Ecuadorian waters within the EEZ or in international waters covered by the UoC, the probability of Ecuadorian boats entering to fish in Peruvian waters is minimal and the satellite control of the boats prevents the entrance to not allowed fishing zones (e.g. Galapagos Islands).
Potential **for vessels outside of the UoC or client group fishing the same stock**	As mentioned above, the number of vessels entering the mahi-mahi fishery amounts to about 220 mother vessels and 4,000 fibres of which 98 and approximately 1,000 fibres would be included in the UoC. Mahi mahi is also fished with heavylongline, purse seine and gillnet fishing for mahi mahi. But these are not directed fisheries.

	On the other hand, the Peruvian vessels that access the UoA in external waters should be considered. It has not been possible to determine what mitigation measures the client has in place to avoid this problem.
Risks of mixing between certified and non-certified catch **during storage, transport, or handling activities** (including transport at sea and on land, points of landing, and sales at auction)	There is a risk of mixing when landing fish caught as MSC and fish not caught as MSC at the same landing points. There is also a risk during transport and handling before being sent to the processing plants. It has not been possible to determine what mitigation measures the client has in place to avoid this problem.
Risks of mixing between certified and non-certified catch **during processing activities** (at-sea and/or before subsequent Chain of Custody)	Similarly, there is a risk of mixing in the processing activity in the processing plants as there is a possibility that the plants will buy uncertified fish. It has not been possible to determine what mitigation measures the client has in place to avoid this problem.
Risks of mixing between certified and non-certified catch **during transhipment**	Transhipment is not allowed between different motherships, therefore there is no risk of mixing between certified and non-certified catch during transhipment. However, possible purchases from non-certified third-party fiber vessels in fishing areas that could pose a risk of mixing should be controlled. It has not been possible to determine what mitigation measures the client has in place to avoid this problem.
Any other risks of substitution between fish from the UoC (certified catch) and fish from outside this unit (non-certified catch) before subsequent Chain of Custody is required	Yes, there is a risk. Fishermen may buy fish in the fishing areas from other fibers or vessels (cases of purchase of fish from tuna vessels have been reported) from non-certified mahi mahi. It has not been possible to determine what mitigation measures the client has in place to avoid this problem..

5.3. Eligibility to Enter Further Chains of Custody

1. The report shall include:
a. A conclusion and determination of whether the product will be eligible to enter further certified chains of custody and if it is eligible to be sold as MSC certified or carry the MSC ecolabel.
b. A list of parties, or category of parties, eligible to use the fishery certificate and sell product as MSC certified.
c. The point of intended change of ownership of product, and
d. A list of eligible landing points if relevant
e. The point from which subsequent Chain of Custody is required.

(References: FCR 7.12.1, 7.12.1.5, 7.12.2, 7.12.2.1 7.12.3)

[Note: If the CAB makes a negative determination under 7.12.1, the CAB shall state in its reports that fish and fish products from the fishery are not eligible to be sold as MSC certified or carry the MSC ecolabel. If the Client Group includes other entities such as agents, unloaders, or other parties involved with landing or sale of certified fish, this needs to be clearly stated in the report including the point from which Chain of Custody is required.]

In the case the fishery would be certified, the product caught by the UoA would be eligible to be sold by the client group as MSC certified and enter further certified CoC without any particular restriction. However, the team found that the fishery does not comply with the MSC Fisheries Requirements, so it is not recommended to award the certification to this fishery.

5.4. Eligibility of Inseparable or Practicably Inseparable (IPI) stock(s) to Enter Further Chains of Custody

No IPI stocks have been identified by the team during the assessment.

6 Evaluation Results

6.1. Principle Level Scores

Table 6.1: Final Principle Scores

Overall weighted Principle-level scores	Score
Principle 1 - Target species	**82,5**
Principle 2 - Ecosystem	**76,3**
Principle 3 - Management	**70,8**

6.2. Summary of PI Level Scores

Table 6.2. Final Performance Indicator Scores

Principle	Component	Weight		Performance Indicator (PI)	Score
One	Outcome	0,333	1.1.1	Stock status	80
	Management	0,667	1.2.1	Harvest strategy	100
			1.2.2	Harvest control rules & tools	85
			1.2.3	Information & monitoring	75
			1.2.4	Assessment of stock status	75
Two	Primary species	0,200	2.1.1	Outcome	75
			2.1.2	Management strategy	65
			2.1.3	Information/Monitoring	85
	Secondary species	0,200	2.2.1	Outcome	70
			2.2.2	Management strategy	65
			2.2.3	Information/Monitoring	85
	ETP species	0,200	2.3.1	Outcome	80
			2.3.2	Management strategy	75
			2.3.3	Information strategy	80
	Habitats	0,200	2.4.1	Outcome	80
			2.4.2	Management strategy	80
			2.4.3	Information	85
	Ecosystem	0,200	2.5.1	Outcome	60
			2.5.2	Management	75
			2.5.3	Information	85
Three	Governance and policy	0,500	3.1.1	Legal &/or customary framework	65
			3.1.2	Consultation, roles & responsibilities	65
			3.1.3	Long term objectives	70
	Fishery specific Management system	0,500	3.2.1	Fishery specific objectives	70
			3.2.2	Decision making processes	75
			3.2.3	Compliance & enforcement	65
			3.2.4	Monitoring & management performance evaluation	90

6.3. Summary of Conditions

1. Assign a number to each condition. Table 6 below shall be completed by listing the Conditions by number against the relevant Performance Indicator. Add as many rows to the table as needed.
2. If no conditions are required, the report shall include a statement confirming this. The table below should then be deleted.

[Note: Table 6 is for summary purposes only. See Appendix 1.3 of this report template for full requirements for documenting conditions in accordance with the MSC scheme requirements.]

As seen in section 6.2 – Summary of PI Level scores, 15 PIs do not reach a score of 80: PI 1.2.3, 1.2.4, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.3.2, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.2.3.

In accordance to FCR 7.21.2, 15 conditions for these PIs would have had to be opened to provide an indication of the actions that may have been required should the fishery have been certified. However, as it is not recommended to award the MSC certificate to this fishery, no conditions have been opened.

6.4. Recommendations

(OPTIONAL)

[If the CAB wishes to include any recommendations to the client, include these here.]

6.5. Determination, Formal Conclusion and Agreement

(REQUIRED FOR FR AND PCR)

1. The report shall include a formal statement as to the certification determination recommendation reached by the Assessment Team about whether or not the fishery should be certified.

(Reference: FCR 7.16)

(REQUIRED FOR PCR)

2. The report shall include a formal statement as to the certification action taken by the CAB's official decision-makers in response to the Determination recommendation.

6.6. Changes in the fishery prior to and since Pre-Assessment

(OPTIONAL)

Identify any work conducted by the client (or the management agency) specifically targeted at bringing the fishery to the MSC standard, either prior to or since any pre-assessment report that was prepared. This information is particularly valuable for MSC's reporting on the impacts of its programme.

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DOCUMENTO SAC-07-06a(ii) EVALUACIÓN DE ESTRATEGIAS DE ORDENACIÓN (EEO) EXPLORATORIA DE DORADO (CORYPHAENA HIPPURUS) EN EL OCÉANO PACÍFICO ORIENTAL SUR Juan L. Valero, Alexandre Aires-da-Silva, Mark N. Maunder, Carolina Minte-Vera, Jimmy Martínez-Ortiz, Edgar J. Torrejón-Magallanes, y Miguel N. Carranza

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REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016

Reglamento de la Ley General de Pesca de Perú – Decreto Supremo nº 01-94-PE

Resolución C-00-085: acuerda entre otros temas, el empleo de técnicas para liberar especies no objetivo, evaluar la efectividad de otras medidas para reducir la captura incidental de especies no objetivo, establecer un programa para obtener datos de la flota palangrera.

Resolución C-01-046: acuerda la liberación hasta donde sea posible de aquellas especies no objetivo de la pesca atunera.

Resolución C-02-057: acuerda identificar áreas de alto captura incidental de Dorado y verificar la estabilidad en el tiempo y en el espacio de dichas áreas.

RESOLUCION C-03-02- RESOLUCION SOBRE LA ADOPCION DE LA CONVENCIÓN PARA EL FORTALECIMIENTO DE LA COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL ESTABLECIDA POR LA CONVENCIÓN DE 1949 ENTRE LOS ESTADOS UNIDOS DE AMÉRICA Y LA REPÚBLICA DE COSTA RICA

Resolución C-04-05 (Rev 2)- "Resolución consolidada sobre captura incidental"

Resolución C-99-114: recomienda que el personal científico de la Comisión estime las capturas y la mortalidad por pesca incidental de especies no objetivo.

RESOLUCIÓN LEGISLATIVA Nº 30785 (República del Perú) QUE APRUEBA LA CONVENCIÓN PARA EL FORTALECIMIENTO DE LA COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL ESTABLECIDA POR LA CONVENCIÓN DE 1949 ENTRE LOS ESTADOS UNIDOS DE AMÉRICA Y LA REPÚBLICA DE COSTA RICA

Subsecretaría de Recursos Pesqueros (SRP) - Vice Ministerio de Acuacultura y Pesca – Ministerio de Agricultura, Ganadería, Acuacultura y Pesca (MAGAP). 2013. Plan de Acción Nacional para la Conservación y el Manejo del recurso Dorado en Ecuador (PAN Dorado) / National Action Plan for J & P Guerrero - Verduga (eds). SRP- MAGAP. Manta-Manabí-Ecuador. 120 pp.

The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (in force as from 11 December 2001)

Apendices

Appendix 1 Scoring and Rationales

Appendix 1.1 Performance Indicator Scores and Rationale

Evaluation Table for PI 1.1.1 – Stock status

<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td colspan="4">Stock status relative to recruitment impairment</td></tr>
<tr><td>Guidepost</td><td>It is likely that the stock is above the point where recruitment would be impaired (PRI).</td><td>It is highly likely that the stock is above the PRI.</td><td>There is a high degree of certainty that the stock is above the PRI.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">During the pre-assessment (January 2010) of the Ecuador Mahi Mahi it was noted that there was little known about the biology and the fishery of this species (MRAG, 2010):

• There was insufficient data on spawning periods, recruitment and behaviour;
• The length at which the species reaches sexual maturity was not determined;
• Growth of this species has not been determined
• The number of immature fish that are caught and landed have not been recorded.
• At stage Mahi mahi was landed without gonads and therefore fecundity was not determined.
• There was no size-age data;
• Population levels of the stock(s) were not known;
• There was no joint research with other countries in the region that have a mahi mahi fishery.
• Information was insufficient to allow analysis of the population dynamics of the species and establish scientific criteria to support implementation of regional management measures.

For this reason, the assessment team (MRAG, 2010) found that the status of the mahi mahi stock was unknown in relation to limit reference points or proxy values. Even though a significant amount of new, then recent, information had been collected on the biological characteristics and fishing operations of the Ecuador fleet, the data was not sufficient to be used in a formal stock assessment and therefore the risked based approach was conducted.

For the full assessment, considering the above and following MSC rules (PF2.1.1) the Bureau Veritas team was uncertain whether the RBF should be followed and, therefore, announced the “Use of the RBF in a fishery assessment form” on the MSC website on the 26th of February, 2019, to ensure at least 30 days for stakeholder consideration.

Since then, after a desk top research analysis, it was found that a formal stock assessment had been conducted in 2016 and that although no formal reference points had been adopted, certain management quantities (B0, MSY, Bsp) had been estimated, therefore, proxy reference points could be determined. Also, following the FIP, the collecting of biological characteristics and data on fishing operations continued to be collected, therefore, it cannot be said that this fishery is data deficient and, therefore, no longer</td></tr>
</table>

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
		qualifies to be evaluated using the RBF approach. Mahi Mahi is a special case in that a TRP bears no relationship to Bmsy, because the species is very short lived ("annual crop") and recruitment success is determined to a very large degree (if not entirely) by environmental factors and may fluctuate by an order of magnitude or more. This creates a situation where there is no yield optimization (MSY) possible through controlling the amount of fishing, and no way that the stock biomass can be controlled through changes in fishing effort. Reductions in fishing effort under normal conditions cause large foregone catch without a concomitant response in stock size. For stocks such as these, it is possible and reasonable to establish a lower limit reference point, such as the lowest abundance from which the stock rebounded to higher stock size. Further, it is possible and reasonable to establish a precautionary management trigger level RP that is above the lower limit, but this is not a Bmsy equivalent target. https://mscportal.force.com/interpret/s/article/TRP-in-annual-or-nearly-annual-fisheries-PI-1-1-1-1527262011107 Mahi Mahi is thought to be highly resilient to overfishing due to its high productivity in all the oceans of the world (Palko et al., 1982). In the EPO in particular, Mahi Mahi show high rates of growth during a very short lifespan (about three years), early maturity (50% maturity at 0.5-1 years of age), high fecundity, and the capacity to spawn throughout the year in some areas (Martínez-Ortiz and ZúñigaFlores, 2012). An exploratory stock assessment (Aires-da-Silva et al., 2016) was conducted for Mahi Mahi in the South EPO, considered to be the "core region" of the Mahi Mahi stock in the EPO. In this region, Mahi Mahi are mainly subject to targeted artisanal longline fisheries in Peru and Ecuador, but the species is also caught incidentally (as bycatch) by the tuna purse-seine fisheries. The assessment was implemented in Stock Synthesis (SS) with a monthly time step for the years 2007 to 2014, fitted to sex-combined length-composition data from Peru and purse-seine bycatch and sex-specific length-composition data and CPUE from Ecuador. The monthly time step allowed depletion caused by catches (from Peru and Ecuador, and the purse-seine bycatch) and measured by the CPUE to inform the estimates of absolute abundance. This assessment of mahi mahi estimated biomass and MSY-related quantities. SBR can be considered as a static quantity (sSBR), since it is related to the unfished equilibrium status of a stock (**Figure 1.1.1.1**). For the assessment recruitment is assumed to be independent of the spawning stock size because dorado is a highly fecund pelagic spawner. In the parameterization of the Beverton-Holt stock-recruitment relationship used in the stock assessment model, this assumption is defined by fixing the steepness parameter (h) at 1. This work synthesized the knowledge about the population dynamics of Mahi Mahi and its history of exploitation in the South EPO, without drawing conclusions about stock status, because no reference points, target or limit, have been defined for Mahi Mahi in the EPO. However, according the MSC-MSCI Vocabularly, proxy indicators and reference points for PRI and B_{MSY} for scoring both stock biomass and exploitation rate are allowed. Empirical observation of sustainability can be used as well as results from a quantitive approach, like a stock assessment. Mahi Mahi is a highly productive stock and therefore it is expected that the B_{MSY} is very low. The results of the stock assessment are given in spawning biomass (BSP) and not total biomass (B). The BSP_{MSY} was analytically determined to be $0.2BSP_0$, which is lower than the suggested proxy of $0.4B_0$, therefore according to MSC-MSCI Volcabulary (page 377), the default PRI should be $75\%B_{MSY}$, which in this case would be 0.15. The most recent estimate (2014) of the status of the resource estimated the stock to be at 0.22, which is above the PRI. Further, according to the MSC Portal, another approach may be to simply say that		

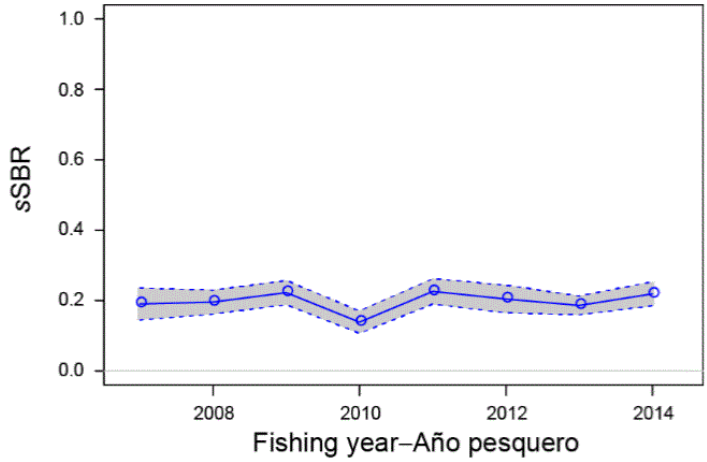
<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td></td><td></td><td colspan="3">productivity is unrelated to stock size above the limit reference point, and therefore any productivity higher than the limit point is acceptable. Other approaches such as setting F=M, or working to achieve an annual escapement of around 40% are all pragmatic proxies for MSY.
The figure below presents the spawning biomass ratios with the 95% confidence intervals, and the interpretation is that this ratio has always been above the PRI of 0.15. The base case estimate for the MSY is 89,211 t, which is about 17% higher the maximum recorded total annual catch of about 76,000 t. However, the most recent stock estimate was for 2014, and since no official catch data are available since then, the results have to be treated with caution. It can, however, be said that it is highly likely that the stock is above PRI, therefore SG 80 is met.
However, there is not a high degree of certainty that the stock is still above the PRI in 2019 and therefore SG 100 has not been met.Should the catch data become available and show that these were below the MSY since 2014, the score can be raised to SG100.
 

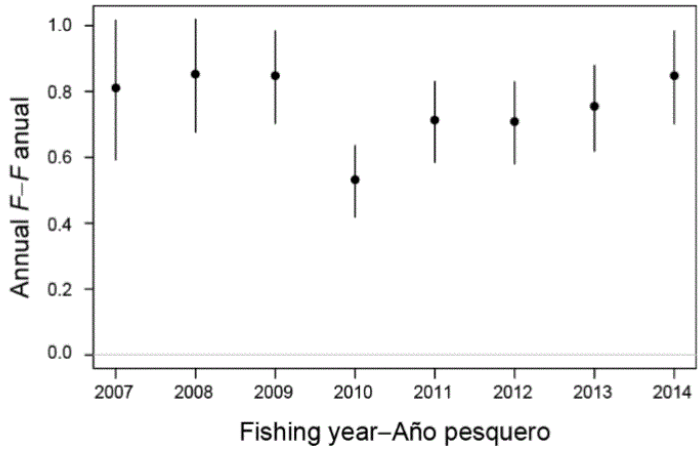
Figure 1.1.1.1. Estimated static spawning biomass ratios (sSBR) of Mahi Mahi recruited to the fisheries of the South EPO (Aires-da-Silva et al. 2016). The solid blue line connects the maximum likelihood estimates (open circles). The shaded area indicates the approximate 95-percent confidence intervals around these estimates.</td></tr>
<tr><td>b</td><td colspan="4">Stock status in relation to achievement of MSY</td></tr>
<tr><td></td><td>Guidepost</td><td></td><td>The stock is at or fluctuating around a level consistent with MSY.</td><td>There is a high degree of certainty that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.</td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Maunder et al. (2016) used monthly longline CPUE data from Ecuador to illustrate the use of a monthly depletion estimator. During fishing years (July to June) 2009-2013, monthly CPUE decreased from maximum values in October to minimum values in April, when they were on average 0.126 of their October value, ranging from 0.048 in 2009 to 0.267 in 2011 (Table 1.1.1.1). However, CPUE would be expected to decrease substantially even without fishing, given the high M of Mahi Mahi: for example, CPUE in April would be 0.6 of its value in October if M = 1 year^{-1} (the M assumed in the base case 2015 Mahi Mahi assessment, Aires-da-Silva et al., 2016) and no fishing.
The 2016 exploratory model base-case estimate of the MSY of Mahi Mahi in the South EPO was 89,211 tonnes (t), which is above the maximum recorded total annual catch of about 76,000 t (Aires-da-Silva et al., 2016), which, by implication, indicates that the stock should</td></tr>
</table>

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
		be above the biomass at MSY level. According to the base case, and while measured at the start of the spawning season (November, as defined in the model), the summary biomass of dorado has remained quite stable during the historic period of the assessment, averaging about 90,000 t per year. Likewise, the spawning biomass, also measured at the start of the spawning season, has remained very stable over the historic period of the assessment, averaging about 18,000 t. The precision of the spawning biomass estimates is very high (average CV = 0.1). The estimated static SBRs were quite stable over the assessment period, averaging at 0.20 (**Figure 1.1.1.1**) with very narrow 95 percentiles, indicating the stock is at or fluctuating around a level consistent with MSY and **SG80 has been met.** **Table 1.1.1.1.** Monthly ratio of average Ecuadorian longline CPUE to average CPUE in October during 20092013. Avg.: Monthly average ratio for 2009-2013. (Valero, et. al, 2019)		

	2009	2010	2011	2012	2013	Avg. – Prom.
Oct	1.000	1.000	1.000	1.000	1.000	1.000
Nov	0.671	0.737	0.802	0.603	0.757	0.654
Dec	0.450	0.543	0.644	0.364	0.573	0.450
Jan - Ene	0.302	0.400	0.517	0.220	0.434	0.320
Feb	0.203	0.295	0.414	0.133	0.328	0.232
Mar	0.136	0.217	0.333	0.080	0.249	0.170
Apr - Abr	0.091	0.160	0.267	0.048	0.188	0.126

According to (v2.0 GSA 2.2.3, subsection 2.2.3.1) where proxies are used that are not expressed as percentages of B0, it should be ensured that any reference point used as a proxy for scoring the PRI is set above the point where there is an appreciable risk of recruitment failure; and any reference point used as a proxy for the MSY level maintains the stock well above the PRI and at levels of production and stock sizes consistent with B_{MSY} or a similar highly productive level.

For this species productivity is unrelated to stock size above the limit reference point (approximately $0.15BSP_0$), and therefore according to the MSC interpretation guide, any productivity higher than the limit point is acceptable. Also, according to the MSC interpretation guide, another pragmatic proxy for MSY for highly productive stocks is setting F=M. https://mscportal.force.com/interpret/s/article/TRP-in-annual-or-nearly-annual-fisheries-PI-1-1-1-1527262011107. According to the **Figure 1.1.1.2** fishing mortality has always been below the natural mortality, which is assumed to be $1yr^{-1}$, indicating that fishing mortality is below the F_{MSY}, and hence the stock is above the MSY level. However, formal catch data since 2015 are not available as yet, therefore, even when considering the above there is not a high degree of certainty that the stock is still fluctuating around a level consistent with MSY in 2019, therefore **SG100 has not been met.**

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	 **Figure 1.1.1.2.** Annual fishing mortality (F), for all Mahi Mahi fisheries of the South EPO, estimated by the 2016 exploratory stock assessment (Aires-da-Silva et al. 2016)		
References	Aires-da-Silva, A., Valero, J. L., Maunder, M. N., Minte-Vera, C., Lennert-Cody, Roman, M. H., MartinezOrtiz, J., Torrejón-Magallanes, E. J., and Carranza, M. N. 2016. Exploratory Stock Assessment of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean in 2015. Inter-Amer. Trop. Tuna Comm., 7th Scient. Adv. Com. Meeting. SAC-07-06ª(i). Maunder, M.N., Aires-da-Silva, A., Minte-Vera, C., Lennert-Cody, C., Valero, J.L., and Martínez-Ortiz, J. 2015. A step-by-step illustration of the basis for the monthly depletion estimator in a Stock Synthesis model for Mahi Mahi. Inter-American Tropical Tuna Commission. 2nd Technical Meeting on Mahi Mahi, Lima, Peru, 27-29 October 2015. Martínez-Ortiz, J., and Zúñiga-Flores, M. 2012. Estado actual del conocimiento del recurso Mahi Mahi (Coryphaena hippurus) Linnaeus, 1758 en aguas del Oceano Pacifico Suroriental (2008-2011). Informe Tecnico Final del proyeto titulado: "Dinámica de la población: la pesca y la biología del Mahi Mahi en Ecuador". MAGAP-MSC-EPESPO 2012. 122 pp. MRAG, 2010. Revised Assessment Report for A Field Trial of the Marine Stewardship Council (MSC). Guidance on Assessment of Small-Scale/Data-Deficient (GASS/DD) Fisheries. The Ecuador Mahi Mahi Longline Fishery. January 2010. MRAG Americas, Inc. Eds. Robert J. Trumble, Robert C. Wakeford, and Martin Hall. Available at: https://fisheryprogress.org/system/files/documents_assessment/Final%20Mahi%20Assessment%20Report%20-%20Revised%20by%20MRAG%20Jan%202010-FINAL.pdf Palko, B.J.,Beardsley, G.L., and Richards, W.J. 1982. Synopsis of the biological data on dolphin-fishes, Coryphaena hippurus Linnaeus and Coryphaena equiselis, Linnaeus. NOAA Technical Report NMFS Circular 443. FAO Fisheries Synopsis No. 130. Valero, J. L., Aires-da-Silva, A., Maunder, M. N., Minte-Vera, C., Martínez-Ortiz, J., Torrejón-Magallanes, E. J. and Carranza, M. N. 2016. Exploratory management strategy evaluation (MSE) of Mahi Mahi (Coryphaena hippurus) in the south Eastern Pacific Ocean. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, Seventh Meeting Valero, J. L., Aires-da-Silva, A., Maunder, M. N. 2019. Potential reference points and harvest control rules for Mahi Mahi (*Coryphaena hippurus*) in the eastern Pacific ocean. San Diego, California (USA) 13-17 May 2019. SAC-10-1.		
Stock Status relative to Reference Points			

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	$75\%BSP_{MSY}$ (MSC-MSCI Vocabularly, page 377, proxy for highly productive stocks)	$75\%BSP_{MSY}=0.15$	$BSP_{2014}/BSP_0=0.22$
Reference point used in scoring stock relative to MSY (SIb)	BSP_{MSY}/BSP_0 (MSC-MSCI Vocabularly, page 377, proxy for highly productive stocks)	$BSP_{MSY}/BSP_0=0.2$	$BSP_{2014}/BSP_0=0.22$
OVERALL PERFORMANCE INDICATOR SCORE:			**80**
CONDITION NUMBER (if relevant):			**N/A**

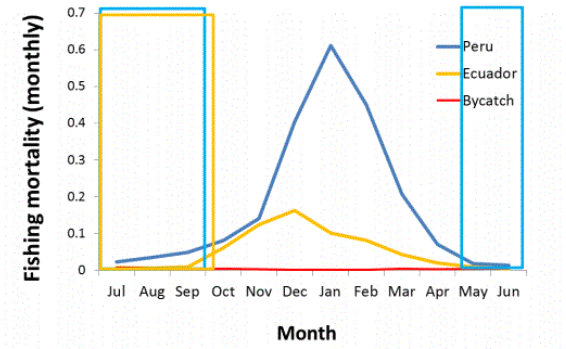
Evaluation Table for PI 1.1.2 – Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	Not relevant		Not relevant
	Justification	SA2.3.1 determines that teams shall only score PI 1.1.2 when Stock Status PI 1.1.1 does not achieve an 80 score. In the case of the assessed fishery PI 1.1.1 scored 80, therefore PI 1.1.2 shall not be scored.		
b	Rebuilding evaluation			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	See justification provided for previous SI		
References		MSC FCR v2.0 (SA2.3.1)		
OVERALL PERFORMANCE INDICATOR SCORE:				**Not scored**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	Y	Y
	Justification	Mahi Mahi is a special case in that a TRP bears no relationship to Bmsy, because the species is very short lived ("annual crop") and recruitment success is determined to a very large degree (if not entirely) by environmental factors and may fluctuate by an order of magnitude or more. This creates a situation where there is no yield optimization (MSY) possible through controlling the amount of fishing, and no way that the stock biomass can be controlled through changes in fishing effort. Reductions in fishing effort under normal conditions cause large foregone catch without a concomitant response in stock size. https://mscportal.force.com/interpret/s/article/TRP-in-annual-or-nearly-annual-fisheries-PI-1-1-1-1527262011107 Considering the above, a TAC for this fishery would not be a reasonable management tool, as the fishable biomass of this year is not related to the spawning biomass of last year (only at very low levels of the spawning stock biomass) as the fishable biomass (recruitment) is mostly dependend on environmental factors. The harvest strategy has been designed for this type of fishery ("annual crop") to achieve stock management objectives reflected in PI 1.1.1 SG80. The fishery is controlled by three main management measures • Size limit • Closed season • Gear type **Size limits** **Peru:** 70 cm min FL, since 2011 **Ecuador:** 80 cm min TL, since 2011  		

PI 1.2.1		There is a robust and precautionary harvest strategy in place

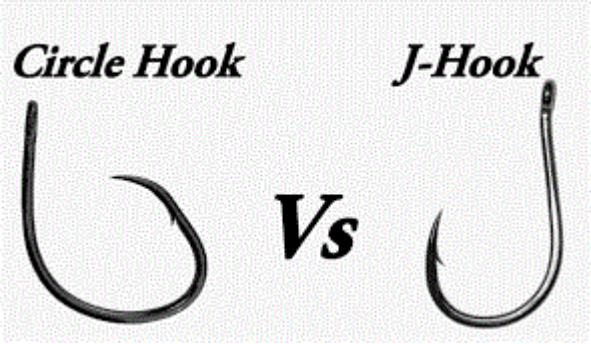


Average monthly *Fs* during 2007-2014 from Aires-da-Silva *et al.* 2016

Seasonal closures

Peru: May 1-Sep 30, since 2014
Ecuador: Jul 1-Oct 7, since 2011

Gear: "J" type number 4 or 5 or circular hooks. sizes number 14 or 15.



The Ministerial Decree No. 023, dated February 14, 2011, established the Ecuadorian National Action Plan for the Dolphinfish Management and Conservation as a tool based on guidelines for the conservation, management and ecological certification of the Dolphinfish. The harvest strategy is set out in the Ecuardian National Action Plan for Dolphin Fish.

At the national level, the Under Secretariat for Fishing Resources has issued the following Decrees that establish regulatory measures for the dolphinfish:

Decree No. 004-A published in Official Registry #410 of August 31, 2004, article 1 of which establishes a ban on the capture, transportation, possession, processing and domestic or international commercialization of Dolphinfish (*Coryphaena hippurus*), from June I to October 31 each year. Article 2 prohibits the capture, transportation, possession, processing and domestic or international commercialization of dolphinfish of sizes less than 80 centimeters total length, in order to provide the fish with an opportunity to at least carry out its first spawning; and article 3 allows for the use of longlines, or "dolphinfish" or "thin" longlines with a "J" type number 4 or 5 or circular hooks. sizes number 14 or 15.

This harvest strategy has been designed to avoid recruitment and growth overfishing which are aligned to achieve stock management objectives reflected in PI 1.1.1 SG80. The stock is highly productive and short-lived ("annual crop") and through the closed season and size limits the recruitment has not as yet been impaired (**Figure 1.2.1.1**) and as indicated under PI 1.1.1, the spawning biomass ratio remains around stable levels indicating that the harvest strategy is responsive to the state of the stock, therefore **SG100 has been met**.

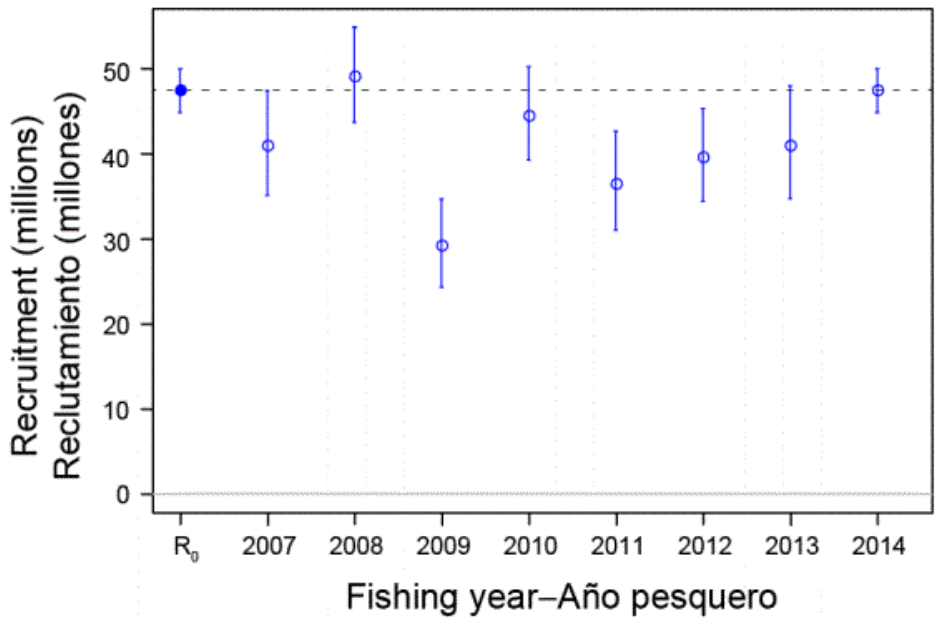
<table>
<tr><td colspan="2">PI 1.2.1</td><td colspan="4">There is a robust and precautionary harvest strategy in place</td></tr>
<tr><td></td><td></td><td colspan="4"> 

Figure 1.2.1.1. Estimates of the annual recruitment of dorado in the South EPO. The vertical lines represent the 95% confidence intervals around the recruitment estimates (open circles). The solid blue circle represents the estimate of virgin recruitment (R0). In Stock Synthesis, age-0 recruitment is defined as postlarval fish.</td></tr>
<tr><td>b</td><td colspan="5">Harvest strategy evaluation</td></tr>
<tr><td></td><td>Guidepost</td><td>The harvest strategy is likely to work based on prior experience or plausible argument.</td><td>The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.</td><td>The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The Ecuadorian length-composition data show the clear dominance and progression of a single cohort of Mahi Mahi over the months of each fishing year (Figure 1.2.1.2), Aires-da-Silva et al., 2016). The smallest sizes of Mahi Mahi (40-60 cm FL) are recruited to the fishery as early as June-July, hence the closure between June and October. With the opening of the fishing season this new cohort is then targeted by the fishery until the natural end of the fishing season around March-April. The mean length of the fish in the catches gradually increases as the fishing season progresses and the fishery targets a single cohort growing in size (“annual crop”) (Aires-da-Silva et al., 2016). The mean size of the fish in the catches drops sharply at the natural end of the fishing season, as the recruits of the following cohort enter the fishery. Since 2011 in Ecuador and 2014 in Peru, the fishery has been closed from May through October.</td></tr>
</table>

PI 1.2.1	There is a robust and precautionary harvest strategy in place

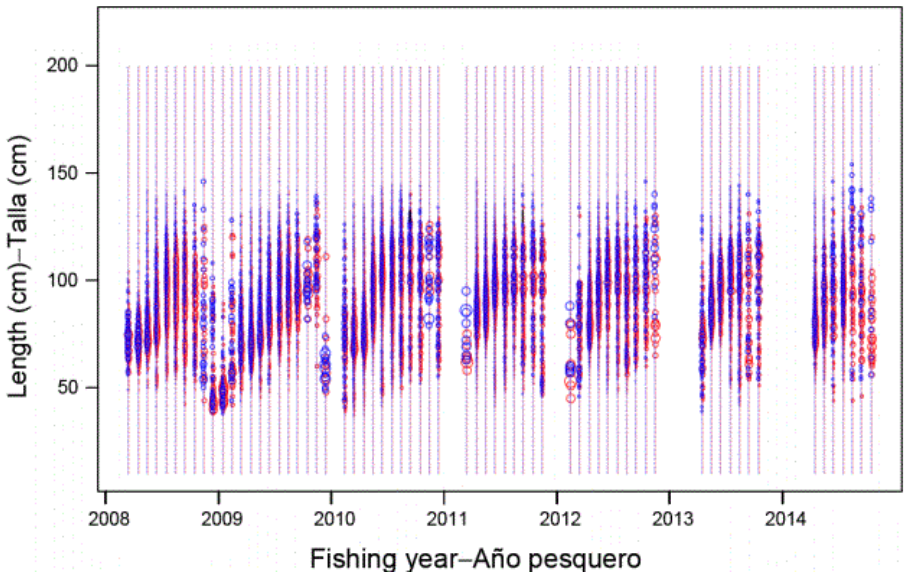


Figure 1.2.1.2. Size compositions of dorado catches by Ecuadorian fisheries, by month, fishing years 2008- 2014. Red and blue circles represent females and males, respectively. The areas of the circles are proportional to the catches.

The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels. A simplified version of the SS model (Aires-da-Silva et al. 2016) was used as the operating model for the MSE (Valero et al. 2016).

The exploratory work focused on testing the current management strategy, which is based on seasonal closures, and alternatives including different monthly fishery closures and openings, size limits for the fish in the catch, and discard mortality rates. Population and fisheries dynamics were projected for 2015-2019 under the alternative harvest strategies and discard mortality rates.

The alternative harvest strategies were also evaluated retrospectively for 2007-2014. YPR analyses were conducted to describe expected YPR and spawning biomass ratio (SBR) as a function of age of entry to the fishery and annual fishing mortality (F). There were tradeoffs between SBR and yield for strategies based on alternative season openings, closures, and minimum size limits with different assumptions regarding discard mortality rates of undersized fish.

Alternative season closures and openings have similar general effects on SBR and total yield; later season openings, however, increase SBR without marked reductions in expected yield, while earlier closures increase SBR but at the expense of reduced catch. YPR analyses showed that the age of entry that will produce the maximum YPR is around 10 months, based on the annual F estimated by the assessment. That would mean that a fishery opening around October-November would be consistent with YPR considerations.

SBR is expected to increase with minimum size limits, while yield is expected to increase with no or moderate discard mortality and to decrease with greater discard mortality. Under assumed moderate discard mortalities, increasing minimum size limits is expected to result in increased SBR, but at the expense of reduced yield.

Therefore, the harvest strategy of a closed season and size restrictions of Peru and Ecuador has been evaluated and shown to be consistent with YPR and performed well against simulated alternative size limits and seasonal closures (Valero et al., 2016) while maintaining the stock slightly above levels estimated to produce MSY (Aires-da-Silva et al. 2016) and these regulations maintain stocks at target levels, therefore **SG100 has been met**.

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
c	Harvest strategy monitoring			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	IATTC Resolution C-11-08 established a scientific observer program for longline vessels over 20 meters length overall, which would cover at least 5% of the fishing effort (defined as effective days fishing, excluding transit days) by such vessels, which started in 2013 and is still continuing. Ecuador has at least 10% of observer coverage on board motherships (Agreement 204), therefore monitoring is in place that indicates whether the harvest strategy is working. Further, dorado length-composition data are collected by IMARPE at the principal ports where Peruvian artisanal fisheries unload their catches, but these are not separated by sex. Sampling is mainly opportunistic, since it depends on the availability of dorado and the logistics of access the catches for sampling. Dorado length-composition data from Ecuadorian artisanal fisheries are collected at the ports of Esmeraldas, San Pablo de Manta, and Anconcito, mainly by SRP samplers, who record fork length, total weight, and sex (Martínez-Ortiz and Zúñiga-Flores, 2012). Some size data are collected by fishery observers. Since 1993, IATTC observers have estimated the size composition of the bycatches of dorado in the tuna purseseine fishery by classifying the fish into three size categories (0-30 cm, 31-60 cm, >60 cm). Therefore monitoring is in place that is expected to determine whether the harvest strategy is working. **SG60 is met.**		
d	Harvest strategy review			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
	Justification	Every five years the Ecuardian National Action Plan for Dolphin Fish needs to be reviewed and this will be done during this year in collaboration with WWF, therefore **SG 100 is met**.		
e	Shark finning			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	In accordance with SA2.4.3 this SI shall be scored when the target species is a shark. Since the target species of the assessed fishery is not a shark this SI shall not be scored.		
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as

PI 1.2.1		**There is a robust and precautionary harvest strategy in place**		
			appropriate.	appropriate.
	Met?	(Not relevant)	(Not relevant)	(Not relevant)
	Justification	The gear is very selective due to the size of the hooks and the season, which favours targeting only big individuals (80cm and above) therefore unwanted catches are negligible at UoA-level.		
References		Aires-da-Silva, A., Valero, J. L., Maunder, M. N., Minte-Vera, C., Lennert-Cody, Roman, M. H., MartinezOrtiz, J., Torrejón-Magallanes, E. J., and Carranza, M. N. 2016. Exploratory Stock Assessment of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean in 2015. Inter-Amer. Trop. Tuna Comm., 7th Scient. Adv. Com. Meeting. SAC-07-06ª(i).		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				**N/A**

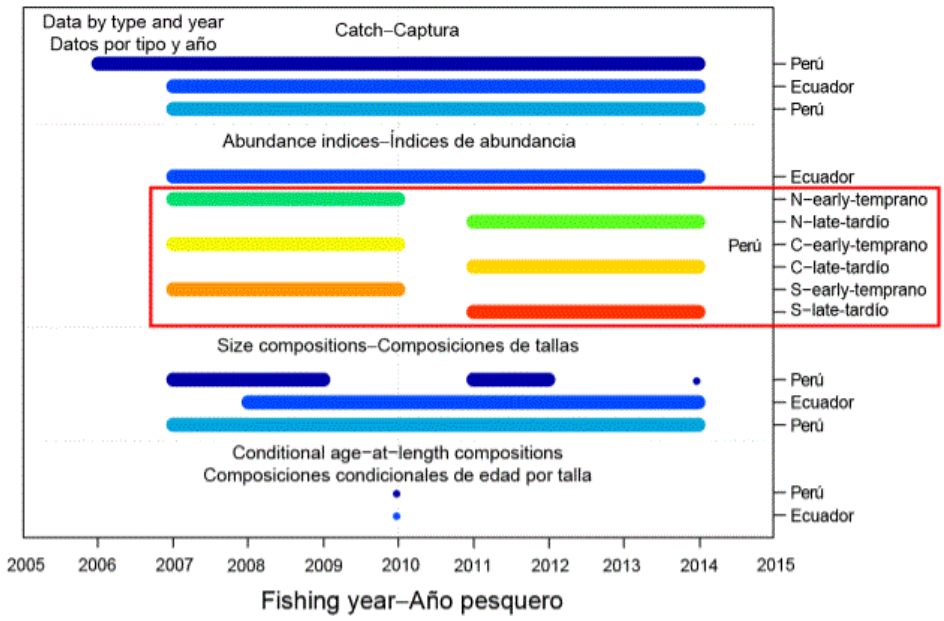
Evaluation Table for PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guidepost	**Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	Y	Y
	Justification	A simplified version of the SS model used for the exploratory assessment (Aires-da-Silva et al. 2016) was used as the operating model for the MSE (Valero et al. 2016). The exploratory work focused on testing the current management strategy, which is based on seasonal closures, and alternatives including different monthly fishery closures and openings, size limits for the fish in the catch, and discard mortality rates. Population and fisheries dynamics were projected for 2015-2019 under the alternative harvest strategies and discard mortality rates. The alternative harvest strategies were also evaluated retrospectively for 2007-2014. YPR analyses were conducted to describe expected YPR and spawning biomass ratio (SBR) as a function of age of entry to the fishery and annual fishing mortality (F). There were tradeoffs between SBR and yield for strategies based on alternative season openings, closures, and minimum size limits with different assumptions regarding discard mortality rates of undersized fish. Alternative season closures and openings have similar general effects on SBR and total yield; later season openings, however, increase SBR without marked reductions in expected yield, while earlier closures increase SBR but at the expense of reduced catch. YPR analyses showed that the age of entry that will produce the maximum YPR is around 10 months, based on the annual F estimated by the assessment. That would mean that a fishery opening around October-November would be consistent with YPR considerations. The age of entry consistent with maximum YPR would be higher at F than those estimated by the exploratory assessment. SBR is expected to increase with minimum size limits, while yield is expected to increase with no or moderate discard mortality and to decrease with greater discard mortality. Under assumed moderate discard mortalities, increasing minimum size limits is expected to result in increased SBR, but at the expense of reduced yield. In this fishery management comprises only of technical measures; size limits, closed seasons and hook type. These are set and fixed for a long time and described in the Ecuardian National Action Plan for Dolphin Fish. This management regime has been based on a exploratory stock assessment and various scenarious as described above. These technical measures have shown to deliver the proxy reference points as described under PI 1.1.1., therefore according to GSA2.5 (MSC-MSCI Vocabulary, page 395) this arrangement may be regarded as equivalent to a dynamic HCR operating over a longer time scale if some of the indicators are monitored to confirm that the HCRs are delivering the intended targets for the stock. Mahi Mahi is thought to be highly resilient to overfishing due to its high productivity in all the oceans of the world; in particular in the EPO, Mahi Mahi show high rates of growth during a very short lifespan (about three years), early maturity (50% maturity at 0.5-1 years of age), high fecundity, and the capacity to spawn throughout the year in some areas, therefore with the combination of closed season, size restriction and specified hook size, it is expected that this HCR will keep the stock fluctuating at or above a target level		

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
		consistent with MSY, most of the time, therefore **SG100 has been met.**		
b	HCRs robustness to uncertainty			
	Guidepost		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Y	N
	Justification	The stock is highly productive and short-lived, through the closed season and size limits the HCR avoids recruitment and growth overfishing. Theoretically, this fishery depends on an annual cohort and recruitment only becomes dependent on spawning biomass at levels below $0.2B_{sp}$. For this species productivity is unrelated to stock size above the limit reference point (approximately $0.15BSP_0$), and therefore according to the MSC interpretation guide, any productivity higher than the limit point is acceptable, therefore the HCR is likely to be robust to the main uncertainties and **SG80 is met.** The ecological role this stock plays has not been taken into consideration therefore **SG100 is not met.**		
c	**HCRs evaluation**			
	Guidepost	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
	Justification	A simplified version of the SS model used for the exploratory assessment (Aires-da-Silva et al. 2016) was used as the operating model for the MSE (Valero et al. 2016 and 2019). The exploratory work focused on testing the current management strategy, which is based on seasonal closures, and alternatives including different monthly fishery closures and openings, size limits for the fish in the catch, and discard mortality rates. Population and fisheries dynamics were projected for 2015-2019 under the alternative harvest strategies and discard mortality rates. The alternative harvest strategies were also evaluated retrospectively for 2007-2014. YPR analyses were conducted to describe expected YPR and spawning biomass ratio (SBR) as a function of age of entry to the fishery and annual fishing mortality (F). Considering that fishing takes place on one cohort only, it can be said evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs. However, the last assessment has been done in 2016 and no catch data is available since 2015, therefore this can't be said with certainty, hence **SG100 is not met.**		
References		Aires-da-Silva, A., Valero, J. L., Maunder, M. N., Minte-Vera, C., Lennert-Cody, Roman, M. H., MartinezOrtiz, J., Torrejón-Magallanes, E. J., and Carranza, M. N. 2016. Exploratory Stock Assessment of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean in 2015. Inter-Amer. Trop. Tuna Comm., 7th Scient. Adv. Com. Meeting. SAC-07-06ª(i). Valero, J.L., Aires-da-Silva, A., Maunder, M.N., Minte-Vera, C.V. and Martínez-Ortiz, J. (2016). Exploratory management strategy evaluation (MSE) of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, Seventh Meeting. Valero, J. L., Aires-da-Silva, A., Maunder, M. N. 2019. Potential reference points and harvest control rules for Mahi Mahi (*Coryphaena hippurus*) in the eastern Pacific ocean.		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place	
	San Diego, California (USA) 13-17 May 2019. SAC-10-1.	
OVERALL PERFORMANCE INDICATOR SCORE:		**85**
CONDITION NUMBER (if relevant):		**N/A**

Evaluation Table for PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guidepost	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
		Y	Y	N
	Justification	The data used in the stock assessment model are shown in **Figure 1.2.3.1** by type, fishery, and fishing years included in the model.  **Figure 1.2.3.1**. Types of data, by fishery and year, available for the assessment of Mahi Mahi in the South EPO. The abundance indices inside the red square are not used in the model; they are included for comparative purposes only. The historic period of the assessment covers the 2007-2014 fishing years (July 2007-June 2015). In the South EPO, Mahi Mahi are mainly subject to targeted artisanal longline fisheries by Peru and Ecuador, but the species is also caught incidentally (as bycatch) by the tuna purse-seine fisheries. The stock assessment model is not spatially-structured, in the sense that no fisheries based on spatial considerations are defined, except as implicit in the spatial distribution of the Ecuadorian and Peruvian fisheries. However, these three fisheries are defined separately in this assessment, so that their catches are associated with separate size selectivity curves. No information on Mahi Mahi discards is available; therefore, in this report the term 'catch' refers to retained catch, and thus observed landings and unloadings.		

PI 1.2.3		Relevant information is collected to support the harvest strategy		
		Peru Mahi Mahi is exploited by artisanal fisheries in coastal and oceanic waters off Peru. Availability of the resource is highly seasonal, usually occurring from September to March, and is associated with warm SSTs (21-30˚C). During these months, Mahi Mahi accounts for about 90% of the total volume of landings by the Peruvian artisanal fishery (Solano-Sare et al., 2008). The Instituto del Mar de Perú (IMARPE) has some landing records going back to the late 1980s, but the major expansion of the Peruvian fishery occurred in the early 2000s, following the increased availability of Mahi Mahi in 1998 that coincided with the strong El Niño event of that year. For this assessment, IMARPE made available official catch landings data, collected by the Statistics Office of the Ministry of Production (PRODUCE), for Mahi Mahi taken by the Peruvian artisanal fisheries from 2000 to 2015. For the 2000-2005 period only annual statistics are available, but after that they are available by month. Using this combination of annual and monthly data, an attempt was made to construct a historical monthly time series of Peruvian Mahi Mahi catches for the January 2000-December 2015 period. Monthly estimates for 2000-2005 were obtained by applying to the annual data the average monthly proportions of the catches available for 2006-2015 Ecuador Mahi Mahi is exploited by Ecuadorian artisanal fisheries, mainly the multi-species longline fishery which shifts target among large pelagic fish species, including Mahi Mahi, tuna, billfishes, and sharks. This fishery began gradually in the mid-1970s, but underwent a great expansion during the 1990s and 2000s. The traditional fishing areas, which were initially within 40 nautical miles (nm) of the coast, have expanded gradually over the years to as far as 1,400 nm from the mainland coast west of the Galapagos Islands, establishing what is now known as the “oceanic-artisanal fishery” in Ecuador. As in Peru, there is a great seasonality in these fisheries: the longline fishery targeting Mahi Mahi operates mainly during October-February, with peak catches in December and January. The longline fishery for tuna-billfish-shark (TBS) species takes place all year round. However, catches of TBS species decline greatly during the Mahi Mahi season because longline vessels change their gear in order to target Mahi Mahi, using the smaller doradero hooks. Martínez-Ortiz et al. (2015) provide an extensive description of the Ecuadorian artisanal fishery for large pelagics, including species composition and spatio-temporal dynamics. An attempt was made to construct a historical monthly time series of Mahi Mahi catches taken by Ecuadorian fisheries during the January 1987-June 2015 period (**Figure 3.3.4** in the background section). The stock assessment is implemented in the Stock Synthesis modelling platform, with a monthly time step, and covers the July 2007-June 2015 period. The catch data used were from Peru, Ecuador, and purse-seine bycatches. The model is fitted to (i) Mahi Mahi catch per unit of effort (CPUE) data from Ecuadorian artisanal fisheries, (ii) length-composition data from Peruvian artisanal fisheries as well as purse-seine bycatches (sexes combined), and (iii) length-composition data from Ecuadorian artisanal fisheries (sexes separated). The monthly time step allows depletion caused by catch and measured by the CPUE to inform estimates of absolute abundance. Following from the above it can be deduced that sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy, therefore **SG80 is met**. However, it can’t be said that a comprehensive range of information on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information is available, therefore **SG100 is not met.**		
b	Monitoring			
	Guidepost	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage**	**All information** required by the harvest control rule is monitored with high frequency and a high degree

PI 1.2.3		Relevant information is collected to support the harvest strategy		
		with sufficient frequency to support the harvest control rule.	**consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	N	N
	Justification	Annual catches averaged about 61,000 t during the assessment period, with 82%, 16%, and 2% of the catches taken by Peru, Ecuador, and as bycatch in the tuna purse-seine fisheries, respectively. Peru and Ecuador account for most of the Mahi Mahi catches in the EPO. Catches in these two countries are regularly monitored: " Peru: Catch landings data is collected by the Statistics Office of the Ministry of Production (PRODUCE), for Mahi Mahi taken by the Peruvian artisanal fisheries and length-composition data is collected by IMARPE at the principal ports where Peruvian artisanal fisheries unload their catches. Ecuador: Catch statistics can be extracted from the databases of Ecuador's landings monitoring system for artisanal fisheries (Sistema de Control y Monitoreo; SCM), which is operated by the Undersecretariat of Fisheries Resources (SRP). Catch estimates for the early period can be obtained from fishery statistics published by the National Fisheries Institute (INP). Mahi Mahi length-composition data from Ecuadorian artisanal fisheries are collected at the ports of Esmeraldas, San Pablo de Manta, and Anconcito, mainly by SRP samplers, who record fork length, total weight, and sex (Martínez-Ortiz and Zúñiga-Flores, 2012). Some size data is collected by fishery observers. Since 1993, IATTC observers have estimated the size composition of the bycatches of Mahi Mahi in the tuna purseseine fishery by classifying the fish into three size categories (0-30 cm, 31-60 cm, >60 cm). Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule, therefore **SG60 is met.** However, stock abundance (only one stock assessment has been performed in 2016) and UoA removals are not as yet regularly monitored at a level of accuracy and coverage consistent with the harvest control rule therefore **SG80 is not met.**		
c	Comprehensiveness of information			
	Guidepost		There is good information on all other fishery removals from the stock.	
	Met?		Y	
	Justification	In addition to the information collected under PI1.2.3b; the fishery is usually highly selective; average of 89.87% of efficiency between 2013 and 2017; In addition, Ecuador has (apart from the fishery catch data) a database with the biological and fishing information of each trip registered by the Ministry of Aquaculture and Fisheries observers, where among other things, by-catch species are recorded. With these data, the Ministry produces reports showing the discards and incidental catches of the Ecuadorian fisheries, and the data are sent to the IATTC for further analyses. Therefore, there is good information on all other fishery removals from the stock, hence **meeting SG80**.		
References		Martínez-Ortiz, J., Aires-da-Silva, A.M., Lennert-Cody, C.E., and Maunder, M.N. 2015. The Ecuadorian artisanal fishery for large pelagics: species composition and spatio-temporal dynamics. Plos One. 10.		

PI 1.2.3	Relevant information is collected to support the harvest strategy	
	Martínez-Ortiz, J., and Zúñiga-Flores, M. 2012. Estado actual del conocimiento del recurso Mahi Mahi (Coryphaena hippurus) Linnaeus, 1758 en aguas del Oceano Pacifico Suroriental (2008-2011). Informe Tecnico Final del proyeto titulado: "Dinámica de la población: la pesca y la biología del Mahi Mahi en Ecuador". MAGAP-MSC-EPESPO 2012. 122 pp. Solano-Sare, A., Tresierra-Aguilar, A., García-Nolasco, V., Dioses, T., Marín, W., Sánchez, C., and WosnitzaMendo, C. 2008. Biologia y pesqueria del Perico. Instituto del Mar del Perú. 23 pp.	
OVERALL PERFORMANCE INDICATOR SCORE:		**75**
CONDITION NUMBER (if relevant):		**1**

Evaluation Table for PI 1.2.4 – Assessment of stock status

PI 1.2.4		**There is an adequate assessment of the stock status**		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guidepost		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
	Justification	The Stock Synthesis model (SS - Version 3.24f; Methot and Wetzel 2013) was used to assess the status of Mahi Mahi in the South EPO. It consists of a catch-at-length, age-structured, integrated (fitted to many different types of data) statistical stock assessment model. It is fitted to the observed data (indices of relative abundance and size compositions) by finding a set of population dynamics and fishing parameters that maximize a penalized likelihood, given the amount of catch taken by each fishery. The underlying concept of the model is that monthly declines in the CPUE are explained by the catch, and therefore provide information on absolute abundance, as assumed in standard depletion estimators (Maunder et al. 2015). The following parameters were assumed to be known: 1. Mean length-at-age, and variability of the length-at-age; 2. Length-weight relationship; 3. Natural mortality rate (M = 1 yr-1 for both sexes); 4. Sex ratio of age-0 fish (post-larval) (0.5); 5. Length-specific maturity curve; 6. Steepness (h) of the stock-recruitment relationship (h = 1). 7. The CPUE time series of the Ecuadorian artisanal fishery was chosen as the most reliable index of abundance to calibrate the stock assessment model. For this reason, its coefficient of variation (CV) was fixed at 0.2. 8. Female selectivity curves for the Peruvian and Ecuadorian fisheries, which catch larger Mahi Mahi, are assumed to be asymptotic. Males are allowed to have a lower selectivity than females and to have dome-shape selectivity. The selectivity of the purse-seine bycatch fishery was assumed to be asymptotic. Considering the above, the assessment takes into account the major features relevant to the biology of the species and the nature of the UoA, therefore **SG100 is met.**		
b	Assessment approach			
	Guidepost	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	N	
	Justification	The assessment synthesized the knowledge about the population dynamics of Mahi Mahi and its history of exploitation in the South EPO, without drawing conclusions about stock status, because no reference points, target or limit, have been defined for Mahi Mahi in the EPO. However, according the MSC-MSCI Vocabularly, proxy indicators and reference points for PRI and B_{MSY} for scoring both stock biomass and exploitation rate are allowed. Empirical observation of sustainability can be used as well as results from a quantitive approach, like a stock assessment. Therefore, given the estimated management quantities, stock status relative to generic reference points appropriate to the species category could be estimated; **SG60 is met.** Mahi Mahi is a highly productive stock and therefore it is expected that the B_{MSY} is very low. The results of the stock assessment are given in spawning biomass (B_{SP}) and not total biomass (B). The BSP_{MSY} was analytically determined to be $0.2BSP_0$, which is lower than the suggested proxy of $0.4B_0$, therefore according to MSC-MSCI Volcabulary (page 377), the default PRI should be $75\%B_{MSY}$, which in this case would be 0.15. Even though reference points can be deduced from the results of the stock assessment, they were not estimated during the assessment therefore **SG80 is not met.**		

<table>
<tr><td colspan="2">PI 1.2.4</td><td colspan="3">There is an adequate assessment of the stock status</td></tr>
<tr><td></td><td></td><td colspan="3"></td></tr>
<tr><td rowspan="4">c</td><td colspan="4">Uncertainty in the assessment</td></tr>
<tr><td>Guidepost</td><td>The assessment identifies major sources of uncertainty.</td><td>The assessment takes uncertainty into account.</td><td>The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The important aspects of the base case assessment (1) and the three sensitivity analyses (2-4) can be summarized as follows (Table 1.2.4.1):
1. Base case assessment: steepness of the stock-recruitment relationship = 1 (no relationship between stock and recruitment); mean length-at-age, and the parameters that define the variability of the length-at-age, are fixed; fitted to CPUE time series for Ecuadorian artisanal fishery; asymptotic length-based selectivities for females caught by the Ecuadorian and Peruvian fisheries; down-weighted size composition data for all fisheries (λ = 0.05 for Peru, 0.5 for Ecuador, 0.005 for the tuna purse-seine fishery; see above).
2. Sensitivity to alternative natural mortality (M) values M values between 0.1 yr-1 and 1.6 yr-1 were used as alternatives to the M of 1 yr-1 assumed in the base case. This range of alternatives is partially based on the wide range of reported M values for Mahi Mahi, from 0.43 yr-1 (Zúñiga, 2014) to 2.5 yr-1 (Hoening method applied to data from Zúñiga, 2009).
3. Sensitivity to time-varying catchability The base case model estimates time varying catchability (Q) for Ecuadorian CPUE. An alternative analysis was conducted with catchability estimated as a single parameter with no time-varying deviates (Qnotv).
4. Sensitivity to alternative selectivity curves The base case assumes that the selectivity functional form is asymptotic. We allowed selectivity to be dome-shaped in the Peruvian fishery, where selectivity is allowed to be lower for larger fish.
The assessment takes uncertainty into account; SG80 is met. However, it is not evaluating stock status relative to reference points in a probabilistic way; therefore SG100 is not met.

Table 1.2.4.1. Sensitivities to different configurations of the base case model for the exploratory assessment for Mahi Mahi (Aires-da-Silva et al., 2016). M: natural mortality; Q: catchability; Dome: dome-shaped selectivities.
<table>
<tr><th rowspan="2"></th><th rowspan="2">Base case
Caso base</th><th colspan="3">Sensitivity analyses - Análisis de sensibilidad</th></tr>
<tr><th colspan="2">1</th><th>2</th><th>3</th></tr>
<tr><th></th><th>M_0.43</th><th>M_1.6</th><th>Q_notv</th><th>Dome</th></tr>
<tr><td>S_0 (t)</td><td>90,045</td><td>205,001</td><td>62,015</td><td>85,577</td><td>89,952</td></tr>
<tr><td>B_0 (t)</td><td>254,687</td><td>545,880</td><td>192,791</td><td>242,067</td><td>254,429</td></tr>
<tr><td>S_{MSY}-S_{RMS} (t)</td><td>17,987</td><td>15,336</td><td>22,351</td><td>17,196</td><td>17,893</td></tr>
<tr><td>MSY-RMS (t)</td><td>89,211</td><td>79,502</td><td>100,530</td><td>84,490</td><td>89,010</td></tr>
<tr><td>S_{2014}/S_0</td><td>0.22</td><td>0.08</td><td>0.38</td><td>0.23</td><td>0.22</td></tr>
<tr><td>S_{MSY}/S_0-S_{RMS}/S_0</td><td>0.20</td><td>0.07</td><td>0.36</td><td>0.20</td><td>0.20</td></tr>
<tr><td>S_{2014}/S_{MSY}-S_{2014}/S_{RMS}</td><td>1.10</td><td>1.00</td><td>1.07</td><td>1.16</td><td>1.11</td></tr>
</table></td></tr>
<tr><td rowspan="4">d</td><td colspan="4">Evaluation of assessment</td></tr>
<tr><td>Guidepost</td><td></td><td></td><td>The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>N</td></tr>
<tr><td>Justific</td><td colspan="3">Alternative hypotheses and assessment approaches have not been rigorously explored, Some model diagnostics were run on the assessment model; likelihood profiling of virgin</td></tr>
</table>

PI 1.2.4		There is an adequate assessment of the stock status		
	ation	recruitment, a method for diagnosing over-weighting of size-composition data, data conflicts, and model misspecification, was applied to the assessment. The age-structured production model (ASPM) diagnostic was proposed by Maunder and Piner (2015) as a way to: (i) further evaluate model misspecification, (ii) ascertain the influence of composition data on the estimates of absolute abundance and trends in abundance, and (iii) check whether catch alone can explain the trends in the indices of abundance. Therefore the assessment has been tested and shown to be robust. However, alternative hypotheses and assessment approaches have been not been rigorously explored therefore **SG100 has not been met.**		
e	Peer review of assessment			
	Guidepost		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
	Justification	According to Aires-da-Silva et al. 2016, three meetings were held within the IATCC platform. The first meeting, held in Manta, Ecuador, in 2014, helped to establish the collaborative research forum that is necessary to work on Mahi Mahi at the large regional scale of the EPO. Also, a large and diverse amount of fishery and biological data for Mahi Mahi available from IATTC member countries was identified. The second meeting, held in Lima, Peru, in 2015, led to significant progress on two important questions that need to be addressed for regional management of Mahi Mahi in the EPO: 1) stock structure assumptions, and 2) which methodologies and indicators of stock status to use. A third meeting was held in Panama City, Panama, in 2016. This meeting focused on evaluating data needs and assessment methods for data-limited Mahi Mahi fisheries in the EPO. The exploratory assessment was presented at the 7th scientific committee ICCAT meeting. Therefore is can be deduced that the assessment of the stock status was subject of peer review, since scientists from different countries and research centres attended and participated in the assessment; **SG80 is met**, but was not internally and externally reviewed therefore **SG100 is not met.**		
References		Aires-da-Silva, A., Valero, J. L., Maunder, M. N., Minte-Vera, C., Lennert-Cody, Roman, M. H., MartinezOrtiz, J., Torrejón-Magallanes, E. J., and Carranza, M. N. 2016. Exploratory Stock Assessment of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean in 2015. Inter-Amer. Trop. Tuna Comm., 7th Scient. Adv. Com. Meeting. SAC-07-06ª(i). Maunder, M.N., Aires-da-Silva, A., Minte-Vera, C., Lennert-Cody, C., Valero, J.L., and Martínez-Ortiz, J. 2015. A step-by-step illustration of the basis for the monthly depletion estimator in a Stock Synthesis model for Mahi Mahi. Inter-American Tropical Tuna Commission. 2nd Technical Meeting on Mahi Mahi, Lima, Peru, 27-29 October 2015. Maunder, M.N., and Piner, K.R. 2015. Contemporary fisheries stock assessment: many issues still remain. ICES Journal of Marine Science (2015), 72(1), 7–18. doi:10.1093/icesjms/fsu015. Methot, R.D., and Wetzel, C.R. 2013. Stock Synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fish Res. 142: 86-99. Valero, J.L., Aires-da-Silva, A., Maunder, M.N., Minte-Vera, C.V. and Martínez-Ortiz, J. (2016). Exploratory management strategy evaluation (MSE) of Mahi Mahi (Coryphaena hippurus) in the South Eastern Pacific Ocean. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, Seventh Meeting. Zúñiga-Flores, M.S. 2014. Determinación e interpretación de los parámetros		

PI 1.2.4	There is an adequate assessment of the stock status	
	poblacionales, edad, crecimiento y reproducción del Mahi Mahi (Coryphaena hippurus) capturado en aguas del Océano Pacifico Sur-Oriental durante 2008-2012. Reporte final de la consultoría para World Wildlife Fund/ ViceMinisterio de Acuacultura y Pesca (MAGAP), Ecuador. 73 pp.	
OVERALL PERFORMANCE INDICATOR SCORE:		**75**
CONDITION NUMBER (if relevant):		**2**

Evaluation Table for PI 2.1.1 – Primary species outcome

PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guidepost	Main primary species are **likely** to be above the PRI OR If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are **highly likely** to be above the PRI OR If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY.
	Met?	Blue marlin: Y Silky shark: Y	Blue marlin: N Silky shark: N	Blue marlin: N Silky shark: N
	Justification	As stated in Section **3.4.3**, 8 species were identified as Primary based on FCR SA3.1.3. Also, as explained in that section, and based on FCR SA3.4.5, six of these species were considered Minor and two Main (**Table 3.4.2.2.1**). The two Main Primary species identified are: the blue marlin (*Makaira nigricans*) and the silky shark (*Carcharhinus falciformis*). **Blue marlin (*Makaira nigricans*)** The best information currently available indicates that blue marlin constitutes a single world-wide species and that there is a single stock of blue marlin in the Pacific Ocean. For this reason, statistics on catches are compiled, and analyses of stock status are made for the entire Pacific Ocean (IATTC, 2019b). The most recent full assessment of the status and trends of the species was conducted in 2013 and included data through 2011. It indicated that blue marlin in the Pacific Ocean were fully exploited, i.e. that the population was being harvested at levels producing catches near the top of the yield curve. Over the past five years (2014-2018), however, annual catches have increased slightly in the EPO, averaging 4,382 t, indicating that catches may currently be exceeding MSY (IATTC, 2019b). In Ecuador, Agreement 031 from October 8, 2004 states that only thin surface longline (locally known as 'doradero') with hook type "J" of size number 4 or 5, or circular hook of size number 14 or 15 is allowed, thus preventing incidental catches as much as possible. In addition, there is a national program to educate fishermen on by-catch reduction. Therefore, even though the species might be below the PRI, the UoA has measures in place that are expected to ensure that the UoA does not hinder recovery and rebuilding, therefore **meeting SG60**. Nevertheless, due to the high percentage of blue marlin catches in 2016 (i.e., 14.47%, **Table 3.4.2.1.1**), we cannot be sure that these measures do not hinder the recovery and		

PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
		rebuilding of the species, thus **not meeting SG80**. Regarding sharks, target and limit reference points have not yet been established for pelagic sharks by the WCPFC or the IATTC, the organizations responsible for management of pelagic sharks caught in international fisheries for tuna and tuna-like species in the Pacific Ocean (http://isc.fra.go.jp/recommendation/isc18/isc18_blueshark.html). However, stock assessments or stock status indicators are available for four shark species in the EPO: silky (*Carcharhinus falciformis*), blue (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), and common thresher (*Alopias vulpinus*). From these four sharks, the stock status of the blue shark (from ISC17 Plenary Report: http://isc.fra.go.jp/recommendation/isc17/isc17_blueshark.html), the shortfin mako (http://isc.fra.go.jp/recommendation/isc18/isc18_shortfinmako.html), and the common thresher (Teo et al., 2018) were assessed only for the North Pacific, therefore they cannot be considered as Primary species for the South Pacific. **Silky shark (*Carcharhinus falciformis*)** The indices of relative abundance for large silky sharks in the eastern Pacific Ocean (EPO), developed from bycatch-per-set data from purse-seine sets on floating objects and presented at the 9th meeting of the Scientific Advisory Committee (SAC-09) in May 2018 (IATTC, 2018a), were updated in 2019 with data from 2018 (IATTC, 2019b). In both the north and south EPO, the indices for large silky sharks for 2018 decreased to about their 2016 values, following an increase in 2017 (IATTC, 2019a). Indices for medium and small silky sharks in 2017 were similar, or decreased slightly, relative to their 2016 values (IATTC, 2018a). Because of recent increases in the number of sharks recorded as released alive, indices for large silky sharks that included these data were also calculated and showed a somewhat less pessimistic long-term trend (IATTC, 2019a). However, there is concern that the size category of sharks released alive may be poorly estimated, and thus the increase in live release could bias the indices by size. In addition, a recent Pacific-wide silky shark assessment (Clarke et al. 2018) highlighted the need for a better understanding of movements and stock structure of the species in the Pacific Ocean and stated that the exploratory models were not considered sufficiently robust to provide an assessment of stock status for silky sharks in the Pacific Ocean as a whole or at either regional scale. In any case, while the model estimates of depletion are not considered reliable, they do indicate that Pacific Ocean silky shark populations are likely to have declined considerably over the last two decades in response to the increased levels of catch, and the current model suggests that fishing mortality rates could be higher than the F_{MSY} level (F/F_{MSY} >1) (Clarke et al., 2018), but no changes to management measures are recommended (IATTC, 2018b). Apart from Agreement 031 from October 8, 2004 regarding the thin surface longline and hook type allowed, and the national program to educate fishermen on by-catch reduction, there are national (i.e., Agreement nº 116 on Hammerhead sharks, Decree nº 486 and 902 regarding shark fishing and the implementation of the National Action Plan for the Conservation and Management of Sharks in Ecuador – PAT-Ec) and international (i.e., Resolution C-16-05 from IATTC on the Management of Shark Species - https://www.iattc.org/PDFFiles/Resolutions/IATTC/_English/C-16-05-Active_Management%20of%20sharks%20species.pdf) conservation and management measures that Ecuador implements regarding shark species. Therefore, **SG60 is met**. However, the national management measures are not specific for silky sharks, and the IATTC, despite having found that fishing mortality rates could be higher than the F_{MSY} level and that the silky shark is the most common shark caught in both the EPO purse seine and longline fisheries (IATTC, 2018c; Siu et al., 2017), has not recommended any changes to its management in its latest meeting. Moreover, the silky shark is listed in the Memorandum of Understanding on the Conservation of Migratory Sharks of the CMS since 2016 for which

<table>
<tr><td colspan="2">PI 2.1.1</td><td colspan="4">The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.</td></tr>
<tr><td></td><td></td><td colspan="4">Ecuador, even though it is not binding, is signatory since 2017. In addition, and bearing in mind that the UoA silky shark percentage catch in 2016 amounted to almost 2.3% (Table 3.4.2.1.1), we cannot be sure that the UoA is not hindering the recovery and rebuilding of this species that it is likely below the PRI. Therefore, SG80 is not met.</td></tr>
<tr><td rowspan="4">b</td><td colspan="5">Minor primary species stock status</td></tr>
<tr><td>Guidepost</td><td></td><td></td><td>Minor primary species are highly likely to be above the PRI

OR

If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species</td></tr>
<tr><td>Met?</td><td></td><td></td><td>Striped marlin: Y
Skipjack tuna: Y
Albacore: Y
Yellowfin tuna: N
Bigeye tuna: Y
Swordfish: Y</td></tr>
<tr><td>Justification</td><td colspan="3">There are 6 species identified as Primary Minor:
<table>
<tr><th>Scientific name</th><th>Common name (EN)</th><th>Common name (ES)</th></tr>
<tr><td>Kajikia audax</td><td>Striped marlin</td><td>Picudo gacho/Marlin rayado</td></tr>
<tr><td>Katsuwonus pelamis</td><td>Skipjack tuna</td><td>Listado</td></tr>
<tr><td>Thunnus alalunga</td><td>Albacore</td><td>Atún sierra</td></tr>
<tr><td>Thunnus albacares</td><td>Yellowfin tuna</td><td>Atún de aleta amarilla</td></tr>
<tr><td>Thunnus obesus</td><td>Bigeye tuna</td><td>Patudo/Albacora</td></tr>
<tr><td>Xiphias gladius</td><td>Swordfish</td><td>Pez espada</td></tr>
</table>
Striped marlin (Kajikia audax)

The last full assessment of striped marlin was conducted in 2008, using Stock Synthesis, and later updated with data through October 2010. Key results were that (1) the stock was not overfished; (2) overfishing was not occurring; and (3) the spawning stock biomass was above the level that would support MSY (IATTC, 2019). SG100 is, therefore, met.

Skipjack tuna (Katsuwonus pelamis)

Skipjack tuna is a notoriously difficult species to assess. However, based on the latest assessment, both biomass and recruitment have been increasing over the past 20 years, and were above their respective upper reference levels in 2016 and 2017. No adverse impacts of the fishery have been found and none of the models indicate a credible risk to the skipjack stock(s) (SAC-09-07 REV, http://www.iattc.org/Meetings/Meetings2018/SAC-</td></tr>
</table>

PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
		09/PDFs/Docs/_English/SAC-09-07-EN-REV-23-Apr-18_Skipjack-tuna-indicators-of-stock-status.pdf). Therefore, **meeting SG100**. **Albacore (*Thunnus alalunga*)** The assessment of the South Pacific albacore was carried out in 2018 using MULTIFAN-CL and covered the 1960-2016 period. Contradictory signals about stock status were found, but no model suggested overfishing or an overfished state (IATTC, 2019). Therefore, **meeting SG100**. **Yellowfin tuna (*Thunnus albacares*)** IATTC currently uses an interim limit reference point for yellowfin tuna but target reference points and harvest control rules are not used. The model currently used for the stock assessment of yellowfin tuna in the eastern Pacific Ocean (SAC-10-08, https://www.iattc.org/Meetings/Meetings2019/SAC-10/Docs/_English/SAC-10-08_Yellowfin%20tuna%20Stock%20status%20indicators.pdf) is unable to reconcile data that apparently carry contradictory signals about the status of the stock. The low values for recent years estimated for three CPUE-based indicators suggest low abundance of the population, but this is inconsistent with the increased average size of the fish in the catch of these fisheries. It is therefore not clear from the indicators whether yellowfin abundance is in fact reduced, or changes have occurred in the fisheries. Research is planned to revise the model and several of its assumptions in preparation for the benchmark assessment in 2020 (SAC-10-08). Most of the catches in the EPO are taken by purse-seiners (SAC-10-07, https://www.iattc.org/Meetings/Meetings2019/SAC-10/Docs/_English/SAC-10-07_Yellowfin%20tuna%20assessment%20for%202018.pdf), and the percentage of reported catches from the UoA from 2013 to 2017 (except for 2016) was always below 1.1% (**Table 3.4.2.1.2**). But the fact that in 2016, the percentage amounted to almost 4% and to be precautionary, as we don't exactly know the status of the stock, in the case yellowfin might be below the PRI, we cannot know if the UoA might hinder the recovery and rebuilding of this species, therefore **SG100 is not met**. **Bigeye tuna (*Thunnus obesus*)** The last EPO bigeye tuna updated assessment was conducted in 2017 and it indicated a recovering trend between 2005-2009, but the rebuilding trend was not sustained during 2010-2013. The spawning biomass ratio (SBR) declined gradually to a historically low value of 0.15 at the start of 2013. Thereafter, the SBR has increased to 0.23 at the start of 2016. Even though recent fishing mortality rates (F) are above the level corresponding to MSY (F_{MSY}), the spawning biomasses (S) are slightly above that level. Therefore, bigeye tuna, currently is not considered overfished in the Eastern Pacific Ocean, although it is undergoing overfishing (SAC-09-05, https://www.iattc.org/Meetings/Meetings2018/SAC-09/PDFs/Docs/_English/SAC-09-05-EN_Bigeye-tuna-assessment-for-2017.pdf). Based on these results and the fact that the percentages caught by the UoA are relatively low (i.e., always below 0.5% from 2013 to 2017), indicates that the UoA does not hinder the recovery and rebuilding of this species, therefore **SG100 is met**. **Swordfish (*Xiphias gladius*)** The most recent assessment of the stock of swordfish in the South EPO was conducted with Stock Synthesis, using data updated to April 2011 (IATTC, 2019). The key results from that assessment were that (1) the swordfish stock in the South EPO was not experiencing overfishing and was not overfished; and (2) the spawning biomass was about 50% above the carrying capacity, and substantially above the level expected to produce catch at the MSY level. In addition, there was no indication of a significant impact of fishing on this stock. Therefore, **meeting SG100**.

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
References	Clarke, S.C., Langley, A., Lennert-Cody, C.E., Aires-da-Silva, A., and Maunder, M. 2018. Pacific-wide silky shark (Carcharhinus falciformis) stock status assessment. WCPFC-SC14-2018/SA-WP-08. Western and Central Pacific Fisheries Commission Scientific Committee Fourteenth Regular Session, Busan, Korea, 8-16 August 2018. IATTC, 2018a. UPDATED STOCK STATUS INDICATORS FOR SILKY SHARKS IN THE EASTERN PACIFIC OCEAN, 1994-2017. Document SAC-09-13. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, 9th meeting, La Jolla, California (USA) 14-18 May 2018. Available at: https://www.iattc.org/Meetings/Meetings2018/SAC-09/PDFs/Docs/_English/SAC-09-13-EN_Updated-purse-seine-indicators-for-silky-sharks-in-the-EPO.pdf IATTC, 2018b. STAFF RECOMMENDATIONS FOR MANAGEMENT AND DATA COLLECTION, 2018. Document SAC-09-15 REV 2. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, 9th meeting, La Jolla, California (USA) 14-18 May 2018. Available at: http://www.iattc.org/Meetings/Meetings2018/SAC-09/PDFs/Docs/_English/SAC-09-15-EN-REV-17-May-18_Staff-recommendations-2018.pdf IATTC, 2018c. IATTC public domain data files for download: Shark EPO purse seine catch and effort aggregated by year, month, flag or set type, 1°x1° and Shark EPO longline catch and effort aggregated by year, month, flag, 5°x5°. Available at https://www.iattc.org/Catchbygear/IATTC-Catch-by-species1.htm IATTC, 2019a. UPDATED STOCK STATUS INDICATORS FOR SILKY SHARKS IN THE EASTERN PACIFIC OCEAN, 1994-2018. Document SAC-10-17. Inter-American Tropical Tuna Commission, Scientific Advisory Committee, 10th meeting, San Diego, California (USA), 13-17 May 2019. Available at: https://www.iattc.org/Meetings/Meetings2019/SAC-10/Docs/_English/SAC-10-17_Purse-seine%20indicators%20for%20silky%20sharks%20in%20the%20EPO.pdf IATTC, 2019b. Report on the tuna fishery, stocks and ecosystem in the Eastern Pacific Ocean in 2018. Document IATTC-94-01. Inter-American Tropical Tuna Commission, 94th meeting, Bilbao, Spain, 22-26 July 2019. Available at: https://www.iattc.org/Meetings/Meetings2019/IATTC-94/Docs/_English/IATTC-94-01_The%20tuna%20fishery,%20stocks,%20and%20ecosystem%20in%20the%20Eastern%20Pacific%20Ocean%20in%202018.pdf Siu, S., A. Aires-da-Silva, C. Lennert-Cody and M.N. Maunder. 2017. Shark landing data available from longline fisheries in Central America: progress report. IATTC Presentation SAC-08-08a(ii). Available at https://www.iattc.org/Meetings/Meetings2017/SAC08/PDFs/Presentations/_English/SAC-08-08a-(ii)-PRES_Updated-results-of-FAO-GEF-sharkproject.pdf Teo, S. L. H., E. G. Rodriguez, O. Sosa-Nishizaki. 2018. Status of common thresher sharks, *Alopias vulpinus*, along the west coast of North America: updated stock assessment based on alternative life history. NOAA technical memorandum NMFS, pp. 595. Available at: https://repository.library.noaa.gov/view/noaa/18085
OVERALL PERFORMANCE INDICATOR SCORE:	**75** The assessment team has to follow the MSC FCP v2.1 7.17.10 (Table 4) to score PIs with different scoring elements (see below the Scoring Calculation).
CONDITION NUMBER (if relevant):	**3**

PI 2.1.1 – Scoring Calculation for each scoring element.

The Combining scoring per elements set out in Table 4 (MSC FCP v2.1 7.17.10) was used to determine the PI score. All elements meet SG60; most achieve higher performance, at or exceeding SG80; only a few fail to achieve SG80 and require intervention action.

Species	SIa	SIb	Element score	PI score
Blue marlin	60	N/A	**60**	**75**
Silky shark	60	N/A	**60**	
Striped marlin	N/A	100	**100**	
Skipjack tuna	N/A	100	**100**	
Albacore	N/A	100	**100**	
Yellowfin tuna	N/A	80	**80**	
Bigeye tuna	N/A	100	**100**	
Swordfish	N/A	100	**100**	

Evaluation Table for PI 2.1.2 – Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guidepost	There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to above the point where recruitment would be impaired.	There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the point where recruitment would be impaired.	There is a **strategy** in place for the UoA for managing main and minor primary species.
	Met?	Y	Y	N
	Justification	Agreement 031 from October 8, 2004 states that only thin surface longline (locally known as 'doradero') with hook type "J" of size number 4 or 5, or circular hook of size number 14 or 15 is allowed, thus preventing incidental catches as much as possible. In addition, there is a national program to educate fishermen on by-catch reduction. Regarding sharks, there are national and international management measures specific to mitigate pressures on shark populations. At a national level, for example, there is the implementation of the National Action Plan for the Conservation and Management of Sharks (PAT-Ec) to conserve and manage sharks (Executive Decree 486 and 902); or the establishment of the Single Observer Program for the Longline Fleet of Ecuador (Ministerial Agreement 204), which is linked to other projects of national interest such as the National Action Plan for the Conservation and Management of the Mahi mahi (PAN Dorado), and the PAT-Ec. At a regional level, IATTC has a resolution to manage shark species (C-16-05, https://www.iattc.org/PDFFiles/Resolutions/IATTC/_English/C-16-05-Active_Management%20of%20sharks%20species.pdf). Therefore, there is a partial strategy in place for the UoA that is expected to not hinder the rebuilding of the two main primary species which might currently be below the PRI. Thus, **SG80 is met**. However, as there are not specific regulations/strategy to manage all primary species (e.g., even the shark's national management measures are not specific for silky sharks), **SG100 is not met**.		
b	Management strategy evaluation			
	Guidepost	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	N	N
	Justification	As explained under SIa, there are national and international measures / partial strategy for managing primary species, such as the gear specifications (hook type and size number); also, the fishery is usually highly selective (without taking into account 2016 catches), i.e.,		

<table>
<tr><td colspan="2">PI 2.1.2</td><td colspan="3">There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.</td></tr>
<tr><td></td><td></td><td colspan="3">average of 89.87% of efficiency between 2013 and 2017 (see Table 3.4.2.1.1); in addition, Ecuador has (apart from the fishery catch data) a database with the biological and fishing information of each trip registered by the Ministry of Aquaculture and Fisheries observers, where among other things, by-catch species are recorded. With these data, the Ministry produces reports showing the discards and incidental catches of the Ecuadorian fisheries, and the data are sent to the IATTC for further analyses. Therefore, the measures/partial strategy are considered likely to work, hence meeting SG60.

However, due to:
(i) the high percentage of blue marlin catches in 2016 (i.e., 14.47%, Table 3.4.2.1.1);
(ii) the fact that the national management measures are not specific for silky sharks;
(iii) that even Executive Decree 486 (on Shark fishing, trading and export) in its Art 6 states that those who, during the exercise of the fishing activity, catch sharks as the sole and exclusive product of bycatch, may trade and use their meat entirely;
(iv) that silky sharks are listed in the Shark's MoU of the CMS since 2016; and
(v) bearing in mind that the UoA silky shark percentage catch in 2016 amounted to almost 2.3% (Table 3.4.2.1.1),

means that we cannot be confident that the measures/partial strategy will work, thus, not meeting SG80.</td></tr>
<tr><td>c</td><td colspan="4">Management strategy implementation</td></tr>
<tr><td></td><td>Guidepost</td><td></td><td>There is some evidence that the measures/partial strategy is being implemented successfully.</td><td>There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).</td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">There is evidence that: (i) the fishing method is usually highly selective (i.e., average of 89.87% of efficiency between 2013 and 2017 (without taking into account 2016 catches) - Table 3.4.2.1.1); (ii) Ecuador reports its catches to the IATTC, as documented in several of its Scientific Advisory Committee meetings (e.g., IATTC, 2014; 2016a; 2016b; 2016c); (iii) the Single Observer Program for the Longline Fleet of Ecuador (Ministerial Agreement 204) is being implemented and trainings for observers have been carried out (e.g., Manual for on-board observers of industrial and artisanal longliners, or the database on incidental catches); (iv) the implemented Traceability and Fishing Control System (e.g., 2018 Report for the 2015-2016 closing season), (v) the cooperation between the Ministry of Aquaculture and Fisheries and the National Directorate of Aquatic Spaces (DIRNEA) – Maritime Authority of Ecuador, (vi) the sanctioning administrative proceedings regarding different issues (handed to the team by the SRP), therefore SG80 is met.

However, the low selectivity observed in 2016 (i.e., only 28.38% of the UoA catches were the target species) means that we cannot be certain that the measures/partial strategy are achieving its overall objective as set out in SIa. Thus, SG100 is not met.</td></tr>
<tr><td>d</td><td colspan="4">Shark finning</td></tr>
<tr><td></td><td>Guidep</td><td>It is likely that shark finning</td><td>It is highly likely that shark</td><td>There is a high degree of</td></tr>
</table>

PI 2.1.2		**There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**		
	ost	is not taking place.	finning is not taking place.	**certainty** that shark finning is not taking place.
	Met?	Y	N	N
	Justification	The IATTC banned shark finning in 2005 (Resolution C-05-03). Within the PAT-Ec (National Action Plan for the Conservation and Management of Sharks in Ecuador), it is expressly specified that one of its objectives is to eliminate finning. Moreover, Executive Decree N. 486 on Shark fishing, trading and export (from 30th July, 2007), in its Article 5 states that "Finning shall be prohibited", and Article 7 states "Only the landing of whole sharks will be allowed" and "If shark fins were found without their respective bodies, the fins will be confiscated and the corresponding legal actions will be initiated against the captain and owner of the vessel". Therefore, it is likely that shark finning is not taking place, hence, **meeting SG60**. However, MSC mentions (FCR v2-0, GSA2.4.5 – GSA2.4.7) external validation levels to indicate the types of confidence that the MSC would require to demonstrate that shark finning is not occurring. At SG80 **"**good external validation" should be understood to indicate a validation level equivalent to a nominal observer coverage of 20% of effort. According to Art 2 Ministerial Agreement 204, at least 10% of the trips carried out by vessels over 20 m and the motherships fleet shall be monitored. As this is below the 20% coverage required by MSC, and, in addition, it only covers motherships and not the whole fleet, we cannot state that it is highly likely that shark finning is not taking place. therefore, **SG80 is not met**.		
e	Review of alternative measures			
	Guidepost	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Y	N	N
	Justification	From the eight primary species (both, main and minor) caught by the UoA, the silky shark is the only one considered an unwanted catch. As seen in SIa, there are national and international legislations for the conservation and management of shark species. In addition, there are studies that have assessed the efficiency of using circular hooks (instead of the J hooks) to reduce incidental catches (mostly addressed to sea turtles but also for sharks) with data from 2004-2010 (Andraka et al., 2013; Sondheimer et al., 2013) and from 2013-2014 (Martínez–Ortíz et al., 2016; Diz and Bravo, 2018), therefore, **SG60 is met**. In May 2018, a proposal on "Management measures and improvements of the fishing gear of the artisanal mothership fleet of superficial longlines targeting mahi mahi (*Coryphaena hippurus*) to reduce its impact on protected species" was presented to be carried out in 2018, 2019 and 2020. Due to operational reasons, it was not done in 2018. Currently, this proposal is being planned to be implemented in the 2019-2020 season. However, as these are not **regular** reviews of the potential effectiveness and practicality of		

PI 2.1.2		**There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**
		alternative measures to minimise UoA-related mortality of unwanted catches of main primary species, **SG80 is not met**.
References		Andraka, S., Mug, M., Hall, M., Pons, M., Pacheco, L., Parrales, M., et al. 2013. Circle Hooks: Developing better fishing practices in the artisanal longline fisheries in the Eastern Pacific Ocean. *Biological Conservation*, 160: 214–223. Diz, R., and Bravo, K. 2018. Estudio de la eficiencia de los anzuelos circulares para reducir las capturas incidentales en la pesquería del dorado (Coryphaena hippurus). Plan de Acción Nacional del Recurso Dorado. In: Actualización de la Información para la Evaluación del FIP Dorado. Subsecretaria de Recursos Pesqueros. Abril 2018. Ministerio de Acuacultura y Pesca. IATTC, 2014. DOCUMENT SAC-05-11b. PRELIMINARY RESULTS FROM IATTC COLLABORATIVE RESEARCH ACTIVITIES ON DORADO IN THE EASTERN PACIFIC OCEAN AND FUTURE RESEARCH PLAN. IATTC, SCIENTIFIC ADVISORY COMMITTEE, FIFTH MEETING, La Jolla, California (USA). 12-16 May 2014. Available at: https://www.iattc.org/Meetings/Meetings2014/SAC-05/Docs/_English/SAC-05-11b_Dorado-research.pdf IATTC, 2016a. DOCUMENT SAC-07-06a(i). EXPLORATORY STOCK ASSESSMENT OF DORADO (CORYPHAENA HIPPURUS) IN THE SOUTHEASTERN PACIFIC OCEAN. IATTC, SCIENTIFIC ADVISORY COMMITTEE, SEVENTH MEETING, La Jolla, California (USA). 09-13 May 2016. Available at: https://www.iattc.org/Meetings/Meetings2016/SAC-07/PDFs/Docs/_English/SAC-07-06a(i)-REV-12-Jan-18_Dorado-assessment.pdf IATTC, 2016b. DOCUMENT SAC-07-06a(ii). EXPLORATORY MANAGEMENT STRATEGY EVALUATION (MSE) OF DORADO (CORYPHAENA HIPPURUS) IN THE SOUTHEASTERN PACIFIC OCEAN. IATTC, SCIENTIFIC ADVISORY COMMITTEE, SEVENTH MEETING, La Jolla, California (USA). 09-13 May 2016. Available at: https://www.iattc.org/Meetings/Meetings2016/SAC-07/PDFs/Docs/_English/SAC-07-06a(ii)_Management-strategy-evaluation-MSE-for-dorado.pdf IATTC, 2016c. REPORT OF THE MEETING. IATTC, SCIENTIFIC ADVISORY COMMITTEE, SEVENTH MEETING, La Jolla, California (USA). 09-13 May 2016. Available at: https://www.iattc.org/Meetings/Meetings2016/SAC-07/PDFs/Docs/_English/SAC-07-RPT_7th-Meeting-of-the-Scientific-Advisory-Committee.pdf Martínez–Ortíz, J., García-Dominguez, M. and Gilces-Anchundia, M. 2016. Using the circular hook C15 in the artisanal fishery resource Mahi-mahi *Coryphaena hippurus* (Perciformes: Coryphaenidae) surface longline. Muisne (Esmeraldas) 2013-2014. WWF-MAGAP report for the National Plan for the Conservation of Sea Turtles. Sondheimer, F., García, M., Martínez, J., and Guerrero, P. 2013. Reporte Nacional del Programa de Reducción de la captura Incidental de Tortugas Marinas de Ecuador - La introducción de las mejores prácticas pesqueras en la pesquería artesanal de palangre en Ecuador: 2003-2012. Ministerio de Agricultura, Ganadería, Acuacultura y Pesca –WWF. Marzo 2013.
OVERALL PERFORMANCE INDICATOR SCORE:		**65**
CONDITION NUMBER (if relevant):		**4**

Evaluation Table for PI 2.1.3 – Primary species information

PI 2.1.3		**Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species**		
Scoring Issue		SG 60	SG 80	SG 100
A	Information adequacy for assessment of impact on main primary species			
	Guidepost	Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adeqaute to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptiblity attributes for main primary species.	Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status.
	Met?	Y	Y	N
	Justification	**Table 3.4.2.1.1** shows the UoA catch composition in metric Tons from 2013 to 2017, and **Table 3.4.2.1.2** shows the catch composition from the observer's program in number of individuals from 2008 to 2016, therefore, there is adequate qualitative and quantitative information available to assess the impact of the UoA on the main primary species with respect to their status, hence, **meeting SG80**. Ecuador has at least 10% of observer coverage on board motherships (Agreement 204). Nevertheless, the MSC guidance (FCR v2-0, GSA3.6.3) regarding observer coverage states that for species that are highly variable, clumped in distribution and/or relatively rare, higher levels of observer coverage are needed; and only for more normal species, observer coverage rates above 20% provide diminishing returns and small incremental improvements in the CV of catch estimates. In addition, the 10% coverage does not include the whole fleet (i.e., the fiberglass vessels associated to the motherships are not included), therefore, we cannot state that the information available is adequate to assess with a high degree of certainty the impact of the UoA on main primary species with respect to status. Hence **SG100 is not met**.		
B	Information adequacy for assessment of impact on minor primary species			
	Guidepost			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			Y

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
	Justification	As mentioned in SIa, Ecuador has (apart from the fishery catch data) a database with the biological and fishing information of each trip registered by the Ministry of Aquaculture and Fisheries observers, where among other things, by-catch species are recorded, therefore, **SG100 is met**.		
C	Information adequacy for management strategy			
	Guidepost	Information is adequate to support **measures** to manage **main** primary species.	Information is adequate to support a **partial strategy** to manage **main** Primary species.	Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective.
	Met?	Y	Y	N
	Justification	As mentioned in SIa and SIb, there are several sources of information that support the measures/partial strategy to manage the fishery (including the primary species), i.e., the fishery catch data and the observers' data. This information is then analysed and used to evaluate whether the strategy is achieving its objective by, for example, checking the efficiency of the implemented Traceability and Fishing Control System. Thus, **SG80 is met**. However, as mentioned in SIa, the observer coverage of 20% of effort is not achieved, hence, the information is not adequate to evaluate with a high degree of certainty whether the strategy is achieving its objective and **SG100 is not met**.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**85**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 2.2.1 – Secondary species outcome

PI 2.2.1		**The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Main secondary species stock status			
	Guidepost	Main Secondary species are **likely** to be within biologically based limits. OR If below biologically based limits, there are measures in place expected to ensure that the UoA does not hinder recovery and rebuilding.	Main secondary species are **highly likely** to be above biologically based limits OR If below biologically based limits, there is either **evidence of recovery** or a **demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding. AND Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that also have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main secondary species are within biologically based limits.
	Met?	N/A	N/A	N/A
	Justification	As stated in Section **3.4.4**, 68 species were identified as 'Secondary' based on FCR SA3.1.4. From the 68 species, 2 were classified as 'Main' (according to FCR SA3.7.1 and SA3.4.2-3.4.5): the Pelagic thresher shark (*Alopias pelagicus*) and the Blue shark (*Prionace glauca*). As explained in that section, an RBF should have been triggered in order to assess them. However, at the time of the site visit, the team had only available the data from 2013 to 2015 and in number of individuals. With those data, both species were classified as 'Minor', and it was only later on during the assessment process, when the team received the data from 2013 to 2017 in metric tons, that they were reclassified to 'Main'. Therefore, as this is just a "desk-approach", using only the information available to the team and not being able to take into account the multi-stakeholder approach of the RBF, the results obtained for these two species are preliminary. Following MSC FCP v2.1 Figure PF1 and Table PF1, a Productivity-Susceptibility Analysis (PSA) was carried out (see Appendix 1.2.2 for details) to assess this PI.		

PI 2.2.1		**The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.**		
		Table PF8 (FCP v2.1) was used to determine the final score.		
b	**Minor secondary species stock status**			
	Guidepost			Minor secondary species are highly likely to be above biologically based limits. OR If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species
	Met?			N/A
	Justification	Biologically based limits have not been established for any of the 66 different species classified as minor secondary: 1 bird, 1 cephalopod, 24 condrichthyes and 40 osteichthyes (**Table 3.4.2.2.1**). Since stock status reference points are not available for any of the minor secondary species impacted by the UoA, they were all classified as Data Deficient species according to FCR7.7.6 and an RBF shall be triggered for assessing this SI. However, Annex PF4.1.4 allows the team to avoid conducting RBF on 'minor' species when evaluating PI2.1.1 or 2.2.1 as long as final PI score is adjusted downward according to clause PF5.3.2. Due to the high number of different taxa to be assessed as minor secondary species the assessment team decided to use this option. Therefore, in accordance with PF5.3.2.1 the **final PI score shall not be greater than 80**.		
References		Drew, M., White, W. T., Dharmadi, A. V. H. and C. Huveneers. 2015. Age, growth and maturity of the pelagic thresher *Alopias pelagicus* and the scalloped hammerhead *Sphyrna lewini*. *Journal of Fish Biology*, 86: 333–354. Joung, S-J., Lyu, G-T., Hsu, H-H., Liu, K-M., and Wang, S-B. 2018. Age and growth estimates of the blue shark *Prionace glauca* in the central South Pacific Ocean. *Marine and Freshwater Research*, 69(9): 1346-1354. Liu, K-M., Chen, C-T., Liao, T-H., Joung, S. 1999. Age, Growth, and Reproduction of the Pelagic Thresher Shark, *Alopias pelagicus* in the Northwestern Pacific. *Copeia*, 1999 (1): 68-74. Martínez-Ortíz, J. & Zúñiga-Flores, M. 2012. *Current state of knowledge of the resource (*Coryphaena hippurus*) Linnaeus, 1758 in Southeast Pacific Ocean (2008-2011).* Final Technical Report of the project entitled: "Dynamics of the population: fisheries and fish biology of the mahi mahi in Ecuador". Reardon, M., Márquez, F., Trejo, T. & Clarke, S.C. 2009. *Alopias pelagicus*. The IUCN Red List of Threatened Species 2009: e.T161597A5460720. http://dx.doi.org/10.2305/IUCN.UK.2009-2.RLTS.T161597A5460720.en. Downloaded on 27 August 2019. Stevens, J. 2009. *Prionace glauca*. The IUCN Red List of Threatened Species 2009: e.T39381A10222811. http://dx.doi.org/10.2305/IUCN.UK.2009-2.RLTS.T39381A10222811.en. Downloaded on 27 August 2019. Wells, R.J.D., Spear, N., Kohin, S. 2016. Age validation of the blue shark (*Prionace glauca*) in the eastern Pacific Ocean. *Marine and Freshwater Research*, 68(6): 1130-1136. Zhu, J., Dai, X., Xu, L., Chen, X., and Chen, Y. 2011. Reproductive biology of female blue		

PI 2.2.1	**The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.**
	shark *Prionace glauca* in the southeastern Pacific Ocean. *Environ Biol Fish*, 91:95–102.
OVERALL PERFORMANCE INDICATOR SCORE:	**70**
CONDITION NUMBER (if relevant):	**5**

PI 2.2.1 – Scoring Calculation for each scoring element.

Following MSC FCP v2.1 Figure PF1 and Table PF1, a Productivity-Susceptibility Analysis (PSA) was carried out (see Appendix 1.2.2 for details) to assess this PI. The team has applied the rules set out in Table PF8 (FCP v2.1) to determine the final score.

Table 1.2.2.1 PI 2.2.1 score summary using the RBF (following PF4.5 of FCP v2.1).

Species	MSC PSA-derived score	Risk Category Names	MSC scoring guidepost	PI score
Alopias pelagicus	68	Med	60-79	**70**
Prionace glauca	75	Med	60-79	

Evaluation Table for PI 2.2.2 – Secondary species management strategy

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guidepost	There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **strategy** in place for the UoA for managing main and minor secondary species.
	Met?	Y	Y	N
	Justification	As explained in PI 2.2.1, there are 2 main secondary species (i.e., the Pelagic thresher shark (*Alopias pelagicus*) and the Blue shark (*Prionace glauca*)) and 66 minor secondary species (**Table 3.4.2.2.1**). In Ecuador, there is legislation designed to maintain or not hinder the rebuilding of secondary species. Agreement 031 from October 8, 2004 states that only thin surface longline (locally known as 'doradero') with hook type "J" of size number 4 or 5, or circular hook of size number 14 or 15 is allowed, thus preventing incidental catches as much as possible. In addition, there is a national program to educate fishermen on by-catch reduction. Moreover, since July 2008, there are observers on board motherships and independent fiberglass vessels (Ministerial Agreement 204). According to its Art 2, at least 10% of the trips carried out by vessels over 20 m and the motherships fleet shall be monitored. Regarding sharks, there are national and international management measures specific to mitigate pressures on shark populations. At a national level, for example, there is the implementation of the National Action Plan for the Conservation and Management of Sharks (PAT-Ec) to conserve and manage sharks (Executive Decrees 486 and 902); Art 2 of Executive Decree 486 prohibits any fishery whose specific target are sharks, furthermore, specific fishing gears to catch sharks (e.g., "palangre tiburonero" or longline for sharks) are also prohibited; the establishment of the Single Observer Program for the Longline Fleet of Ecuador (Ministerial Agreement 204), which is linked to other projects of national interest such as the National Action Plan for the Conservation and Management of the mahi mahi (PAN Dorado), and the PAT-Ec; or Ministerial Agreement 116, which states that it is prohibited the retention on board, transhipment, unloading, storage, and sale of hammerhead sharks (whole or in pieces), of the Scalloped hammerhead (*Sphyrna lewini*) and Smooth hammerhead (*Sphyrna zygaena*) on industrial fishing vessels (purse seiners, longlines, gillnets and/or trammel, trawls), motherships, and on sport or recreational fishing boats. At a regional level, IATTC has a resolution to manage shark species (C-16-05, https://www.iattc.org/PDFFiles/Resolutions/IATTC/_English/C-16-05-Active_Management%20of%20sharks%20species.pdf). For all the abovementioned, there is a partial strategy that is expected not to hinder		

<table>
<tr><td colspan="2">PI 2.2.2</td><td colspan="3">There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.</td></tr>
<tr><td></td><td></td><td colspan="3">rebuilding of the two main secondary species, therefore meeting SG80.

However, there is not a full strategy in place for the UoA for managing main and minor secondary species, therefore SG100 is not met.</td></tr>
<tr><td rowspan="4">b</td><td colspan="4">Management strategy evaluation</td></tr>
<tr><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).</td><td>There is some objective basis for confidence that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.</td><td>Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.</td></tr>
<tr><td>Met?</td><td>Y</td><td>N</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">As explained under SIa, Ecuador has gear specifications to prevent incidental catches as much as possible (hook type and size number – Agreement 031), at least 10% of observer coverage on board motherships (Agreement 204), as well as other national and international measures for managing secondary species, therefore, meeting SG60.

However, the two main secondary species were caught over 2% in all years but one. As it can be observed in Table 3.4.2.2.1, the catch of the pelagic thresher was over 2% in all years but 2017, while the blue shark was over 2% in all years but 2013, being the highest for both of them in 2016, i.e., 28.5% (even higher than the target species, mahi mahi, whose percentage catch that year was only 28.38%) and 10.42%, respectively.

Moreover, even Executive Decree 486 (on Shark fishing, trading and export) in its Art 6 states that those who, during the exercise of the fishing activity, catch sharks as the sole and exclusive product of bycatch, may trade and use their meat entirely.

In addition, the MSC guidance (FCR v2-0, GSA3.6.3) regarding observer coverage states that for species that are highly variable, clumped in distribution and/or relatively rare (which is the case for minor species and for the two shark species classified as main due to their percentage of catch), higher levels of observer coverage are needed; and only for more normal species, observer coverage rates above 20% provide diminishing returns and small incremental improvements in the CV of catch estimates.

Therefore, the high percentage of catches of the two main secondary species (mostly that of the pelagic thresher), and the observer coverage of 10%, which, in addition, it is only based on number of trips of the mothership vessels and not the whole fleet (i.e., not including the fiberglass vessels associated to a mothership), it cannot be considered enough to have some objective basis for confidence that the measures/partial strategy will work, hence, SG80 is not met.</td></tr>
<tr><td rowspan="3">c</td><td colspan="4">Management strategy implementation</td></tr>
<tr><td>Guidepost</td><td></td><td>There is some evidence that the measures/partial strategy is being implemented successfully.</td><td>There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
</table>

PI 2.2.2		**There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**		
	Justification	There is evidence that: (i) the fishing method is usually highly selective (i.e., average of 89.87% of efficiency between 2013 and 2017 (without taking into account 2016 catches) - **Table 3.4.2.1.1**); (ii) Ecuador reports its catches to the IATTC, as documented in several of its Scientific Advisory Committee meetings (e.g., IATTC, 2014; 2016a; 2016b; 2016c); (iii) the Single Observer Program for the Longline Fleet of Ecuador is being implemented and trainings for observers have been carried out (e.g., Manual for on-board observers of industrial and artisanal longliners, or the database on incidental catches); (iv) the implemented Traceability and Fishing Control System (e.g., 2018 Report for the 2015-2016 closing season), (v) the cooperation between the Ministry of Aquaculture and Fisheries and the National Directorate of Aquatic Spaces (DIRNEA) – Maritime Authority of Ecuador, (vi) the sanctioning administrative proceedings regarding different issues (handed to the team by the SRP), therefore **SG80 is met**. However, as seen previously (specifically regarding 2016 catches and the observer coverage for the whole fleet), its implementation might not be achieving its objective, therefore, **SG100 is not met**.		
d	Shark finning			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Y	N	N
	Justification	The IATTC banned shark finning in 2005 (Resolution C-05-03). Within the PAT-Ec (National Action Plan for the Conservation and Management of Sharks in Ecuador), it is expressly specified that one of its objectives is to eliminate finning. Moreover, Executive Decree N. 486 on Shark fishing, trading and export (from 30th July, 2007), in its Article 5 states that "Finning shall be prohibited", and Article 7 states "Only the landing of whole sharks will be allowed" and "If shark fins were found without their respective bodies, the fins will be confiscated and the corresponding legal actions will be initiated against the captain and owner of the vessel". Therefore, it is likely that shark finning is not taking place, hence, **meeting SG60**. However, MSC mentions (FCR v2-0, GSA2.4.5 – GSA2.4.7) external validation levels to indicate the types of confidence that the MSC would require to demonstrate that shark finning is not occurring. At SG80 **"**good external validation" should be understood to indicate a validation level equivalent to a nominal observer coverage of 20% of effort. According to Art 2 Ministerial Agreement 204, at least 10% of the trips carried out by vessels over 20 m and the motherships fleet shall be monitored. As this is below the 20% coverage required by MSC, and, in addition, it only covers motherships and not the whole fleet, we cannot state that it is highly likely that shark finning is not taking place. therefore, **SG80 is not met**.		
e	Review of alternative measures to minimise mortality of unwanted catch			
	Justification	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are

PI 2.2.2		**There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**		
			implemented as appropriate.	implemented, as appropriate.
	Met?	Y	N	N
	Guidepost	The Pelagic thresher shark (*Alopias pelagicus*) and the Blue shark (*Prionace glauca*) are the two species classified as main secondary species in this fishery (**Table 3.4.2.2.1**). As seen in SIa, there are national and international legislations for the conservation and management of shark species. In addition, there are studies that have assessed the efficiency of using circular hooks (instead of the J hooks) to reduce incidental catches (mostly addressed to sea turtles but also for sharks) with data from 2004-2010 (Andraka et al., 2013; Sondheimer et al., 2013) and from 2013-2014 (Martínez–Ortíz et al., 2016; Diz and Bravo, 2018), therefore, **SG60 is met**. In May 2018, a proposal on "Management measures and improvements of the fishing gear of the artisanal mothership fleet of superficial longlines targeting mahi mahi (*Coryphaena hippurus*) to reduce its impact on protected species" was presented to be carried out in 2018, 2019 and 2020. Due to operational reasons, it was not done in 2018. Currently, this proposal is being planned to be implemented in the 2019-2020 season. However, as these are not **regular** reviews of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catches of main primary species, **SG80 is not met**.		
References		Diz, R., and Bravo, K. 2018. Estudio de la eficiencia de los anzuelos circulares para reducir las capturas incidentales en la pesquería del dorado (Coryphaena hippurus). Plan de Acción Nacional del Recurso Dorado. In: Actualización de la Información para la Evaluación del FIP Dorado. Subsecretaria de Recursos Pesqueros. Abril 2018. Ministerio de Acuacultura y Pesca. IATTC, 2014. IATTC, 2016a. IATTC, 2016b. IATTC, 2016c. Martínez–Ortíz, J., García-Dominguez, M. and Gilces-Anchundia, M. 2016. Using the circular hook C15 in the artisanal fishery resource Mahi-mahi *Coryphaena hippurus* (Perciformes: Coryphaenidae) surface longline. Muisne (Esmeraldas) 2013-2014. WWF-MAGAP report for the National Plan for the Conservation of Sea Turtles. Sondheimer, F., García, M., Martínez, J., and Guerrero, P. 2013. Reporte Nacional del Programa de Reducción de la captura Incidental de Tortugas Marinas de Ecuador - La introducción de las mejores prácticas pesqueras en la pesquería artesanal de palangre en Ecuador: 2003-2012. Ministerio de Agricultura, Ganadería, Acuacultura y Pesca –WWF. Marzo 2013.		
OVERALL PERFORMANCE INDICATOR SCORE:				**65**
CONDITION NUMBER (if relevant):				**6**

Evaluation Table for PI 2.2.3 – Secondary species information

PI 2.2.3		**Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts on main secondary species			
	Guidepost	Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status.
	Met?	Y	Y	N
	Justification	The Pelagic thresher shark (*Alopias pelagicus*) and the Blue shark (*Prionace glauca*) are the two species classified as main secondary species in this fishery (**Table 3.4.2.2.1**). As explained in Section **3.4.4**, an RBF should have been used in order to assess them. However, at the time of the site visit, the team had available only the data from 2013 to 2015 in number of individuals. With those data, both species were classified as 'Minor', and it was only later on during the assessment process, when the team received the data from 2013 to 2017 in metric tons, that they were reclassified to 'Main'. Therefore, what was conducted in this assessment is a "desk-approach" (see Appendix 1.2.2 for details), using only the information available to the team and not being able to take into account the multi-stakeholder approach of the RBF. As seen in Appendix 1.2.2, some adequate qualitative and quantitative information is available to estimate productivity and susceptibility attributes for the two main secondary species, **meeting SG80**. However, and even though according to the IUCN Red list, globally, the pelagic thresher shark is classified as Vulnerable and the blue shark as Near Threatened, the stock status of both species is currently unknown for the Eastern Pacific. In addition, the high percentage of catches of both species (mostly for the thresher shark in 2016, whose catch was higher than the target species, mahi mahi), shows the lack of adequate information to assess with a high degree of certainty the impact of the UoA on the two main secondary species with respect to status, thus **not meeting SG100**.		
b	**Information adequacy for assessment of impacts on minor secondary species**			
	Guidepost			Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.

PI 2.2.3		**Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.**		
	Met?			Y
	Justification	Ecuador has (apart from the fishery catch data) a database with the biological and fishing information of each trip registered by the Ministry of Aquaculture and Fisheries observers, where among other things, by-catch species are recorded. In fact, a full list of 66 different species have been identified as minor secondary. In addition, the fishery is usually highly selective (i.e., average of 89.87% of efficiency between 2013 and 2017 (without taking into account 2016 catches) - **Table 3.4.2.1.1**). All this shows that, even though the status of the minor secondary species is not known, the information is adequate to estimate the impact of the UoA on minor secondary species with respect to their status, therefore, **SG100 is met**.		
c	Information adequacy for management strategy			
	Guidepost	Information is adequate to support **measures** to manage **main** secondary species.	Information is adequate to support a **partial strategy** to manage **main** secondary species.	Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**.
	Met?	Y	Y	N
	Justification	As mentioned in SIb, there are several sources of information that support the measures/partial strategy that manages the fishery (including primary and secondary species), i.e., the fishery catches' data and the observers' data. This information is then analysed and used to check the efficiency of the implemented Traceability and Fishing Control System. Therefore, **meeting SG80**. However, as mentioned in PI 2.2.2, the observer coverage of 20% of effort is not achieved, hence, the information is not adequate to evaluate with a high degree of certainty whether the strategy is achieving its objective and **SG100 is not met**.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**85**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 2.3.1 – ETP species outcome

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species The UoA does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Effects of the UoA on population/stock within national or international limits, where applicable			
	Guidepost	Where national and/or international requirements set limits for ETP species, the effects of the UoA on the population/stock are known and **likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population/stock are known and **highly likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits.
	Met?	NR	NR	NR
	Justification	As explained in Section **3.4.5**, five ETP species (all sea turtles) were identified (orange shaded in **Table 3.4.2.2.1**): the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*), and the olive ridley (*Lepidochelys olivacea*). As stated in FCR SA3.1.5, species classified as 'out-of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CR), are classified as ETPs. Three of the five sea turtles caught as bycatch by the UoA are classified as Critically Endangered (CR) in the IUCN Redlist (i.e., the loggerhead, the leatherback and the hawksbill turtles); the green turtle is classified as Endangered (EN); and the olive ridley as Vulnerable (VU). In addition, all of them are listed in Appendix I of CITES, which includes species threatened with extinction and their trade is permitted only in exceptional circumstances. Therefore, all five species fall under the MSC definition of ETP. However, as no national or international limits are set for the sea turtles, this SI will not be scored for these species.		
b	Direct effects			
	Guidepost	Known direct effects of the UoA are **likely** to not **hinder recovery** of ETP species.	Known direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species.	There is a **high degree of confidence** that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Y	Y	N
	Justification	As mentioned in SIa, five sea turtle species have been identified as ETPs: the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*), and the olive ridley (*Lepidochelys olivacea*). Apart from the legislation and management measures that Ecuador has to protect sea turtles at national and international level (i.e., Ministerial Agreement 212 from July 31, 1990; the National Plan for the Conservation of Sea Turtles, the Sea Turtle Bycatch Program, and being a contracting party of CITES and a member country of CIT - explained in detail in section **3.4.5**), the UoA average percentage catch reported by the observers from 2009 to 2016 is 0.2%, being always below 0.8% (i.e., average of 42 individuals per		

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The UoA meets national and international requirements for the protection of ETP species
The UoA does not hinder recovery of ETP species</td></tr>
<tr><td></td><td></td><td colspan="3">year, being the maximum 166 sea turtles by-caught in 2011). From these by-catches, 4.78% were released dead, 2.69% are of an unknown fate, and the rest were released alive with different degrees of injuries (i.e., 36.42% released with the hook on, 30.45% released alive with no injuries, 20% released with minor injuries, 5.67% released with major injuries) (Table 3.4.5.2 and Figure 3.4.5.1).

Therefore, it is highly likely that the UoA is not hindering the recovery of the sea turtle species, hence, meeting SG80.

As part of the Regional Program for the reduction of sea turtle bycatch in longline fisheries, in the period 2004–2010, a series of comparative fishing trials with J-hooks and circle hooks were conducted onboard longline vessels in the Eastern Pacific Ocean (including Ecuador, Panama and Costa Rica). The results showed that for the Ecuadorian experiments circular hooks were an effective measure that was accepted by fishermen in the large pelagics fishery. However, in the mahi mahi fishery, the catch rate of the target species was significantly reduced by around 30-40% (Hall, 2007; Read, 2007; Mug et al., 2008; Andraka et al., 2013; MAE, 2014), thus, it was not an attractive measure (MAE, 2014), and it was expected to be difficult to persuade fishers to adopt the new hook (Andraka et al., 2013).

Similar catch decreases were observed by Largacha et al. (2005) for the same Ecuadorian fishery and by Rodríguez-Valencia et al. (2008) for the Mexican mahi-mahi fishery. However, for the National Plan for the Conservation of Sea Turtles, a more recent study (Martínez–Ortíz et al., 2016) found no significant differences between types of hooks during 2013 and 2014 in Muisne (province of Esmeraldas, Ecuador) in the mahi mahi artisanal fishery.

As stated by the Ministry of Environment (MAE, 2014) and Andraka et al. (2013), the application of the circle hooks in not an attractive measure which could be difficult to be adopted by the mahi mahi artisanal fishers. In addition, a second phase of the hook exchange project was planned for 2018 but due to operational reasons it has still not been implemented, therefore, as the team cannot have a high degree of confidence of its adoption, SG100 is not met.</td></tr>
<tr><td>c</td><td colspan="4">Indirect effects</td></tr>
<tr><td></td><td>Guidepost</td><td></td><td>Indirect effects have been considered and are thought to be highly likely to not create unacceptable impacts.</td><td>There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.</td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Sea turtles face several threats, including the harvesting of their eggs, coastal development, predation of females and juveniles by domestic and feral animals, and climate change (Andraka, et al., 2013). In addition, longline fisheries in the Eastern Pacific Ocean overlap with the migratory routes and habitats of these animals. They can become entangled in fishing lines, and can be hooked by hooks aimed at catching other species of commercial interest, such as tunas, billfishes and mahi mahi, causing serious injuries and mortality of sea turtles. Therefore, these fisheries are also considered to contribute significantly to the threats that sea turtles face in the EPO (Andraka et al., 2013), being these species the main bycatch problem for these fisheries (Gillett, 2011).

In response to the problematic situation of the sea turtles, in 2003, the Sea Turtle Bycatch Reduction Program began operating in Ecuador. At that time, a group of actors including WWF, the IATTC, and representatives of the fishing and processing industry in Ecuador, got</td></tr>
</table>

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species The UoA does not hinder recovery of ETP species
		together to create a project composed of actions to address the problem of incidental capture of sea turtles in the large pelagic longline fishery in the EPO (Sondheimer et al., 2013). Later on, for the development of the **National Plan for the Conservation of Sea Turtles** (MAE, 2014), it was found that the main factors threatening the survival of sea turtles in Ecuador were the following (see Section **3.4.5** for a detailed description): (1) Degradation of nesting beaches; (2) Sand extraction; (3) Artificial lightning; (4) Vehicle use in beaches; (5) Beachfront construction and coastal strip reduction; (6) Marine habitat degradation: Exploration, production, refining and transportation of oil, gas and minerals; Pollution (Chemical pollution); Waste on the beach (Marine litter); Harmful algal blooms; (7) Fishing activities: Trawling fisheries (White/brown shrimp, Titi Shrimp, Hake); Longline fisheries; Gillnet fisheries; Purse seine fisheries; Dip-net fisheries (Jellyfish); (8) Other possible impacts: Boat collisions; Human presence; Sea turtle observation tourism; Direct capture; Trade of products and by-products; Interaction with other species (Predation); Domestic and feral animals; Other natural and anthropogenic factors (Climate change and ocean acidification, Natural events, Mariculture). In addition, there is the **Ministerial Agreement 212** from July 31, 1990, which considers all species of sea turtles in Ecuadorian territorial waters protected by the State. Furthermore, Ecuador is a contracting party of **CITES** and a member country of the **CIT**. For all the abovementioned, it is evident that indirect effects have been considered and are thought to be highly likely to not create unacceptable impacts on these ETP species, hence, **meeting SG80**. However, as these threats/indirect effects have not been quantified, we cannot have a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species, thus, **SG100 is not met**.
References		Andraka, S., Mug, M., Hall, M., Pons, M., Pacheco, L., Parrales, M., et al. 2013. Circle Hooks: Developing better fishing practices in the artisanal longline fisheries in the Eastern Pacific Ocean. *Biological Conservation*, 160: 214–223. Gillett, R. 2011. *Bycatch in Small-Scale Tuna Fisheries*. FAO Fisheries and Aquaculture Technical Paper 560. Hall, M. (2007). Bycatch reduction in the artisanal longline fleets of the Eastern Pacific: summary of activities for the regional sea turtle program of the Eastern Pacific – June 2007. Western Pacific Regional Fishery Management Council: pp35. Largacha, E., Parrales, M., Rendon, L., Velasquez, V., Orozco, M., Hall, M.A., 2005. Working with the Ecuadorian Fishing Community to Reduce the Mortality of Sea Turtles in Longlines: The First Year: March 2004–March 2005. Western Pacific Regional Fishery Management Council, Protected Species Conservation. Transfer Technologies. http://www.wpcouncil.org/protected/Documents/Largacha%20et%20al_2005_Ecuador%20first%20year%20results.pdf MAE (Ministerio del Ambiente del Ecuador). 2014. *Plan Nacional para la Conservación de las Tortugas Marinas*. Guayaquil, Ecuador. Martínez–Ortíz, J., García-Dominguez, M. and Gilces-Anchundia, M. 2016. Using the circular hook C15 in the artisanal fishery resource Mahi-mahi *Coryphaena hippurus* (Perciformes: Coryphaenidae) surface longline. Muisne (Esmeraldas) 2013-2014. WWF-MAGAP report for the National Plan for the Conservation of Sea Turtles. Mug, M., M. Hall y N. Vogel (2008). Bycatch Initiative: Eastern Pacific Programme. A vehicle towards sustainable fisheries. Progress report of fishing experiments with modified gear (2004-2007). WWF – IATTC: pp39.

PI 2.3.1	**The UoA meets national and international requirements for the protection of ETP species** **The UoA does not hinder recovery of ETP species**
	Read, A. J. (2007). Do circle hooks reduce the mortality of sea turtles in pelagic longlines? A review of recent experiments. *Biological Conservation*, 135: pp155-169. Rodríguez-Valencia, J.A., Cisneros, M.A., Ortega, H., Castro, I., Rodríguez, G., Chávez, A., Rodríguez, L.G., 2008. Anzuelos circulares como opción para reducir la captura incidental en las operaciones pesqueras de los palangreros ribereños de Sinaloa (México). *Ciencia Pesquera*, 16: 67–78. Sondheimer, F., García, M., Martínez, J., and Guerrero, P. 2013. Reporte Nacional del Programa de Reducción de la captura Incidental de Tortugas Marinas de Ecuador - La introducción de las mejores prácticas pesqueras en la pesquería artesanal de palangre en Ecuador: 2003-2012. Ministerio de Agricultura, Ganadería, Acuacultura y Pesca –WWF. Marzo 2013.
OVERALL PERFORMANCE INDICATOR SCORE:	**80**
CONDITION NUMBER (if relevant):	**N/A**

Evaluation Table for PI 2.3.2 – ETP species management strategy

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The UoA has in place precautionary management strategies designed to:
• meet national and international requirements;
• ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="4">a</td><td colspan="4">Management strategy in place (national and international requirements)</td></tr>
<tr><td>Guidepost</td><td>There are measures in place that minimise the UoA-related mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.</td><td>There is a strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.</td><td>There is a comprehensive strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.</td></tr>
<tr><td>Met?</td><td>N/R</td><td>N/R</td><td>N/R</td></tr>
<tr><td>Justification</td><td colspan="3">As explained in Section 3.4.5, five ETP species (all sea turtles) were identified (orange shaded in Table 3.4.2.2.1): the loggerhead turtle (Caretta caretta), the green turtle (Chelonia mydas), the leatherback (Dermochelys coriacea), the hawksbill turtle (Eretmochelys imbricata), and the olive ridley (Lepidochelys olivacea).
However, as no national or international limits are set for the sea turtles, this SI will not be scored for these species.</td></tr>
<tr><td rowspan="4">b</td><td colspan="4">Management strategy in place (alternative)</td></tr>
<tr><td>Guidepost</td><td>There are measures in place that are expected to ensure the UoA does not hinder the recovery of ETP species.</td><td>There is a strategy in place that is expected to ensure the UoA does not hinder the recovery of ETP species.</td><td>There is a comprehensive strategy in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Ecuador has specific legislation and management measures to protect sea turtles:
I. Ministerial Agreement 212 from July 31, 1990, which considers all species of sea turtles in Ecuadorian territorial waters protected by the State, and prohibits the capture, processing and the internal or external trade of all species of sea turtles;
II. the National Plan for the Conservation of Sea Turtles (MAE, 2014), whose general objective is to identify the necessary actions to ensure the conservation of sea turtles in Ecuador, such as protecting their nesting, reproduction and feeding areas in Ecuador, reducing the impact of interaction with fisheries, or involving citizens in the protection of turtles, among others. Specifically, in its Line of Action 5 "Reduction of bycatch", three actions are identified to reduce sea turtle capture: (i) to adopt the use of circle hooks, (ii) to modify the fishing gear to avoid catching mahi mahi juveniles and sea turtles, and (iii) to promote the national</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="4">The UoA has in place precautionary management strategies designed to:
• meet national and international requirements;
• ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</td></tr>
<tr><td></td><td></td><td colspan="4">industry to make tools to release sea turtles;

III. the Sea Turtle Bycatch Reduction Program, which includes a series of different activities: workshops with fishermen on good fishing practices, turtle handling workshops, exchange of fishing gears (e.g., circular hooks), project “T” (designing a new type of buoy or buoy rope for longline artisanal fishing), donation of equipment to reduce bycatch, or the observer program to monitor activities on board artisanal vessels (including turtle interaction);

In addition, Ecuador is a contracting party of CITES and a member country of the Inter-american Convention for the Protection and Conservation of the Sea Turtle (CIT).

The Inter-american Convention for the Protection and Conservation of the Sea Turtle (CIT) is an intergovernmental treaty which provides the legal framework for countries in the American Continent to take actions in benefit of these species. The Convention addresses the need to implement concerted measures between nations, coordinate multilateral conservation and protection actions, and ensure the implementation of a regional agenda that will lead to the recovery of these species. It promotes the protection, conservation, and recovery of sea turtle populations and those habitats on which they depend, based on the best reliable data available and taking into consideration the environmental, socioeconomic and cultural characteristics of the Parties (Article II, Text of the Convention). These actions shall cover both nesting beaches and the Parties’ territorial waters.

Therefore, there is a strategy in place which is expected to ensure the UoA does not hinder the recovery of these ETP species, hence, meeting SG80.

A “comprehensive strategy” is a complete and tested strategy made up of linked monitoring, analyses, and management measures and responses. As there is not a comprehensive strategy, SG100 is not met.</td></tr>
<tr><td>c</td><td colspan="5">Management strategy evaluation</td></tr>
<tr><td></td><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).</td><td>There is an objective basis for confidence that the measures/strategy will work, based on information directly about the fishery and/or the species involved.</td><td>The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">A report by the Ministry of Aquaculture and Fisheries on the Incidence of sea turtles in the Thin Surface Longline (Doradero) fishery of Ecuador during 2008-2012 was conducted (Pincay-Espinoza and Bravo-Vásquez, 2018). The information was gathered by fishing observers aboard these vessels. Out of the 927 sets covered by the fishing observers, turtle catches were recorded in 131 sets (i.e., 14.13%). Of the total turtles registered, 88.59% were released alive (with minor wounds and hooks), while 11.41% were released with serious injuries.</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The UoA has in place precautionary management strategies designed to:
• meet national and international requirements;
• ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</td></tr>
<tr><td></td><td></td><td colspan="3">Within the framework of the development of a fisheries improvement project (FIP) on the mahi mahi fishery (Coryphaena hippurus) in Ecuador, the Ministry of Aquaculture and Fisheries, in collaboration with WWF (World Wildlife Fund), developed a hook exchange program during the fishing seasons from 2012 to 2014 in the fishing cove of Muisne (Esmeraldas). The efficiency of circular hooks (compared to the traditional J hooks) to reduce incidental catches (mostly sharks and sea turtles) was assessed (Martínez-Ortíz et al., 2016). 10 individuals of the Olive Ridley turtle (Lepidochelys olivacea) were incidentally caught in 88 sets (i.e., 11.36%), and in the absence of sufficient data to be able to evaluate the efficiency of the gear modifications, it was proposed to carry out a second phase of the hook exchange project in 2018, although, due to operational reasons it has still not been implemented.

In addition, the fishery is usually highly selective (without taking into account 2016 catches), i.e., average of 89.87% of efficiency between 2013 and 2017 (see Table 3.4.2.1.1)

For all the aforementioned, there is an objective basis for confidence that the measures/strategy will work, therefore meeting SG80.

However, as there is the need to have more analyses to quantitatively support that there is a high confidence that the strategy will work, SG100 is not met.</td></tr>
<tr><td>d</td><td colspan="4">Management strategy implementation</td></tr>
<tr><td></td><td>Guidepost</td><td></td><td>There is some evidence that the measures/strategy is being implemented successfully.</td><td>There is clear evidence that the strategy/comprehensive strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) or (b).</td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">From the data reported by the observers from 2009 to 2016, we can observe that the numbers of incidental catches have been decreasing (see Tables 3.4.5.1 and 3.4.5.2) and the percentage of seaturtles released alive have been increasing. Therefore, the strategy is being implemented successfully. Hence, SG80 is met.

This trend, however, is mostly from 2012 to 2016. As we are lacking the more recent years, SG100 is not met.</td></tr>
<tr><td>e</td><td colspan="4">Review of alternative measures to minimize mortality of ETP species</td></tr>
<tr><td></td><td>Guidepost</td><td>There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.</td><td>There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.</td><td>There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.</td></tr>
</table>

PI 2.3.2		**The UoA has in place precautionary management strategies designed to:** • **meet national and international requirements;** • **ensure the UoA does not hinder recovery of ETP species.** **Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.**		
	Met?	Y	N	N
	Justification	There are studies that have assessed the efficiency of using circular hooks (instead of the J hooks) to reduce incidental catches (mostly addressed to sea turtles) with data from 2004-2010 (Andraka et al., 2013; Sondheimer et al., 2013) and from 2013-2014 (Martínez–Ortíz et al., 2016; Diz and Bravo, 2018), therefore, **SG60 is met**. In May 2018, a proposal on "Management measures and improvements of the fishing gear of the artisanal mothership fleet of superficial longlines targeting mahi mahi (*Coryphaena hippurus*) to reduce its impact on protected species" was presented to be carried out in 2018, 2019 and 2020. Due to operational reasons, it was not done in 2018. Currently, this proposal is being planned to be implemented in the 2019-2020 season. However, as these cannot be considered **regular** reviews of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species, **SG80 is not met**.		
References		Martínez–Ortíz, J., García-Dominguez, M. and Gilces-Anchundia, M. 2016. Using the circular hook C15 in the artisanal fishery resource Mahi-mahi *Coryphaena hippurus* (Perciformes: Coryphaenidae) surface longline. Muisne (Esmeraldas) 2013-2014. WWF-MAGAP report for the National Plan for the Conservation of Sea Turtles. MAE (Ministerio del Ambiente del Ecuador). 2014. *Plan Nacional para la Conservación de las Tortugas Marinas*. Guayaquil, Ecuador. Pincay-Espinoza, J. and Bravo-Vásquez, K. 2018. INCIDENCIA DE TORTUGAS MARINAS EN LA PESQUERÍA ARTESANAL DE PALANGRE DE SUPERFICIE DE ECUADOR (2008-2017). Plan de Acción Nacional para la Conservación y el Manejo de Tiburones de Ecuador. Plan de Acción Nacional para la Conservación y el Manejo del Recurso Dorado en Ecuador. Dirección de Políticas de Ordenamiento Pesquero, Subsecretaría de Recursos Pesqueros, Ministerio de Acuacultura y Pesca.		
OVERALL PERFORMANCE INDICATOR SCORE:				**75**
CONDITION NUMBER (if relevant):				**7**

Evaluation Table for PI 2.3.3 – ETP species information

PI 2.3.3		**Relevant information is collected to support the management of UoA impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts			
	Guidepost	Qualitative information is **adequate to estimate** the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species.	Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species.
	Met?	Y	Y	N
	Justification	As mentioned in PI 2.3.1 and Section **3.4.5**, the information gathered by the fishing observers include the fate of the incidental catches (see **Table 3.4.5.2**), therefore, qualitative and some quantitative information are adequate to assess the UoA related mortality and impact to determine whether the UoA may be a threat to protection an recovery of the ETP species. Hence, **SG80 is met**. However, the observer coverage of 20% of effort for species that are highly variable, clumped in distribution and/or relatively rare (see PI 2.2.2) is not achieved. In addition, it does not include the whole fleet (i.e., the fiberglass vessels associated to the motherships are not included). Therefore, we cannot have a high degree of certainty of the magnitude of the UoA-related impacts, mortalities and injuries and the consequences for the status of the ETP species with the available information. Hence, **SG100 is not met**.		
b	Information adequacy for management strategy			
	Guidepost	Information is adequate to support **measures** to manage the impacts on ETP species.	Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species.	Information is adequate to support a **comprehensive strategy** to manage impacts, minimize mortality and injury of ETP species, and evaluate with a **high degree**

PI 2.3.3		**Relevant information is collected to support the management of UoA impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
				of certainty whether a strategy is achieving its objectives.
	Met?	Y	Y	N
	Justification	As explained in PI 2.3.2, Ecuador has specific legislation and management measures to protect sea turtles: (i) **Ministerial Agreement 212** which considers all species of sea turtles in Ecuadorian territorial waters protected by the State; (ii) the **National Plan for the Conservation of Sea Turtles**, whose general objective is to identify the necessary actions to ensure the conservation of sea turtles in Ecuador; and (iii) the **Sea Turtle Bycatch Reduction Program**. The information gathered by the fishing observers allows to measure trends (see **Tables 3.4.5.1** and **3.4.5.2**, and **Figure 3.4.5.1**) and support the aforementioned measures/strategy to manage impacts on ETP species, therefore **SG80 is met**. Nevertheless, there is no comprehensive strategy to manage impacts, minimize mortality and injury of ETP species (see SI 2.3.2). In addition, the observer coverage does not reach the 20% required by MSC for species that are highly variable, clumped in distribution and/or relatively rare, hence, we cannot have a high degree of certainty of whether the strategy is achieving its objectives. Therefore, **SG100 is not met**.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 2.4.1 – Habitats outcome

PI 2.4.1		**The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Commonly encountered habitat status			
	Guidepost	The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	N
	Justification	Commonly encountered habitats are defined by MSC Requirements (FCR GSA3.13.3.1) as those preferred by the target species, that the UoA's gear is designed to exploit, and/or make up a reasonable portion of the UoA's fishing area. The mahi mahi fishery with doradero (thin surface longline) takes place at around 6-13 m depth (Martínez-Ortíz & Zúñiga-Flores, 2012; Martínez-Ortiz et al., 2015) in oceanic waters as far as 100º W, west of the Galapagos Islands (see **Figure 3.4.1.1.1**) therefore, the epipelagic habitat in the Southeastern Pacific Ocean is considered as the commonly encountered habitat for the purpose of this assessment. Pelagic habitats function is mostly determined by their physico-chemical properties (Raymond, 2011). The status of pelagic habitats is affected by human induced pressures such as eutrophication and hazardous substances, as well as by natural and human-induced changes in climate (HELCOM, 2018). The fishery, however, will not change the characteristics of the water column (for example, the temperature, salinity, currents) and it does not come into contact with benthic habitats. Therefore, it is highly unlikely that the fishery will reduce the structure and function of the pelagic habitat to a point where there is serious or irreversible damage. Hence, **meeting SG80**. However, as there is no evidence of it, **SG100 is not met**.		
b	VME habitat status			
	Guidepost	The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	N/R	N/R	N/R
	Justification	As mentioned in SIa, the mahi mahi doradero fishery takes place at around 9-14 m depth in oceanic waters as far as 1,400 nm from the mainland coast west off the Galapagos Islands. Due to the operational procedures of this type of fishing, neither the seabed nor any VMEs are encountered.		

PI 2.4.1		**The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.**		
		In addition, epipelagic habitats in open waters are not included in the definition of paragraph 42, subparagraphs (i)-(v) of the FAO Guidelines on Vulnerable Marine Ecosystems (VMEs), as described in MSC FCR GSA3.13.3.2. Therefore, this **SI is not relevant**.		
c	**Minor habitat status**			
	Guidepost			There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?			N
	Justification	Minor habitats are defined by MSC as those that do not fall within the classification of Commonly Encountered Habitats or VMEs (SA3.13.3). Taking into account that the whole fishing area described in Section **3.2.2** and observed in **Figure 3.4.1.1.1** is considered a commonly encountered habitat, no minor habitats have been identified in this assessment. Moreover, as there is no evidence on the likely impact of the fishery on the sea bottom, **SG100 is not met**.		
References		HELCOM, 2018. HELCOM Thematic assessment of biodiversity 2011-2016. Available at: http://www.helcom.fi/baltic-sea-trends/holistic-assessments/state-of-the-baltic-sea-2018/reports-and-materials Martínez-Ortíz, J. & Zúñiga-Flores, M. 2012. Current state of knowledge of the resource (Coryphaena hippurus) Linnaeus, 1758 in Southeast Pacific Ocean (2008-2011). Final Technical Report of the project entitled: "Dynamics of the population: fisheries and fish biology of the mahi mahi in Ecuador".		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guidepost	There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Y	Y	N
	Justification	MSC FCR Table SA8, states that "the term "if necessary" is used in the management strategy PIs at SG60and SG80 for the primary species, secondary species, habitats and ecosystems components. This is to exclude the assessment of UoAs that do not impact the relevant component at these SG levels". Bearing in mind that the present fishery is highly unlikely to impact benthic habitats, the term "if necessary" does apply here and no measures or partial strategy are required. Hence, **SG60 and SG80 are met**. MSC FCR v2.0 Table GSA8 for "Pelagic longline UoA targeting migratory pelagic species – There is little or no known bottom contact by the gear, except perhaps in cases of gear loss. The species targeted cannot be caught using trawl or other bottom-contacting gear", states that "*The use of the gear, the understanding that comes from years of peer-reviewed research about its impacts, and the specific management strategy that mandates only its use could be construed as a cohesive and strategic arrangement. This is supported by demonstrable understanding about how the use of pelagic longlines work to avoid impacting benthic habitats specifically, and some understanding about the impacts of lost gear on habitat and the relative effects of such impacts are deemed to be low risk for overall habitat health. Periodic assessments (i.e., directed research and risk assessments) are undertaken to inform management decision makers about lost-gear impacts to ensure that management strategies are working and are demonstrably avoiding serious or irreversible harm to "main" habitats and to determine whether changes need to be made to mitigate unacceptable impacts*". As there is no strategy in place for managing the impacts of the fishery on habitats, **SG100 is not met**.		
b	Management strategy evaluation			
	Guidepost	The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved.
	Met?	Y	Y	N
	Justification	As mentioned above, the mahi mahi fishery is an oceanic fishery, which is confirmed by the UoA logbooks and the VMS requirement for motherships which allows continuous monitoring.		

PI 2.4.2		**There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.**		
		In addition, the observer reports also confirm that the fishery does not interact directly with any benthic habitat. Moreover, as stated in SIa, management measures/partial strategy as described under SGs 60 and 80 are not required, therefore, **SG60 and SG80 are met**. As there is no full strategy, there is also no testing of it, therefore, **SG100 is not met**.		
c	Management strategy implementation			
	Guidepost		There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully.	There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		Y	N
	Justification	As confirmed by the UoA logbooks and the VMS requirement for motherships which allows continuous monitoring, the mahi mahi fishery is an oceanic fishery whose commonly encountered habitat is the epipelagic habitat, and which does not interact directly with any benthic habitats. As stated in SIa, no measures or partial strategy are required, therefore this **SG80 is met**. But in the absence of a full strategy, **SG100 is not met**.		
d	**Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs**			
	Guidepost	There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs.	There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	N/R	N/R	N/R
	Justification	As mentioned in PI 2.4.1, the fishery takes place only in the epipelagic habitat where there are no VMEs. Therefore, as there are no management requirements to protect VMEs, this **SI is not relevant**.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**N/A**

Evaluation Table for PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guidepost	The types and distribution of the main habitats are **broadly understood**. OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the types and distribution of the main habitats.	The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
	Met?	Y	Y	N
	Justification	In the mahi mahi fishery, the epipelagic habitat in the Southeastern Pacific Ocean is considered as the main habitat or the commonly encountered habitat. As explained in Section **3.4.1**, the fishery activity (**Figure 3.4.1.1.1**) lays between two of the world's Large Marine Ecosystems (LMEs) (see **Figure 3.4.1.4.1**), the Pacific Central-American Coast LME and the Humboldt Current LME. Both are broadly characterized in Heileman, 2009 and Heileman et al., 2009, respectively. In addition, one of the functions of the IATTC under the 2003 Antigua Convention is to "adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing for, or dependent on or associated with, the fish stocks covered by this Convention, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened". Therefore, among other issues, a description of the offshore pelagic ecosystem of the tropical and subtropical Pacific Ocean, and the oceanographic conditions in the Eastern Pacific Ocean mostly regarding their effects on tuna fisheries are available (IATTC, 2013; 2015; 2019b). Jiménez – Santistevan (2008) has also characterized the equatorial Pacific Ocean between the Galapagos Islands and continental Ecuador. All this shows that the main habitat is broadly understood, hence, **meeting SG60**. **Figure 3.4.1.5.1** shows the protected marine areas in the South Eastern Pacific Ocean where the UoA fishery operates. The characteristics of each of these areas can be consulted in websites such as the MPAtlas website (http://mpatlas.org/explore/) or the protected planet website (http://www.protectedplanet.net/). Nevertheless, as it can be seen in **Figure 3.4.1.5.2**, these protected marine areas are outside the spatial range of the		

<table>
<tr><td colspan="2">PI 2.4.3</td><td colspan="3">Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.</td></tr>
<tr><td></td><td></td><td colspan="3">fishery, therefore, they are not relevant here.

Moreover, as there are no vulnerable habitats in the pelagic ecosystem that could be damaged or impacted by the use of the doradero gear, SG80 is also met.

However, as the detailed distribution of all habitats is not known over their entire range, SG100 is not met.</td></tr>
<tr><td rowspan="5">b</td><td colspan="4">Information adequacy for assessment of impacts</td></tr>
<tr><td>Guidepost</td><td>Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.

OR

If CSA is used to score PI 2.4.1 for the UoA:

Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.</td><td>Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.

OR

If CSA is used to score PI 2.4.1 for the UoA:

Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.</td><td>The physical impacts of the gear on all habitats have been quantified fully.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The nature of the doradero gear means that the seabed is not impacted (see Section 3.2), while impacts to the pelagic habitat are highly likely to be imperceptible.

The information comes from the fishing gear description, observers’ data, fishery logbooks data, and VMS data on where fishing occurs.

Taking into account that pelagic habitats function is mostly determined by their physico-chemical properties (Raymond, 2011), information about the fishery impact on the habitat comes from knowing the fishing methodology and from inferring logically that it does not alter the characteristics of the water column. Therefore, information is adequate to allow for identification of the main impacts of the UoAs on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. SG60 and 80 are met.

However, as the physical impact has not been fully quantified, SG100 is not met.</td></tr>
<tr><td rowspan="3">c</td><td colspan="4">Monitoring</td></tr>
<tr><td>Guidepost</td><td></td><td>Adequate information continues to be collected to detect any increase in risk to the main habitats.</td><td>Changes in habitat distributions over time are measured.</td></tr>
</table>

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
	Met?		Y	Y
	Justification	VMS data on the fishery spatial distribution continues to be collected though the DIRNEA (National Directorate of Aquatic Spaces). As explained in section **3.2**, there is a great seasonality in the mahy mahi fishery: it operates mainly during November-February, with peak catches in December and January, however, when there is "El Niño" event, mahi mahi's availability lasts almost all year round, but the opposite happens during "La Niña" event. Therefore, the availability of mahi mahi may be associated with the introduction from west to east of equatorial and subtropical water masses off the Peruvian and Ecuadorian coasts, mainly between November and February, when mahi mahi highest abundances are found. During this period, the sea surface temperature (SST) related to mahi mahi fluctuated between 20 °C and 26 °C, but it was mostly associated with the 23 °C isotherm (Martínez-Ortíz & Zúñiga-Flores, 2012). Thus, the distribution of the species is related to the SST. Fishermen have to fill the Longliner set form ("Formulario lance palangrero") every time they set their gear. In that form, among other information, they fill in the Sea Surface Temperature. All the information gathered by the fishery are analyzed by the Ministry technicians who can monitor and detect changes. In addition, as the IATTC recognizes ecosystem issues in many of its management decisions, it aims at quantifying and evaluating the Commission's ecosystem approaches to fisheries, through current tools available to assess the state of the ecosystem (IATTC, 2019b), including the physical environment of tunas and billfishes, which is the same as mahi mahi's. For all the abovementioned, **SG80 and 100 are met**.		
References		Heileman, S. (2009) XIV-48 Pacific Central-American Coastal LME. In: Sherman, K. and Hempel, G (Eds.) 2009. The UNEP Large Marine Ecosystems Report: A perspective on changing conditions in LMEs of the world's Regional Seas. UNEP Regional Seas Report and Studies No. 182. United Nations Environment Programme. Nairobi, Kenia. Heileman, S., Guevara, R., Chavez, F., Bertrand, A. and H. Soldi (2009) XVII-56 Humboldt Current LME. In: Sherman, K. and Hempel, G (Eds.) 2009. The UNEP Large Marine Ecosystems Report: A perspective on changing conditions in LMEs of the world's Regional Seas. UNEP Regional Seas Report and Studies No. 182. United Nations Environment Programme. Nairobi, Kenia. IATTC, 2013. Ecosystem Considerations. Document SAC-04-08. Inter-American Tropical Tuna Commission, 4th meeting, La Jolla, California (USA), 29 April-03 May 2013. Available at: https://www.iattc.org/Meetings/Meetings2013/SAC-04/Docs/_English/SAC-04-08_Ecosystem%20considerations%20Ecological%20and%20Physical%20changes%20in%20the%20EPO.pdf IATTC, 2015. Oceanographic Conditions in the EPO and their Effects on Tuna Fisheries. Document SAC-06 INF-C. Inter-American Tropical Tuna Commission, 6th meeting, La Jolla, California (USA), 11-14 May 2015. Available at: https://www.iattc.org/Meetings/Meetings2015/SAC-06/PDFs/INF/_English/SAC-06-INF-C_Oceanographic-conditions-in-the-Eastern-Pacific-Ocean-and-their-effects-on-tuna-fisheries.pdf IATTC, 2019b. Report on the tuna fishery, stocks and ecosystem in the Eastern Pacific Ocean in 2018. Document IATTC-94-01. Inter-American Tropical Tuna Commission, 94th meeting, Bilbao, Spain, 22-26 July 2019. Available at: https://www.iattc.org/Meetings/Meetings2019/IATTC-94/Docs/_English/IATTC-94-01_The%20tuna%20fishery,%20stocks,%20and%20ecosystem%20in%20the%20Eastern%2		

PI 2.4.3	**Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.**
	0Pacific%20Ocean%20in%202018.pdf Jiménez - Santistevan R. 2008. Aspectos biológicos de El Niño en el Océano Pacifico Ecuatorial. Ed. Universidad de Guayaquil.
OVERALL PERFORMANCE INDICATOR SCORE:	**85**
CONDITION NUMBER (if relevant):	**N/A**

Evaluation Table for PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	Ecosystem status			
	Guidepost	The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Y	N	N
	Justification	The dominant source of variability in the upper layers of the Easter Pacific Ocean (EPO) is known as the El Niño-Southern Oscillation (ENSO), an irregular fluctuation involving the entire tropical Pacific Ocean and global atmosphere. El Niño events occur at 2- to 7-year intervals, and are characterized by weaker trade winds, deeper thermoclines, and abnormally high sea-surface temperatures (SSTs) in the equatorial EPO. El Niño's opposite phase, commonly called La Niña, is characterized by stronger trade winds, shallower thermoclines, and lower SSTs. The changes in the physical and chemical environment due to ENSO have a subsequent impact on the biological productivity, feeding, and reproduction of fishes, birds, and marine mammals (IATTC, 2019b). The key elements of the Pacific Central-American Coastal LME and the Humboldt Current LME, include abiotic and biotic factors, such as sea surface temperature, stratification, abundance of phytoplankton, zooplankton bio volume, total fish biomass, ratio of pelagic biomass to demersal biomass, size distribution of the fish community , trophic networks, abundance of predators and the availability of forage species, the capture or landings of all fisheries, the average trophic level of catches, etc. As discussed in PI2.4.1, the assessed fishery does not impact abiotic elements, while the impacts on various key elements of the ecosystem (retained species, bycatch, threatened and protected species and habitats) have already been considered separately in previous PIs relative to 'impact' ('outcome') of P2 (2.1.1, 2.2.1, 2.3.1, 2.4.1). Other aspects of the potential impacts on the biotic elements of the ecosystem are considered below, especially in relation to the impacts that the assessed fleet may cause in the relationships and the balance between them, since the normal function of an ecosystem depends to a large extent on the relative stability that the main biotic elements maintain among themselves. A number of key ecosystem elements might be disrupted by the fishery, including trophic relationships, size composition, biodiversity, and species distribution. The elements considered of primary importance and to be most likely threatened by the Ecuador mahi mahi longline fishery is that of trophic structure. A fishery can alter the structure and functioning of ecosystems through trophic interactions. Like other large pelagic fishes, *C. hippurus* plays an important role in epipelagic ecosystems (see **Figures 3.4.1.4.3** and **3.4.1.4.4**), since it may delineate the structure of the food-webs by top-down controls (Varela et al., 2016). In addition, as the Eastern Tropical Pacific Ocean shows wasp-waist-like structure (i.e., combination of top-down and bottom-up controls by a few abundant short-lived species occupying intermediate trophic levels), fisheries of top predators (such as tunas and billfishes or mahi mahi) that prey upon wasp-waist species could have implications in the		

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.
		pelagic system mechanisms when the biomasses of these particular functional groups are altered (Griffiths et al., 2013). The UoA fishery is usually highly selective (without taking into account 2016 catches), i.e., average of 89.87% of efficiency between 2013 and 2017 and it is considered to be sustainable. Therefore, it is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. Hence, **SG60 is met**. However, in 2016, *C. hippurus* catch was only 28.38% of the total UoA catch for that year, while 28.50% was *Alopias pelagicus* (the pelagic thresher shark). In fact, 42.47% of the catch that year was of several shark species and 27.54% of other apex fish species (including several tuna species, marlins or swordfish). Due to this high percentage of catches of top predators (other than the target species) and its possible top-down trophic implications, we can only be partly certain that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm, hence, **SG80 is not met**.
References		Griffiths, S.P., Olson, R.J., and Watters G.M. 2013. Complex wasp-waist regulation of pelagic ecosystems in the Pacific Ocean. *Rev Fish Biol Fisheries*, 23:459–475. Varela, J. L., Lucas-Pilozo, C. R., & González-Duarte, M. M. (2016). Diet of common dolphinfish (*Coryphaena hippurus*) in the Pacific coast of Ecuador. Journal of the Marine Biological Association of the United Kingdom, 97(01), 207–213.
OVERALL PERFORMANCE INDICATOR SCORE:		**60**
CONDITION NUMBER (if relevant):		**8**

Evaluation Table for PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guidepost	There are **measures** in place, if necessary which take into account the **potential impacts** of the fishery on key elements of the ecosystem.	There is a **partial strategy** in place, if necessary, which takes into account **available information and is expected to restrain impacts** of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place.
	Met?	Y	Y	N
	Justification	As already mentioned in PI 2.4.1, the assessed fishery does not impact abiotic elements, therefore no measures or partial strategy are required for the abiotic elements of the ecosystem. Regarding the biotic elements of the ecosystem, Agreement 031 from October 8, 2004 states that only thin surface longline (doradero) with hook type "J" of size number 4 or 5, or circular hook of size number 14 or 15 is allowed to prevent incidental catches as much as possible. In addition, Ecuador has specific legislation and management measures to protect sea turtles: (i) **Ministerial Agreement 212** which considers all species of sea turtles in Ecuadorian territorial waters protected by the State; (ii) the **National Plan for the Conservation of Sea Turtles**, whose general objective is to identify the necessary actions to ensure the conservation of sea turtles in Ecuador; and (iii) the **Sea Turtle Bycatch Reduction Program**. Moreover, there are national and international management measures specific to mitigate pressures on shark populations. At a national level, for example, there is the implementation of the **National Action Plan for the Conservation and Management of Sharks** (PAT-Ec) to conserve and manage sharks (Executive Decree 486 and 902); or the establishment of the Single Observer Program for the Longline Fleet of Ecuador (Ministerial Agreement 204), which is linked to other projects of national interest such as the **National Action Plan for the Conservation and Management of the Mahi mahi** (PAN Dorado), and the PAT-Ec. At a regional level, IATTC has a resolution to manage shark species (C-16-05, https://www.iattc.org/PDFFiles/Resolutions/IATTC/_English/C-16-05-Active_Management%20of%20sharks%20species.pdf). Even though no cetaceans have been reported (not even from the observer's reports), **Ministerial Agreement 196** protects cetaceans stating that all species of whales present in territorial waters are considered protected by the State; and any activity that threatens the life of these marine mammals is prohibited. Ecuador also has (apart from the fishery catch data) a database with the biological and fishing information of each trip registered by the Ministry of Aquaculture and Fisheries observers, where among other things, by-catch species are recorded. All this shows that there is a partial strategy which takes into account available information and is expected to restrain impacts of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance, thus **meeting SG80**.		

PI 2.5.2		**There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.**		
		However as there is not a strategy consisting of a plan containing measures to address all main impacts of the UoA on the ecosystem, **SG100 is not met**.		
b	Management strategy evaluation			
	Guidepost	The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or ecosystem involved
	Met?	Y	N	N
	Justification	Based on the lack of records of cetaceans by-catch, the low percentage of sea birds incidental catch (i.e., just one recorded by the observers in 2011, see **Table 3.4.2.1.2**), the high percentage of seaturtles released alive or without major injuries and the low percentage of shark by-catches (apart from the catches in 2016), the measures are considered likely to work. Thus, **meeting SG60**. However, due to the fact that Executive Decree 486, which forbids the target fishing of sharks, but also allows their commercialization; and the high percentage of captures of sharks and other non-target species during 2016, we cannot be confident that the measures/partial strategy will work. Therefore, **not meeting SG80**.		
c	**Management strategy implementation**			
	Guidepost		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	N
	Justification	For the reasons stated in SIb, there is some evidence that the measures/partial strategy is being implemented successfully, therefore, **meeting SG80**. However, due to the high percentage of captures of sharks and other non-target species during 2016, we cannot state that the measures/partial strategy is achieving its objective as set out in SIa. Hence, not **meeting SG100**.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**75**
CONDITION NUMBER (if relevant):				**9**

Evaluation Table for PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guidepost	Information is adequate to **identify** the key elements of the ecosystem.	Information is adequate to **broadly understand** the key elements of the ecosystem.	
	Met?	Y	Y	
	Justification	The abiotic elements of the pelagic ecosystem in the Eastern Pacific Ocean are identified and understood (see Section **3.4.1** for details). The biotic elements considered of primary importance and to be most likely threatened by the Ecuador mahi mahi longline fishery is the trophic structure. Studies on the diet and the feeding habits of *C. hippurus* in the Northern Pacific Ocean, Atlantic Ocean and Mediterranean Sea (Massutí et al., 1998; Oxenford & Hunte, 1999; Castriota et al., 2007; Tripp-Valdez et al., 2015), as well as in the Pacific coast of Ecuador specifically (Varela et al., 2016) have been conducted. Therefore, information is adequate to broadly understand the key elements of the ecosystem. Thus, **meeting SG80**.		
b	Investigation of UoA impacts			
	Guidepost	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**.
	Met?	Y	Y	Y
	Justification	As mentioned in SIa, the main interactions between the UoA and the key ecosystem elements (i.e., the trophic structure) can be inferred from existing information and have been investigated in detail both in the Pacific coast of Ecuador and in other places of the world (e.g., the Northern Pacific Ocean, Atlantic Ocean and Mediterranean Sea). Therefore, **meeting SG100**.		
c	Understanding of component functions			
	Guidepost		The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**.	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**.
	Met?		Y	N
	Justification	The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the pelagic ecosystem in the eastern tropical Pacific Ocean, covering the area circumscribed by 20°N, 20°S, 150°W (i.e., Olson and Watters, 2013), and specifically in the Humboldt Current System (e.g., Moloney et al., 2005; Thiel et al., 2007)		

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
		are known. Therefore, **SG80 is met**. The impacts of the UoA on P1 target species, primary, secondary and ETP species and habitats are identified (see PI 1.2.3 for target species, 2.1.3 for primary species, 2.2.3 for secondary species, 2.3.3 for ETPs, and 2.4.3 for habitats). However, as at the IATTC detailed information on retained and discarded bycatch by the smaller purse-seine fleet and much of the longline fleet is limited (IATTC, 2019b), the impacts of the fishery are not understood well enough. Hence, **SG100 is not met**.		
d	Information relevance			
	Guidepost		Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	N
	Justification	As seen in PI 1.2.3, 2.1.3, 2.2.3, 2.3.3 and 2.4.3, there is adequate information on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be understood. Hence, **SG80 is met**. Studies on the interactions between the UoA and specific ecosystem elements (i.e. mahi mahi, sharks, seaturtles) have been conducted (Largacha et al. 2005; Hall, 2007; Read, 2007; Mug et al., 2008; Andraka et al., 2013; MAE, 2014; Martínez–Ortíz et al., 2016; Varela et al., 2016). In addition, a model hypothesis of the eastern tropical Pacific Ocean pelagic ecosystem to gain insight into the relationships among the various species has also been carried out. However, as detailed information on retained and discarded bycatch by the smaller purse-seine fleet and much of the longline fleet is limited (IATTC, 2019b), the information on the impacts of the UoA on the components and elements is not adequate to allow all the main consequences for the ecosystem to be inferred. Therefore, **SG100 is not met**.		
e	Monitoring			
	Guidepost		Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?		Y	N
	Justification	Biological and environmental information is being monitored by the IATTC in the area. As already explained in previous PIs (see PIs 1.2.3, 2.1.3, 2.2.3, 2.3.3, and 2.4.3), the information collected includes catches, incidental interactions and their fate, VMS, SST, type of bait. The data are sent to the Ministry of Aquaculture and Fisheries but also to the IATTC for further analyses. Therefore, **SG80 is met**. There is probably adequate information to support the development of a strategy to manage ecosystem impacts, but since there is not a specific strategy to manage the ecosystem impacts of the mahi mahi fishery, **SG100 is not met**.		
References		Andraka, S., Mug, M., Hall, M., Pons, M., Pacheco, L., Parrales, M., et al. 2013. Circle Hooks: Developing better fishing practices in the artisanal longline fisheries in the Eastern Pacific Ocean. *Biological Conservation*, 160: 214–223.		

PI 2.5.3	There is adequate knowledge of the impacts of the UoA on the ecosystem.
	Hall, M. (2007). Bycatch reduction in the artisanal longline fleets of the Eastern Pacific: summary of activities for the regional sea turtle program of the Eastern Pacific – June 2007. Western Pacific Regional Fishery Management Council: pp35. IATTC, 2019b. Report on the tuna fishery, stocks and ecosystem in the Eastern Pacific Ocean in 2018. Document IATTC-94-01. Inter-American Tropical Tuna Commission, 94th meeting, Bilbao, Spain, 22-26 July 2019. Available at: https://www.iattc.org/Meetings/Meetings2019/IATTC-94/Docs/_English/IATTC-94-01_The%20tuna%20fishery,%20stocks,%20and%20ecosystem%20in%20the%20Eastern%20Pacific%20Ocean%20in%202018.pdf Largacha, E., Parrales, M., Rendon, L., Velasquez, V., Orozco, M., Hall, M.A., 2005. Working with the Ecuadorian Fishing Community to Reduce the Mortality of Sea Turtles in Longlines: The First Year: March 2004–March 2005. Western Pacific Regional Fishery Management Council, Protected Species Conservation. Transfer Technologies. http://www.wpcouncil.org/protected/Documents/Largacha%20et%20al_2005_Ecuador%20first%20year%20results.pdf MAE (Ministerio del Ambiente del Ecuador). 2014. *Plan Nacional para la Conservación de las Tortugas Marinas*. Guayaquil, Ecuador. Martínez–Ortíz, J., García-Dominguez, M. and Gilces-Anchundia, M. 2016. Using the circular hook C15 in the artisanal fishery resource Mahi-mahi *Coryphaena hippurus* (Perciformes: Coryphaenidae) surface longline. Muisne (Esmeraldas) 2013-2014. WWF-MAGAP report for the National Plan for the Conservation of Sea Turtles. Moloney, C., Jarre, A., Arancibia, H., Bozec, Y.-M., Neira, S., Roux, J.-P., Shannon, L.J., 2005. Comparing the Benguela and Humboldt marine upwelling ecosystems with indicators derived from inter-calibrated models. ICES J. Mar. Sci. 62 (3), 493–502. Mug, M., M. Hall y N. Vogel (2008). Bycatch Initiative: Eastern Pacific Programme. A vehicle towards sustainable fisheries. Progress report of fishing experiments with modified gear (2004-2007). WWF – IATTC: pp39. Olson, R.J. and Watters, G. M. 2013. A Model of the Pelagic Ecosystem in the Eastern Tropical Pacific Ocean. Inter-American Tropical Tuna Commission, Bulletin Vol. 22, No. 3. La Jolla, California. Read, A. J. (2007). Do circle hooks reduce the mortality of sea turtles in pelagic longlines? A review of recent experiments. *Biological Conservation*, 135: pp155-169. Thiel, M., Macaya, E. C., Acuña, E., Arntz, W. E., Bastias, H., Brokordt, K., et al. (2007). The Humboldt Current System of northern and central Chile: oceanographic processes, ecological interactions and socioeconomic feedback. Ocean. Mar. Biol. Annu. Rev. 45, 195–344. Varela, J. L., Lucas-Pilozo, C. R., & González-Duarte, M. M. (2016). Diet of common dolphinfish (*Coryphaena hippurus*) in the Pacific coast of Ecuador. Journal of the Marine Biological Association of the United Kingdom, 97(01), 207–213.
OVERALL PERFORMANCE INDICATOR SCORE:	**85**
CONDITION NUMBER (if relevant):	**N/A**

Evaluation Table for PI 3.1.1 – Legal and/or customary framework

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainability in the UoA(s); and
• Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and
• Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td colspan="4">Compatibility of laws or standards with effective management</td></tr>
<tr><td>Guidepost</td><td>There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2</td><td>There is an effective national legal system and organised and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.</td><td>There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.</td></tr>
<tr><td>Met?</td><td>Y</td><td>N</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The mahi mahi is a highly migratory species with a wide distribution in the eastern Pacific Ocean. There are pelagic species, including mahi mahi, whose spatial distribution includes the EEZs of Ecuador and Peru, as well as international waters outside of 200 nautical miles. Therefore, the international component of cooperation should also be considered when analysing the fishery.

In the case of Ecuador, Executive Decree No. 636 of 11 January 2019 created the Vice-Ministries of Production and Industries, Export and Investment Promotion, and Aquaculture and Fisheries, with the Under-Secretary for Fisheries Resources (SRP) of the Vice-Ministry of Aquaculture and Fisheries being the highest authority in matters of fisheries management in the country.

The SRP is responsible, among other things, for implementing and supervising the national fisheries policy, ensuring compliance with fisheries laws and regulations, drawing up fisheries development plans and programmes, coordinating the activities of the public and private sectors, managing the financial credit of fisheries, approving the reports and plans of companies in the fisheries sector and studies on the activity of the commissions, and managing the development of the fisheries sector.

Ecuador's Fisheries and Fisheries Development Act (Codification No. 2005007) is the basic regulation for the planning and management of the activity. This law is articulated through its corresponding regulation, the last revision of which is dated February 2016.

In accordance with the contents, this Law regulates the fishing activities of national and international vessels, establishing censuses of authorized vessels, fishermen and the relevant permits and documentation necessary for vessels to fish within Ecuador's EEZ. In addition, the law establishes mechanisms for infractions and sanctions. Ecuador has implemented a satellite monitoring system, which includes an important fraction of the country's fishing vessels, including industrial fleets such as purse seiners, longliners and mother ships. This system is responsible for monitoring, in real time, the situation and possible infractions of the vessels.

Within the framework of this regulation, the National Council for Fisheries Development</td></tr>
</table>

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
		was created, made up of representatives from different public institutions and the private sector to advise the Ecuadorian fisheries administration on decision-making. The National Fisheries Institute (INP) is the body responsible for providing, among other things, scientific advice for management decisions 'by the SRP. However, its role is limited, in many areas, because it does not have enough resources. The SRP itself is responsible, in many cases, for carrying out fisheries research through its own staff. At the international level, Ecuador is a signatory to and has ratified the Agreement on the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. In application of this Agreement, Ecuador has the obligation to cooperate with RFMOs. Thus, Ecuador has been a Contracting Party to the Inter-American Tropical Tuna Commission (IATTC) since 2004 as well as to the Agreement on the International Dolphin Conservation Program (AIDCP). Ecuador participates in the meetings and decision making of the IATTC and, in a direct manner, applies the approved Resolutions to its fishing sector. Ecuador reports its fleet's catches of both tunas and tuna-like species to the IATTC. In this regard, the National Council for Fisheries Development in Resolution No. CNDP-001-2000 published in Official Register No. 22 of February 22, 2000 authorized the Undersecretary for Fisheries Resources to implement the IATTC resolutions, and the rules contained in the AIDCP, through ministerial and/or instructive agreements, without the need for a prior opinion of that Council. However, the Ecuadorian legal framework has been considered outdated by the European Union, which has granted the country the so-called Yellow Card, having found that the country's regulations and procedures for combating IUU fishing do not comply with international and regional standards applicable to the conservation and management of fisheries resources. This warning also considers that there is an obsolete legal framework that does not guarantee that the system of sanctions is dissuasive for those who commit infractions. In relation to Peru, the General Fisheries Law and its Regulations in force since January 1994, establish the legal framework for the exercise of fishing activity in the country. These regulations establish mechanisms for the management and extraction of fishery resources in waters under Peruvian jurisdiction and differentiate access for industrial and artisanal fishing and provide the legal framework for the management of any fishery. This includes a management system that reconciles the principle of sustainability of fishing resources or conservation in the long term, with obtaining the greatest economic and social benefits. The regulation establishes monitoring and control mechanisms and details the infractions and sanctions for non-compliance with the regulations, among other elements. The Regulations of the General Fisheries Act establish that the national fisheries system is approved by means of regulations, the purpose of which is to establish principles, standards and regulatory measures applicable to the fisheries resources to be managed as distinct units There is a Ministry of Production to which the Vice-Ministry of Fisheries and Aquaculture depends and different public bodies related to fisheries such as the Instituto del Mar del Peru (IMARPE) in charge of scientific research on Peruvian fisheries and of providing scientific advice to the Vice-Ministry for better management decisions.

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
		Peru has not ratified the United Nations Convention on the Law of the Sea (UNCLOS) or the Agreement of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. However, Peru has been a Contracting Party to the Inter-American Tropical Tuna Commission (IATTC) since 2003, having ratified its accession in October 2018. (LEGISLATIVE RESOLUTION NO. 30785). At present, and in the framework of the 94th Meeting of the Inter-American Tropical Tuna Commission (IATTC), Peru was elected to the Presidency of this entity. Peru and Ecuador have signed cooperation agreements in fisheries and aquaculture. This framework has made it possible to work together on issues related to illegal fishing and fisheries research. Although there are no elements of joint management in shared fisheries, these agreements have made it possible to improve the exchange of scientific information and the improvement of knowledge on the state of stocks of shared fishery resources such as mahi mahi. It is unique in that although mahi mahi is a highly migratory species that is caught in the IATTC fishing area, to date this organization has not proposed direct management measures for this fishery. There are only a few Resolutions related to by-catch species, which include mahi mahi, as a species affected by tropical tuna fisheries. However, since 2014, there is a specific working group on mahi mahi at the IATTC that has been charged with developing a Stock Assessment for the species in 2016. For all the above, **SG60 does met for this SI**. In relation to mahi mahi, there are specific regulations in both Ecuador and Peru. Thus, Ministerial Agreement No. 023 of February 14, 2011 establishes the National Action Plan for the Conservation and Management of the Mahi mahi Resource in Ecuador (PAN DORADO) as a tool for guidelines for the conservation, management and eco-certification of the Mahi mahi Resource. In addition, the Ministerial Agreement No. 055 of April 2011 establishes the so-called Advisory Council of the Mahi mahi Resource whose mission is to advise the Ecuadorian Administration in relation to fisheries management and establish consultation mechanisms between the public and private sectors to work together for sustainability and seeking certification of the fishery. This NAP has been the basis for compiling existing regulations related to the fishery for this species and the development of new management standards. In Peru, there is also a National Action Plan for the Conservation and Management of the Mahi mahi resource (PAN-Mahi mahi). This Plan is a medium- and long-term planning and management tool for the Peruvian fishery and includes relevant objectives and activities aimed at conserving and managing the fishery in an integrated manner. The main management measures include closure periods and a minimum size. There is a Framework Agreement for Technical Cooperation between the Instituto del Mar del Peru (IMARPE) and the Instituto Nacional de Pesca de Ecuador (INP), signed on 29 February 2012 and renewed since 19 February 2018 within the binational fisheries collaboration. Under this agreement, four binational workshops on the mahi mahi resource have been held between the INP of Ecuador and IMARPE of Peru, the last of which was held at the IMARPE Coastal Laboratory in Tumbes on November 28, 2018. These binational workshops between the INP of Ecuador and IMARPE of Peru allow for updating data on landings, areas of distribution, and other biological aspects of the mahi mahi resource.

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="4">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainability in the UoA(s); and
• Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and
• Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td></td><td></td><td colspan="4">Likewise, the exchange of this information allows the identification of data and models for the assessment of the stock of this resource at the regional level.

In conclusion, there are no elements of effective regional and international cooperation for the mahi mahi fishery beyond the above-mentioned scientific agreement between Ecuador and Peru and the joint work with IATTC in the study of the status of the resource. There is no joint mechanism that would allow the fishery to be managed in both countries and at the regional level under the same parameters.

Therefore, the SG80 is not met for this SI.</td></tr>
<tr><td>b</td><td colspan="5">Resolution of disputes</td></tr>
<tr><td></td><td>Guidepost</td><td>The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.</td><td>The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the UoA.</td><td>The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>N</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The Fisheries Law and its regulations establish the infringements and the sanctioning procedure in case of non-compliance, but do not specify a specific dispute resolution mechanism. This shortcoming of the Fisheries Law was analysed in the pre-assessment carried out by MRAG and the specific actions of the PIF included the reform of the Fisheries Law. However, to date, the new law has not been published.

There are elements of the management system that are used for the discussion and search for solutions to conflicts and disputes in Ecuador. The National Fisheries Development Council has, among its tasks, to establish and guide the country's fisheries policy. In addition, it participates in the approval of plans and programs for the development of fishing and the annual evaluation of the results in order to allow the authorities to make the necessary changes.

In addition, there is a specific Advisory Council for the Mahi mahi resource, created from the publication of the PAN DORADO. One of the objectives of this council is to advise the Ecuadorian Administration on the formulation of strategies and policies to strengthen the competitiveness of the fishing sector and to reach internal agreements that will improve the efficiency of relations between the various actors in the production chain.

On the other hand, Ecuadorian citizens have access to the judicial system to address issues that cannot be dealt with through the specific system and can initiate proceedings against decisions taken by the fisheries administration.

However, neither of the two Councils mentioned above has the specific task of resolving management system disputes, although they are important elements for discussion and advice on fisheries problems and solutions. There are other mechanisms, through the</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainability in the UoA(s); and
• Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and
• Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td></td><td></td><td colspan="3">Ecuadorian Justice System, to resolve certain disputes related to infractions and sanctions.

With respect to Peru, the General Fisheries Law provides mechanisms for the resolution of legal disputes arising within the system. In addition, the Law establishes the crimes and sanctions, but there are no systems for resolving specific conflicts. In general, the legal framework does not open the door to public participation and the resolution of conflicts is, therefore, in the hands of the Administration through the implementation of other mechanisms of the legislation in force.

In the bi-national context of the fishery, there are no dispute resolution mechanisms between the two countries. However, both countries belong to the Andean Community. The parties to the dispute may address the Court of Justice of the Andean Community to settle disputes that cannot be resolved by other administrative or judicial means.

Although the IATTC does not currently manage the mahi mahi fishery, this organization could play an important role in this endeavour. The settlement of disputes between IATTC members (Article XXV Antigua Convention) establishes the mechanisms for resolving such disputes.

In addition, Article 59 of UNCLOS provides the basis for the resolution of disputes over the attribution of rights and jurisdiction in the exclusive economic zone.

For both countries, the management system is considered to incorporate or be subject by law to mechanisms for the resolution of legal disputes arising within the system. However, they are not considered to be transparent and effective in addressing most issues arising from the management system.

SG60 is meet but no SG80</td></tr>
<tr><td>c</td><td colspan="4">Respect for rights</td></tr>
<tr><td></td><td>Guidepost</td><td>The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The management system has mechanisms to fulfil the explicit or traditional legal rights of people dependent on fisheries for their food or livelihood in accordance with the objectives of MSC Principles 1 and 2. However, it cannot be considered as a mechanism that formally commits the parties and therefore would not achieve the SG100.

Ecuador has a set of laws and regulations to manage fishing resources in a way that guarantees access for fishermen to exercise the activity within a clear and accessible framework. These regulations (Fisheries Act and Regulations) consider the rights of</td></tr>
</table>

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
		fishermen. Thus, Articles 1.2 and 1.3 establish the characteristics of artisanal fishing and the fishermen who carry it out. Artisanal fishing has an exclusive fishing area of 8 miles and the law establishes special mechanisms for the promotion of this fishing activity. The Government of Ecuador has implemented National Plans of Action for the main fisheries, such as mahi mahi, and which have as a common basis, to establish specific and clear tools for all the elements of these fisheries through the implementation of new regulations. The specific Advisory Council for the Resource can, among other tasks, advise the administration on the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the production chain of the mahi mahi resource. Through these committees, fishermen can propose changes in the management system of the fisheries in which they are involved, however, these elements of participation do not guarantee the formal commitment of the management system to respect their rights. The Peruvian Fishing Law guarantees access to fishing resources for all natural or legal persons in the country. The law establishes a clear separation between artisanal and industrial fishing. By means of Article nº 57 (Promotion of artisanal fishing activity) the State promotes the development of artisanal fishing activity in marine and continental waters, in the extraction, processing and commercialization phases of fishing and in aquaculture. Artisanal and small-scale fishing activity can work in a reserved zone from mile 0 to mile 5. Through the Fisheries Development Fund (FONDEPES), it is ensured that artisanal fishermen can access resources through both economic and social support (mutual, retirement among others) Article 44 of the Act states that concessions, authorizations and permits for fishermen are specific rights granted by the Ministry for the development of fishing activities. The Regulations to this Law provide for the mechanisms and value of these rights. Small-scale and artisanal fisheries are exempted from paying such rights. **This SI met SG80**
References		COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL. CONVENCIÓN PARA EL FORTALECIMIENTO DE LA COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL ESTABLECIDA POR LA CONVENCIÓN DE 1949 ENTRE LOS ESTADOS UNIDOS DE AMÉRICA Y LA REPÚBLICA DE COSTA RICA ("CONVENCIÓN DE ANTIGUA"). https://www.iattc.org/PDFFiles/IATTC-Instruments/_Spanish/Convencion_de_Antigua_Jun_2003.pdf IATTC 70 A, Acta de Decisión – Adopción de la "Convención de Antigua" 26-28 junio de 2003 RESOLUCION C-03-02- RESOLUCION SOBRE LA ADOPCION DE LA CONVENCIÓN PARA EL FORTALECIMIENTO DE LA COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL ESTABLECIDA POR LA CONVENCIÓN DE 1949 ENTRE LOS ESTADOS UNIDOS DE AMÉRICA Y LA REPÚBLICA DE COSTA RICA Resolución C-99-114: recomienda que el personal científico de la Comisión estime las capturas y la mortalidad por pesca incidental de especies no objetivo. Resolución C-00-085: acuerda entre otros temas, el empleo de técnicas para liberar especies no objetivo, evaluar la efectividad de otras medidas para reducir la captura

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
	incidental de especies no objetivo, establecer un programa para obtener datos de la flota palangrera. Resolución C-01-046: acuerda la liberación hasta donde sea posible de aquellas especies no objetivo de la pesca atunera. Resolución C-02-057: acuerda identificar áreas de alto captura incidental de Dorado y verificar la estabilidad en el tiempo y en el espacio de dichas áreas. Resolución C-04-05 (Rev 2)- "Resolución consolidada sobre captura incidental" REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 DECRETO SUPREMO Nº 021-2001-RE mediante el cual se ratifica el Convenio Marco de Cooperación Pesquera y Acuícola suscrito con la República del Ecuador RESOLUCIÓN LEGISLATIVA Nº 30785 (República del Perú) QUE APRUEBA LA CONVENCIÓN PARA EL FORTALECIMIENTO DE LA COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL ESTABLECIDA POR LA CONVENCIÓN DE 1949 ENTRE LOS ESTADOS UNIDOS DE AMÉRICA Y LA REPÚBLICA DE COSTA RICA Plan de Acción Nacional para la conservación y manejo del recurso perico en el Perú (PAN Perico - Perú) RESOLUCIÓN VICE-MINISTERIAL N° 81-2016-PRODUCE/DVPA Ley General de Pesca de Perú - Decreto Ley Nº 25977 Reglamento de la Ley General de Pesca de Perú – Decreto Supremo nº 01-94-PE The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (in force as from 11 December 2001)
OVERALL PERFORMANCE INDICATOR SCORE:	**65**
CONDITION NUMBER (if relevant):	**10**

Evaluation Table for PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
Scoring Issue		SG 60	SG 80	SG 100
a	Roles and responsibilities			
	Guidepost	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **generally understood**.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for key areas** of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for all areas** of responsibility and interaction.
	Met?	Y	Y	N
	Justification	The Fisheries Law and Regulations establish the functions and responsibilities of each of the decision-making elements of the fishery. The SRP is the institution in charge of carrying out the management proposals and their practical application. The Undersecretary of Fisheries has the mandate from the Minister in charge to take decisions and implement fisheries policies. The SRP is also responsible for the control and monitoring of fishing activity and the application of sanctions in the case of non-compliance. The National Fisheries Institute is responsible for generating scientific and technological information and knowledge for the rational use of hydrobiological resources and their ecosystems and provides management and conservation measures to the competent authorities, contributing to the development of the fisheries and aquaculture sector. The existing National Plans of Action in the main fisheries, such as mahi mahi, have as a common basis, to establish specific and clear tools for all the elements of them through the implementation of new regulations. The Mahi mahi Resource Advisory Council can, among other tasks, advise the administration on the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the mahi mahi resource production chain. The existing fisheries management system in Ecuador clearly identifies the organizations and individuals involved in it. The functions, roles and responsibilities are explicitly defined and well understood for some, but not all, key areas of responsibility and interaction. In the same way, the fisheries management system in Peru identifies, in a general way, the roles and responsibilities of the different organizations and actors involved in the Peruvian fisheries. The Ministry of Production, through the Vice-Ministry of Fisheries and Aquaculture, is responsible for managing fisheries resources in jurisdictional marine waters, rivers, lakes and other water sources in the national territory. Through the Instituto del Mar del Peru (IMARPE) and the Instituto Tecnológico de la Pesca (ITP), scientific and technological research in the sector is promoted. It also manages the fishing infrastructure and promotes artisanal fishing. It represents Peru in regional and international fisheries management forums such as the IATTC. The Fishing Law and its Regulations establish the mechanisms for access to the fishery, the rights of fishermen and develops the infringements and sanctions for non-compliance (among others). In addition, it establishes the roles and responsibilities of the different		

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="4">The management system has effective consultation processes that are open to interested and affected parties.

The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</td></tr>
<tr><td></td><td></td><td colspan="4">parties in management and decision-making.

Through the Fisheries Management Regulations (ROPs) and the National Action Plans (NAPs), the rules of fisheries management are established for the main fisheries in the country. In the case of the mahi mahi, there is a NAP, but a specific ROP has not yet been elaborated, so there are no clearly established roles and responsibilities of the different participants in the fishery. Therefore, this SI met the SG80.</td></tr>
<tr><td rowspan="4">b</td><td colspan="5">Consultation processes</td></tr>
<tr><td>Guidepost</td><td>The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.</td><td>The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.</td><td colspan="2">The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.</td></tr>
<tr><td>Met?</td><td>Y</td><td>N</td><td colspan="2">N</td></tr>
<tr><td>Justification</td><td colspan="4">The Ecuadorian fisheries management system includes consultation mechanisms with the different stakeholders of the fishery. The National Fisheries Development Council and the Mahi mahi Resource Advisory Council (created from the PAN DORADO) are consultation mechanisms where the Administration and the industry can discuss the situation of the fisheries (the latter specifically for mahi mahi) and make proposals for changes in the management processes.

The CCRD initially included FENACOPEC (artisanal fishermen) and ASOEXPEBLA (exporters) as part of the fishing sector and has WWF and INP as advisory bodies. It is also open, at the discretion of the presidency, to the participation of other governmental and non-governmental organizations, individuals and related institutions.

The objective of this council is to advise the Ministry in charge of fisheries policies "in the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the production chain of the mahi mahi resource".

ASOAMAN represents the interests of industrial mahi mahi fishermen in Ecuador. This association, created after the PAN DORADO, is the one that currently has the greatest role in decision making and not so much FENACOPEC. The revision of the PAN DORADO aims, among other objectives, to have a greater participation of all stakeholders.

Ecuador, as a member of the IATTC, maintains with the tuna fishing sector a constant exchange of information that allows them to have coordinated responses and a joint strategy for meetings and decision-making in the IATTC. However, this does not occur, yet, for other fisheries such as the mahi mahi.

In relation to Peru, the MSC pre-assessment conducted in 2012 for its mahi mahi fishery concluded that consultation processes are not formally established and do not occur frequently or regularly. In addition, in most cases, stakeholder participation in the consultation process is not representative and does not incorporate requests from all stakeholders.</td></tr>
</table>

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
		As part of the PIF, the implementation of inclusive participation processes for the different stakeholders involved in the decision-making process for fisheries management was recommended. In addition, the PIF Action Plan suggested the implementation of management committees as a mechanism to improve participation. Although during the first years of implementation of the FIP, different workshops were held with Peruvian fishermen to identify the main stakeholders. Since 2015, meetings and workshops have been held with the aim of identifying solutions to counteract the high and growing informality in mahi mahi fisheries. The main actors involved in the fishery, including fishermen, the administration and representatives of civil society, participated in these tables. However, given that the FIP has not made progress since 2015 in accordance with the Plan of Action, there is no information on the formalisation of these participatory processes and their continuity. **This SI met SG60, but not SG80**.		
c	Participation			
	Guidepost		The consultation process **provides opportunity** for all interested and affected parties to be involved.	The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement.
	Met?		N	N
	Justification	The existing consultation processes in Ecuador do not have the same specific weight depending on the fishery. In the case of the tuna purse-seine fishery, given that it is the country's main fishing industry, there is a level of participation of the different interested parties in the management processes and there are better developed consultation processes between the Administration and the industry than in the case of other fisheries. However, in the case of the mahi mahi fishery, the CCAMLR allows all interested and affected parties in the mahi mahi fishery to be involved in consultation processes, although the decisions of this advisory council are not binding. In addition, in general, the Ecuadorian fisheries administration maintains informal consultation processes with the sector to address specific issues arising from special situations that may occur in the fisheries. For Ecuador, this **SG met SG80, but not SG100**. In relation to Peru, the Vice-Ministry of Fisheries and Aquaculture of the Ministry of Production is exclusively responsible for the development of fisheries management regulations and their implementation. There are no administrative instruments that allow the participation of other stakeholders in the decision-making process of fisheries management. Consultation processes are rare and limited to issues such as access to fisheries resources and their management but are in any case informal. These consultations are carried out with the agents directly involved, but without the participation of civil society. Therefore, the level of participation is considered low. Most of these consultations are carried out for those fisheries, such as anchovy, which have a high socio-economic value compared to other Peruvian fisheries.		

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**
		In the case of Peru, **this SI does not meet SG80**
References		Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 Plan de Acción Nacional para la conservación y manejo del recurso perico en el Perú (PAN Perico - Perú) RESOLUCIÓN VICE-MINISTERIAL N° 81-2016-PRODUCE/DVPA Ley General de Pesca de Perú - Decreto Ley Nº 25977 Reglamento de la Ley General de Pesca de Perú – Decreto Supremo nº 01-94-PE
OVERALL PERFORMANCE INDICATOR SCORE:		**65**
CONDITION NUMBER (if relevant):		**11**

Evaluation Table for PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guidepost	Long-term objectives to guide decision-making, consistent with the MSC fisheries standard and the precautionary approach, are **implicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach are **explicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach, are **explicit** within **and required by** management policy.
	Met?	Y	Partial	N
	Justification	Ecuador's fisheries management system is based on the application of the 1974 Law on Fisheries and Fisheries Development and its implementing regulations. However, this regulation has been updated according to the new needs and obligations of Ecuadorian fisheries management. Its last modification is from 2016. The Fisheries Law is currently being revised and the draft that can be consulted on the website of the Undersecretariat of Fisheries Resources establishes the need to manage fisheries in a sustainable manner with long-term objectives and, in the absence of the best scientific information, to apply the precautionary principle to conserve the available fisheries resources. Although this policy is not formally adopted, the fisheries management mechanisms in Ecuador are integrating, on an individual basis for certain fisheries, these elements. The National Action Plans consider the need for the best scientific information to make management decisions in each fishery. There are currently 3 Action Plans in place (Shrimp Ointment, Mahi Mahi and Shark). In addition, the Plan of Action for the tuna fisheries is in its final phase for adoption. The general objectives of the Action Plans are to establish regulations based on scientific knowledge, to improve the processes of participation and control of the fisheries and to ensure the conservation of the target species and to minimize the impact of the activity on the environment. In the case of the mahi mahi, based on the interest of certifying the fishery and through the processes and results of the FIP, improvements were proposed in the management and decision-making processes of the fishery. Most of the existing management mechanisms come from the implementation of the National Mahi mahi Action Plan (PAN DORADO) in force since 2011 and which represents a set of medium- and long-term management tools for this fishery. The National Action Plan for the Conservation and Management of Ecuador's Mahi mahi resource was established by Ministerial Agreement No. 023 of 14 February 2011. This Plan was conceived as a tool of guidelines for the conservation, management and eco-certification of the mahi mahi resource and its main objectives are -Establish regulations based on good science that improve management and ensure the conservation of the resource. -Establish a control system that incorporates a traceability scheme of the resource. -Involve the communities in matters related to education, awareness and dissemination that allow the conservation and good management of the resource.		

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.
		-Generate priority scientific information for the management of the resource -Reduce bycatch of non-target species. In order to achieve these objectives, a set of rules (Ministerial Agreements) have been published which regulate, on the one hand, the mahi mahi fishery and, on the other hand, rules of a general nature. The Agreements include direct management measures (minimum sizes, closures, size and types of hooks, characteristics of permitted vessels, observer programme) and decision-making systems (Advisory Councils, Action Plan) among others. Peru's Fisheries Law has been in force since 1994, although the Regulations for the application of the Law have been updated periodically. Although no specific mention is made of long-term objectives, the Fishing Regulations establish that fishing resources must be exploited with criteria of responsible management and sustainable use. The Fisheries Act establishes that the Fisheries Management Regulations are the basis for the management of some specific fisheries that can be managed as distinct units. These ROPs include the management measures and authorizations to be able to access the fisheries. However, not all fisheries (including mahi mahi) have ROPs. In relation to this species, and similarly to Ecuador, Peru has a National Action Plan for the Conservation and Management of the Mahi mahi resource in Peru (PAN-Mahi mahi). This Plan is a medium- and long-term planning and management tool for the Peruvian fishery and includes relevant objectives and activities aimed at conserving and managing the fishery in an integrated manner. The objectives of this plan are as follows: - Promote the implementation of effective frameworks for biological, ecological and fisheries research on the mahi mahi resource. - Design and implement an information, follow-up, monitoring and evaluation system for the production chain of the mahi mahi resource. - Strengthen the regulatory framework by developing fisheries management measures for the mahi mahi resource - Reduce the bycatch of mahi mahi in non-target fisheries - Contribute to the protection of biological diversity and ecosystem structure and function. - Identify and assess threats to the mahi mahi population, as well as determine and protect their habitats. - Encourage the development of education, training and technical assistance programs that promote the conservation and sustainable use of the mahi mahi resource. In addition, this Action Plan has an objective linked to all the above and is the publication of a ROP for this fishery planned for 2018 but the situation is not known. Considering the above, it is considered that in both Ecuador and Peru there are management tools that allow for the establishment of long-term objectives, but not for all fisheries. In the case of the mahi mahi, the Action Plan and the ROP allow to meet SG80 partially.
References		Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 Resolución C-99-114: recomienda que el personal científico de la Comisión estime las capturas y la mortalidad por pesca incidental de especies no objetivo.

PI 3.1.3	The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.
	Resolución C-00-085: acuerda entre otros temas, el empleo de técnicas para liberar especies no objetivo, evaluar la efectividad de otras medidas para reducir la captura incidental de especies no objetivo, establecer un programa para obtener datos de la flota palangrera. Resolución C-01-046: acuerda la liberación hasta donde sea posible de aquellas especies no objetivo de la pesca atunera. Resolución C-02-057: acuerda identificar áreas de alto captura incidental de Dorado y verificar la estabilidad en el tiempo y en el espacio de dichas áreas. Resolución C-04-05 (Rev 2)- "Resolución consolidada sobre captura incidental"
OVERALL PERFORMANCE INDICATOR SCORE:	**SG70**
CONDITION NUMBER (if relevant):	**12**

Evaluation Table for PI 3.2.1 Fishery-specific objectives

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guidepost	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	Y	Partial	N
	Justification	The specific management plan for the mahi mahi fishery has as its general objective to ensure the conservation and sustainable use of the species in Ecuador through 5 specific objectives: Among them are: the establishment of regulations based on good science that will improve the administration and ensure the conservation of the resource, generate priority scientific information for the management of the resource and reduce the incidental capture of non-target species. Within the framework of this Plan of Action, different Ministerial Agreements have been promulgated which have as their main objective to manage the mahi mahi fishery through different management tools and which are consistent in achieving the results expressed for MSC Principles 1 and 2. On the other hand, although the IATTC does not directly manage the mahi mahi fishery, there are resolutions that are in line with Principle 2. Thus, Ecuador has implemented in its regulations the resolutions on bycatch on board longline vessels to obtain information on bycatch in this fleet. The mahi mahi fishery does not have a high bycatch of other species and fishermen are aware of and use mechanisms for releasing ETP species, such as sea turtles, and regulations authorize the use of circle hooks. Between 2008 and 2017, 2,168 turtles were recorded as bycatch. In most cases (98.77%) they were released alive into the sea with minor injuries and hooks and 1.23%. In relation to sharks, the National Plan for the Conservation and Management of Sharks, published in 2006, includes management and conservation measures for all shark species including a ban on finning, catching endangered species and recording all catches through the presence of observers and inspectors in port, as well as studying the impact of fisheries on the habitat of this species group. However, there is no information about the impact of the fishery in relation to the habitat and the marine ecosystem. The National Fisheries Institute does not have enough capacity to take on the research challenges necessary to understand the impact of fisheries on the Ecuadorian marine ecosystem. Much of the research is carried out directly by the staff of the Undersecretariat of Fisheries Resources and by the IATTC. The presence of the INP in the discussions and decision making at the lower level. In Peru, the National Mahi mahi Action Plan has as its main objective to promote the		

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.
		conservation and management of the mahi mahi resource and its long-term sustainable use. In order to achieve this objective, it is intended to act along different lines that are consistent with Principles 1 and 2. Thus, Peruvian fisheries management for this species promotes the implementation of effective frameworks for biological, ecological and fisheries research on the resource, reducing mahi mahi bycatch in non-target fisheries, contributing to the protection of biological diversity and ecosystem structure and function, and identifying, assessing threats to the mahi mahi population, as well as determining and protecting its habitats. This NAP includes, among its objectives, the elaboration of a Regulation of Fishing Management (ROP) on the mahi mahi fishery in Peru as a target species or as part of the oceanic ecosystem, based on the advances in the knowledge of this species. However, this ROP has not yet been published. There is a Framework Agreement for Technical Cooperation between the Instituto del Mar del Peru (IMARPE) and the Instituto Nacional de Pesca de Ecuador (INP) through which four binational workshops on the species have been held to date. The main objective of these workshops is to update data on landings, areas of distribution and other biological aspects of mahi mahi fisheries. Likewise, the exchange of this information allows the identification of data and models for the evaluation of the stock of this resource at the regional level. For all the above reasons, it is considered that, although there are objectives for effective management in the short and medium term, broadly consistent in achieving the results of Principles 1 and 2 of the MSC, they are not explicit within the management system and therefore **the SG80 is not fully met and it is partially scored**.
References		DOCUMENTO SAC-07-06a(ii) EVALUACIÓN DE ESTRATEGIAS DE ORDENACIÓN (EEO) EXPLORATORIA DE DORADO (CORYPHAENA HIPPURUS) EN EL OCÉANO PACÍFICO ORIENTAL SUR Juan L. Valero, Alexandre Aires-da-Silva, Mark N. Maunder, Carolina Minte-Vera, Jimmy Martínez-Ortiz, Edgar J. Torrejón-Magallanes, y Miguel N. Carranza Aires-da-Silva, A., Valero, J. L., Maunder, M. N., Minte-Vera, C., Lennert-Cody, Roman, M. H., MartinezOrtiz, J., Torrejón-Magallanes, E. J., and Carranza, M. N. 2016. Exploratory Stock Assessment of Dorado (Coryphaena hippurus) in the South Eastern Pacific Ocean in 2015. Inter-Amer. Trop. Tuna Comm., 7th Scient. Adv. Com. Meeting. SAC-07-06a(i) Resolución C-99-114: recomienda que el personal científico de la Comisión estime las capturas y la mortalidad por pesca incidental de especies no objetivo. Resolución C-00-085: acuerda entre otros temas, el empleo de técnicas para liberar especies no objetivo, evaluar la efectividad de otras medidas para reducir la captura incidental de especies no objetivo, establecer un programa para obtener datos de la flota palangrera. Resolución C-01-046: acuerda la liberación hasta donde sea posible de aquellas especies no objetivo de la pesca atunera. Resolución C-02-057: acuerda identificar áreas de alto captura incidental de Dorado y verificar la estabilidad en el tiempo y en el espacio de dichas áreas. INCIDENCIA DE TORTUGAS MARINAS EN LA PESQUERÍA ARTESANAL DE PALANGRE DE SUPERFICIE DE ECUADOR (2008-2017). Jonathan Pincay-Espinoza y Karla Bravo-Vásquez. Plan de Acción Nacional para la Conservación y el Manejo de Tiburones de Ecuador. Plan de Acción Nacional para la Conservación y el Manejo del Recurso Dorado en Ecuador. Dirección de Políticas de Ordenamiento Pesquero, Subsecretaría de Recursos Pesqueros, Ministerio de Acuacultura y Pesca Ministerio de Comercio Exterior, Industrialización, Pesca y Competitividad (MICIP).2006.

PI 3.2.1	The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.
	Plan de acción nacional para conservación y manejo de Tiburones de Ecuador. 44 pp. Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 Plan de Acción Nacional para la conservación y manejo del recurso perico en el Perú (PAN Perico - Perú) RESOLUCIÓN VICE-MINISTERIAL N° 81-2016-PRODUCE/DVPA Ley General de Pesca de Perú - Decreto Ley Nº 25977 Reglamento de la Ley General de Pesca de Perú – Decreto Supremo nº 01-94-PE
OVERALL PERFORMANCE INDICATOR SCORE:	**70**
CONDITION NUMBER (if relevant):	**13**

Evaluation Table for PI 3.2.2 – Decision-making processes

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Decision-making processes			
	Guidepost	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Y	Y	
	Justification	Ecuador's management system is increasingly based on scientific knowledge of fishery resources. However, despite the existence of a scientific body (INP) in charge of advising the SRP, it does not have enough technical and economic capacity to fulfill this role effectively, although an effort is being made to improve this situation. The SRP itself carries out its own technical-scientific research, based on data from the landing control and observer program, with the objective of improving knowledge of the fisheries and acting based on this. The catch control system is effective, through the observers on board and the inspectors at the landing points, which provides the necessary information for better decision making. The SRP is responsible for making and implementing management decisions for the mahi mahi fishery based on the data it analyses and collects. In general, management decisions are consulted and shared with the fisheries sector before implementation. Although there are no specific participatory mechanisms for all fisheries. In the case of mahi mahi, the NAP-Mahi mahi, through the CCAMLR, new management mechanisms or modifications to existing ones are proposed and discussed and subsequently implemented through the publication of new rules. The Advisory Council is composed of authorities, fishermen and exporters of fresh fish. Among the strategies of the PAN DORADO and in relation to this Council, it is established as a transparent mechanism of intersectoral representation in the planning and decision-making process. However, the recommendations of this advisory council are not binding, and its role is to advise the fisheries administration in relation to the formulation of strategies and policies that strengthen the management, sustainable use, production and competitiveness of the mahi mahi production chain. **This element met the SG80**		
b	Responsiveness of decision-making processes			
	Guidepost	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Y	N	N
	Justific	The decision-making system can respond to serious problems that may arise in the fishery		

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**
	ation	and have been identified through research, activity monitoring, evaluation or consultation with stakeholders. In recent years many actions have been implemented to improve the situation of the fishery and to give it a management framework that allows decisions to be taken based on better scientific knowledge and with more agile and adaptive tools for each situation of the fishery. Processes to improve the mahi mahi fishery have been implemented, which have made it possible to establish new management tools and review those already in place (observer program, increased control and inspection, collection of fishery data, exploratory assessment, etc.). The PAN DORADO is currently being revised with the aim of adapting it to changes that may occur in the fishery. The CCRD represents all the parties interested in the fishery and has, among other objectives, to formulate policies that will allow the improvement of the management of the fishery in a more sustainable way. In this sense, the management system is transparent. However, there are no elements to identify that the system is prepared to adapt effectively and quickly to important changes that could appear in any of the components of the fishery. Therefore, **this element met SG60**,
c	Use of precautionary approach	
	Guidepost	Decision-making processes use the precautionary approach and are based on best available information.
	Met?	N
	Justification	The Advisory Council and the Undersecretariat of Fishing Resources have scientific information from the observer program implemented from the PAN DORADO and from the landings control. The information is first processed and analyzed by the SRP and then sent to the IATTC. There is no specific working group in the IATTC for the mahi mahi fishery, but since 2014 technical meetings on mahi mahi are held periodically. The objective of these meetings was born under the mandate of the Antigua Convention and its ecosystem approach to fisheries, and it was considered appropriate for the IATTC staff to study the species, with a view to determining the impact of the fishery and recommending appropriate conservation measures if necessary. In addition, IATTC members from the coastal regions requested that collaborative research on mahi mahi be carried out with the IATTC staff so that sound information could be available for the management and conservation of this important resource in the region. Three meetings have been held to date. Based on this commitment, coastal countries such as Ecuador and Peru have sent their fisheries data to the IATTC and as a first result an exploratory assessment and recommendations for management measures were published in 2016. However, there is no specific working group and no specific timetable for the mahi mahi fishery within the IATTC. The EA carried out in 2016 is not included in a regular management mechanism for the fishery, at least for the time being. On the other hand, Ecuadorian law does not consider the precautionary approach in decision making, although it has been included in the PAN DORADO as a basis for management decisions. The SRP has made a notable effort in obtaining and analyzing information regarding this fishery, however, it is not a scientific entity that can provide

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**		
		sufficiently robust management advice. This SI does not met SG80.		
d	Accountability and transparency of management system and decision-making process			
	Guidepost	Some information on the fishery's performance and management action is generally available on request to stakeholders.	**Information on the fishery's performance and management action is available on request**, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Y	Y	N
	Justification	Since the implementation of the PAN-Mahi mahi, Ecuador has improved the level of information collection and processing of this fishery through the control of landings and on-board observers. This information has served, among other aspects, to carry out an exploratory stock assessment at the regional level by the IATTC. The information on the fishery is transmitted to the IATTC, but there is no detailed information on it that can be consulted directly on the IATTC website for this species and fishing method. The SRP shares with stakeholders, through meetings and fora, information regarding the status of the fishery and management measures and distributes it on request. The ACRD, created in the framework of the PAN DORADO, includes the participation of fishermen, among others. The information generated in these processes has been made available and accessible to all stakeholders. However, it is not possible to directly access detailed information on the fishery through the web pages of the Ecuadorian administrations. However, and according to the information received from the fishermen during the Site Visit, they are aware of some key elements of the management of the fishery, but they are not usually summoned by the Undersecretariat of Fisheries Resources to inform them of the situation of the fishery. Therefore, even though information exists and that administrations share it with interested parties, there are no specific mechanisms in place to do so. Not all the information on the behaviour of the fishery and management measures is available on the Internet or to all interested parties. Therefore, **this element met the SG80, but not by the SG100**		
e	Approach to disputes			
	Guidepost	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**		
		same law or regulation necessary for the sustainability for the fishery.		
	Met?	Y	Y	N
	Justification	Fishing in Ecuador is one of the main economic and social activities of the country. Therefore, the Fisheries Administration is permanently working on improving access to resources within a framework of sustainability and with greater participation of the fisheries sector, scientists and civil society. The publication, implementation and revision of National Plans of Action for certain fisheries and species responds to this dynamic. However, not all fisheries have published Action Plans yet. This policy has led to a good harmony, in general, between the national fishing sector and the fishing administration and it is not usual for legal disputes to occur that result in judicial decisions against the management system and must be implemented immediately. In relation to the mahi mahi fishery, there is no evidence, with the information provided by the SRP of the existence of legal disputes. **This SI met SG80**.		
References		Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016		
OVERALL PERFORMANCE INDICATOR SCORE:				**75**
CONDITION NUMBER (if relevant):				**14**

Evaluation Table for PI 3.2.3 – Compliance and enforcement

PI 3.2.3		**Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.**		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guidepost	Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Y	N	N
	Justification	Ecuador has a satellite monitoring system (VMS) aimed at industrial fishing vessels and mother-liners that must install it and keep it operational regardless of gross registered tonnage (GRT). The system installed must comply with the technical and operational specifications issued by the National Directorate of Aquatic Spaces (DIRNEA), which is part of the National Maritime Authority. DIRNEA also guarantees the inviolability and confidentiality of the data transmitted by each vessel. Fishing boats cannot carry out fishing operations without having installed and operating satellite monitoring device. The information is analyzed in real time by both DIRNEA and the Undersecretary of Fisheries Resources through the Fisheries Satellite Monitoring Centre located in the facilities of this organization in the port of San Mateo. The boats emit a signal with the system every hour. There is also a system of land-based control of vessel landings by inspectors from the Undersecretariat of Fisheries Resources. At each landing point there are inspectors who check the catch and whether it conforms to the declaration made by the captain or owner of the vessel. If there is an irregularity, sanction procedures are initiated, and the catches are seized. There is a total of 167 inspectors at national level. Landing control coverage at authorised points is 100%. Fishing control is coordinated from the Directorate of Control of Fishing Resources belonging to the Undersecretary of Fishing Resources. Its mission is to control fishing management through the systematic and permanent evaluation of compliance with the laws, regulations, standards, fishing and environmental policies in force. This administrative body is represented by the Director of Control of Fishing Resources. There is a NATIONAL FISHERIES CONTROL PLAN where all the processes and control mechanisms are gathered. The SRP and DIRNEA carry out some inspections at sea, but their vessels are small and usually cannot go further than 6-8 miles, so they do not reach larger vessels such as mother ships. The navy collaborates sporadically in the control of fishing inspection activities because its effort is mainly dedicated to control and fight against drug trafficking. The infringements detected are collected in a database and have specific protocols for action and analysts who develop the evidence to subsequently impose the required sanctions in accordance with the existing legal framework. Small-scale fibres do not have satellite monitoring and therefore the degree of control of their activities is less than for the industrial fleet and checks at sea are not frequent. The existing control system is therefore implemented and has the capacity to enforce the rules and regulations of the management system mainly on land, but not at sea.		

<table>
<tr><td colspan="2">PI 3.2.3</td><td colspan="3">Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.</td></tr>
<tr><td></td><td></td><td colspan="3">From the point of view of regulation, there is a NATIONAL ACTION PLAN TO PREVENT, DISCOURAGE AND ELIMINATE UNREGULATED AND UNREGULATED ILLEGAL FISHING (INDNR FISHING PAN-EC), in addition to the regulations to the fisheries law. This PAN includes the actions and procedures for control, monitoring and prosecution of illegal fishing activities.

Despite this, the European Union has given Ecuador a warning, in the form of a Yellow Card, in September 2019. This notice is since, according to the EU, the current legal framework is outdated and does not comply with international and regional standards applicable to the conservation and management of fisheries resources.

Furthermore, the implementation of the law is hampered by this outdated legal framework, ineffective administrative procedures and lenient treatment of violations. As a result, the system of sanctions is neither depriving offenders of the benefits derived from IUU fishing nor is it dissuasive. It considers that there are serious shortcomings in terms of control, especially in the tuna fishing and processing industries, undermining the reliability of the traceability system on which the certification of the legality of catches is based.

Ecuador is in the process of approving a new Fisheries Law that would provide solutions to existing problems, but it has not yet been approved and therefore implemented. Therefore, SG60 would not be fulfilled for this YES.

This element met SG60, but not SG80</td></tr>
<tr><td>b</td><td colspan="4">Sanctions</td></tr>
<tr><td></td><td>Guidepost</td><td>Sanctions to deal with non-compliance exist and there is some evidence that they are applied.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>N</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Articles No 64 et seq. of the Fisheries Act define the causes of the infringements and the various penalties depending on the seriousness of the infringements. Thus, there are fines; temporary suspension of the benefits they enjoy; suppression of such benefits; confiscation of the fishing; and imprisonment. According to the seriousness of the offence, one or more of the penalties indicated will be applied.

According to the information provided, most of the sanctions are due to failure of satellite devices. Since there is an inspection on land at the time of landing, the number of infringements is very low, however, there is no effective control at sea so there is no information on infringements during the extractive activity and therefore no record of sanctions.

According to information from the Undersecretariat of Fisheries Resources in 2018, 1800 files were opened for irregularities related to fishing activity, of which 40% reached a fine. In the case of Mahi mahi there have only been three serious cases between 2017 and 2019.

However, the yellow card imposed by the European Union has as one of the main arguments for its application, that the administrative processes derived from the infringements are ineffective and lenient and as a result, the system of sanctions is not depriving the offenders of the benefits derived from IUU fishing nor is it dissuasive.

The proposed Fishing Law currently being debated in Ecuador will modify the legal framework related to infractions and sanctions, but this law has not yet been approved.</td></tr>
</table>

PI 3.2.3		**Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.**		
		Therefore, **this element does not met the SG80**		
c	Compliance			
	Guidepost	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	Y	Y	N
	Justification	According to the information provided by the National Directorate of Fishery Control of the Undersecretariat of Fishery Resources, there are no serious problems of infractions in this fishery. The satellite monitoring system is effective and serious infringements are hardly recorded However, small vessels (fibres) do not have satellite monitoring. In addition, checks at sea are carried out on board small boats, in the first 6-8 miles of the coast and not where the mother ships fish. The Mahi Mahi Fisheries Advisory Committee gives fishermen the opportunity to contribute their knowledge and information to feed the management system. In addition, there is an observer program for the longline fleet of the Undersecretariat of Fisheries Resources that provides relevant information that is used as a basis for the mahi mahi stock assessments. Although its coverage does not cover 100% of the activity. **This element met SG80, but not SG100**		
d	Systematic non-compliance			
	Guidepost		There is no evidence of systematic non-compliance.	
	Met?		N	
	Justification	There is no evidence of systematic non-compliance by both artisanal and industrial fishermen in this fishery. The number of sanctions is low, and they are not considered as serious faults that imply economic sanctions to the fishermen. Most of them do not involve the immobilization of the vessel which would be the most serious misconduct. However, the yellow card imposed by the European Union has as one of the main arguments for its application, that the administrative processes derived from the infringements are ineffective and lenient and as a result, the system of sanctions is not depriving the offenders of the benefits derived from IUU fishing nor is it dissuasive. In addition, the lack of control over activity at sea does not ensure that control is effective in determining that systematic non-compliance exists. Therefore, **this element does not met the SG80**		
References		Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador PLAN DE ACCION NACIONAL PARA PREVENIR, DESALENTAR Y ELIMINAR LA PESCA ILEGAL NO DECLARADA Y NO REGLAMENTADA (PAN PESCA INDNR- Ec) Ministerio de Agricultura, Ganadería, Acuacultura y Pesca - Viceministerio de Acuacultura y Pesca		

PI 3.2.3	Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.
	PLAN NACIONAL DE CONTROL PESQUERO, SUBSECRETARÍA DE RECURSOS PESQUEROS. 2018 REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 https://ec.europa.eu/fisheries/sites/fisheries/files/illegal-fishing-overview-of-existing-procedures-third-countries_en.pdf https://ec.europa.eu/commission/presscorner/detail/en/QANDA_19_6037
OVERALL PERFORMANCE INDICATOR SCORE:	**65**
CONDITION NUMBER (if relevant):	**15**

Evaluation Table for PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Evaluation coverage			
	Guidepost	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	Y	Y	Y
	Justification	PAN DORADO is the main management tool for the mahi mahi fishery in Ecuador. The PAN is a management guidelines document that includes mechanisms to improve information on the fishery and to have more solid criteria for decision making. The management measures for mahi mahi in Ecuador are the minimum sizes and closed seasons published before the NAP and collected by the NAP as the main management tools. Through the Advisory Council established under this Plan, new management mechanisms or modifications to existing ones are proposed and discussed and subsequently implemented through the publication of new rules. The PAN DORADO includes a procedure for its periodic evaluation every 5 years. Currently, this process is being carried out including all parts of the specific management system of the fishery. Among the strategies of the PAN DORADO stands out the adaptive management for its execution, in such a way that it is possible to make periodic evaluations of its level of execution, hierarchization of objectives and reassignment of priorities to the components related to monitoring, control, management, reduction of the impact on the marine ecosystem and education. Therefore, **this SI met a score of SG100**.		
b	Internal and/or external review			
	Guidepost	The fishery-specific management system is subject to **occasional internal** review.	The fishery-specific management system is subject to **regular internal** and **occasional external** review.	The fishery-specific management system is subject to **regular internal** and **external** review.
	Met?	Y	Y	N
	Justification	The PAN DORADO contemplates that it should be externally evaluated every 5 years. In 2013, a mid-term evaluation was carried out to determine its degree of implementation and effectiveness. The final evaluation of the first implementation period should have been carried out in 2015, however, this evaluation is currently underway. These processes are participatory with all the actors of the fishery involved including scientists, the country's fishery administration, fishermen and civil society. This process is carried out by contracting an external consultancy for this purpose. Therefore, if it is considered that there is a regular internal review. On the other hand, there is no regular mechanism in place for external review of the fisheries management framework. However, occasionally, the main elements of management related to the status of the stock are discussed between scientists from Ecuador and Peru. In addition, within the framework of the IATTC, the Mahi mahi Technical		

PI 3.2.4		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**
		Meetings are occasionally held in which agreements have been discussed and reached to improve the management of the mahi mahi stock at the regional level. For all these reasons, it is considered that the management system is subject to regular internal and occasional external reviews, which is why **this SI met SG80, but not SG100**.
References		Acuerdo Ministerial N.º 023 de 14 de febrero de 2011 mediante el cual se establece el Plan de Acción Nacional para la Conservación y Manejo del Recurso Dorado de Ecuador REGLAMENTO A LA LEY DE PESCA Y DESARROLLO PESQUERO. Decreto Ejecutivo 3198. Registro Oficial 690 de 24-oct.-2002. Ultima modificación: 19-feb.-2016 Reuniones Técnicas de DORADO – CIAT: https://www.iattc.org/Meetings/Meetings2015/DOR-02/pdfs/Docs/_Spanish/DOR-02-RPT_2a-Reunion-Tecnica-sobre-el-dorado.pdf https://www.iattc.org/Meetings/Meetings2015/DOR-02/2ndTechnicalMeetingDoradoSPN.htm https://www.iattc.org/Meetings/Meetings2014/DOR-01/1stTechnicalMeetingDoradoSPN.htm
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		**N/A**

Appendix 1.2 Risk Based Framework (RBF) Outputs

(REQUIRED FOR ALL REPORTS WHERE THE RBF HAS BEEN USED)

1.1.1 Appendix 1.2.1 Consequence Analysis (CA) for Principle 1

N/A

1.1.2 Appendix 1.2.2 Productivity-Susceptibility Analysis (PSA)

As mentioned in Section 4.4.4 – Risk Based Framework, in order to be able to have a preliminary score for P2, the assessment of the two Main Secondary species (the pelagic thresher shark, *Alopias pelagicus* and the blue shark, *Prionace glauca*) was carried out as a "desk-approach" RBF, using only the information available to the team, and not being able to take into account the multi-stakeholder approach of the RBF. The results obtained for these two species (see **Tables 1.2.2a** and **1.2.2.1**), therefore, are preliminary.

Table 1.2.2.a. PSA Rationale Table

PI number	**2.2.1**	
A. Productivity		
Scoring element (species)	**Pelagic thresher (*Alopias pelagicus*)**	
Attribute	**Rationale**	**Score**
Average age at maturity.	Females are 8.0-9.2 years of age at maturity and males 7.0-8.0 (Liu et al., 1999; https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/) In a study were age and growth parameters were estimated for Eastern Indian Ocean *A. pelagicus* from growth-band counts of thin-cut vertebral sections, age at maturity was calculated to be 10.4 and 13.2 years for males and females, respectively (Drew et al., 2015)	**2**
Average maximum age	The pelagic thresher is known to live up to 16 years in the wild (https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/). Extrapolating growth rates for exceptionally large sharks show that large females may be 28.5 years old, while large males may be significantly younger (17.5 years) (Liu et al., 1999). In a study were age and growth parameters were estimated for Eastern Indian Ocean *A. pelagicus* from growth-band counts of thin-cut vertebral sections, the highest age estimation for male and female *A. pelagicus* was 24 years (Drew et al., 2015). From this information, the score would be 2 or 3, therefore, to be precautionary, a score of 3 (high risk for >25 years) was chosen.	**3**
Fecundity	The number of embryos per litter is usually two (Liu et al., 1999) and rarely only one (https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/)	**3**
Average maximum size	This species has been recorded to reach 500 cm, but this figure is questionable and may have resulted from confusion with other	**3**

	threshers. Most pelagic threshers are less than 330 cm and 88.4 kg. (https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/) In a study were age and growth parameters were estimated for Eastern Indian Ocean *A. pelagicus* from growth-band counts of thin-cut vertebral sections, total maximum length for male and female *A. pelagicus* was 3166 and 3250mm LT, respectively (Drew et al., 2015).	
Average size at maturity	Females measure 282-292 cm at maturity and males 267-276 cm (Liu et al., 1999; https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/) In a study were age and growth parameters were estimated for Eastern Indian Ocean *A. pelagicus* from growth-band counts of thin-cut vertebral sections, average size at maturity was 282.5-296.9 cm and 263.3-305.5 cm for for females and males, respectively (Drew et al., 2015).	**3**
Reproductive strategy	Development is through aplacental viviparity. Embryos are nourished from the yolk sac in early development but later in development they feed on ovulated eggs (termed 'oophagy'), with only one young born per uterus. (https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/)	**3**
Trophic level	4.5 (https://www.fishbase.de/summary/Alopias-pelagicus.html)	**3**
B. Susceptibility		
Fishery only where the scoring element is scored cumulatively	[Insert list of all the fisheries impacting the given scoring element, as required in PF4.4.3].	
Attribute	**Rationale**	**Score**
Areal Overlap	*A. pelagicus* is a species found in the Indian and Pacific Oceans. (https://www.fishbase.de/summary/Alopias-pelagicus.html; https://www.cms.int/sharks/sites/default/files/document/cms_sharks-mos3_inf.15j_thresher%20sharks_e_0.pdf; https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/alopias-pelagicus/)	**1**
Encounterability	The type of gear used to fish mahi mahi is the doradero (thin surface longline), whose hooks are set around 9-14 m depth (Martínez-Ortíz & Zúñiga-Flores, 2012). In Ecuador, the fleet operates in oceanic waters (see **Figure 3.2.2.2**). *A. pelagicus* is an epipelagic species, occurring in the upper parts of the water column, but their depth range can extend to deeper (500–750 m) water. It is often associated with oceanic habitats, shelf sea habitats and may occur in shallower water close to land. (https://www.cms.int/sharks/sites/default/files/document/cms_sharks-mos3_inf.15j_thresher%20sharks_e_0.pdf).	**2**
Selectivity of gear type	Length at maturity for *A. pelagicus* ranges from 263 up to 305 cm (Liu et al., 1999; Drew et al., 2015). Bearing in mind that mahi mahi maximum length is 2m, and usually 1 m (Martínez-Ortíz & Zúñiga-Flores, 2012), it means that pelagic threshers which are half the size at maturity (i.e., approximately 130-150 cm) are retained by the doradero.	**3**
Post capture mortality	Score = 3 as default score for retained species (Principle 1 or Principle 2). (FCP v2.1, Table PF5: PSA susceptibility attributes and scores)	**3**

Catch (weight) only where the scoring element is scored cumulatively	N/A	

PI number	**2.2.1**	
A. Productivity		
Scoring element (species)	**Blue shark (*Prionace glauca*)**	
Attribute	**Rationale**	**Score**
Average age at maturity.	Males and females in the North Pacific reach sexual maturity at estimated ages of 5 and 6 years, respectively (Nakano 1994, within Wells et al., 2016).	**2**
Average maximum age	Longevity of blue sharks is estimated at 20–26 years (Skomal and Natanson 2003 - within Wells et al., 2016). In the central South Pacific Ocean, the longevities were estimated to be at least 16.8 and 21.6 years for females and males, respectively (Joung et al., 2018).	**2**
Fecundity	The female gives birth up to 80 young (https://www.fishbase.de/summary/Prionace-glauca.html). In the southeastern Pacific Ocean, a study found that the litter size varied from 13 to 68 (Zhu et al., 2011).	**3**
Average maximum size	In the central South Pacific Ocean, the theoretical maximum length for females, is 330.4 cm, and for males, 376.6 cm (Joung et al., 2018). In the North-west Atlantic Ocean a maximum size of 383 cm TL (320 cm FL) was reported (Bigelow and Schroeder 1953 - within Wells et al., 2016).	**3**
Average size at maturity	Growth studies have documented size-at-maturity of 200 cm total length for both sexes in the North Pacific (Suda 1953; Nakano et al. 1985; Nakano and Seki 2003 – within Wells et al., 2016).	**2**
Reproductive strategy	It is a viviparous species (https://www.fishbase.de/summary/Prionace-glauca.html; https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/prionace-glauca/).	**3**
Trophic level	4.4 (https://www.fishbase.de/summary/Prionace-glauca.html).	**3**
B. Susceptibility		
Fishery only where the scoring element is scored cumulatively	[Insert list of all the fisheries impacting the given scoring element, as required in PF4.4.3].	
Attribute	**Rationale**	**Score**
Areal Overlap	The blue shark *Prionace glauca* is a pelagic shark species that has a circumglobal distribution in tropical, subtropical and temperate waters (Compagno 1984 within Joung et al., 2018)	**1**
Encounterability	The type of gear used to fish mahi mahi is the doradero (thin surface longline), whose hooks are set around 9-14 m depth (Martínez-Ortíz & Zúñiga-Flores, 2012). In Ecuador, the fleet operates in oceanic waters (see **Figure 3.2.2.2**). Being a pelagic species, the blue shark's habitat consists of open ocean areas from the surface to 1,148 ft (350 meters) in depth. (https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/prionace-glauca/) When in the tropics the blue shark seeks deeper waters with	**2**

	cooler temperatures (Stevens, 2009).	
Selectivity of gear type	Length at maturity for *P. glauca* is 200 cm total length for both sexes in the North Pacific (Suda 1953; Nakano et al. 1985; Nakano and Seki 2003 – within Wells et al., 2016). Bearing in mind that mahi mahi maximum length is 2 m, and usually 1 m (Martínez-Ortíz & Zúñiga-Flores, 2012), it means that pelagic threshers which are half the size at maturity (i.e., approximately 100 cm) are retained by the doradero.	**3**
Post capture mortality	Score = 3 as default score for retained species (Principle 1 or Principle 2). (FCP v2.1, Table PF5: PSA susceptibility attributes and scores)	**3**
Catch (weight) only where the scoring element is scored cumulatively	N/A	

Following the PF4.5 of FCP v2.1, the team used the "MSC RBF Worksheets" to calculate the overall productivity and susceptibility score (PSA score) and the equivalent MSC scores for each scoring issue.

The result obtained can be found in the following Table (**1.2.2.1**):

Table 1.2.2.1 PI 2.2.1 score summary using the RBF (following PF4.5 of FCP v2.1).

Species	MSC PSA-derived score	Risk Category Names	MSC scoring guidepost	PI score
Alopias pelagicus	68	Med	60-79	**70**
Prionace glauca	75	Med	60-79	

Appendix 1.3 Conditions

(REQUIRED FOR ALL REPORTS WHERE CONDITIONS ARE NEEDED FOR CERTIFICATION)

As seen in section 6.2 – Summary of PI Level scores, 14 PIs do not reach a score of 80: PI 1.2.3, 1.2.4, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.3.2, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.2.3.

In accordance to FCR 7.21.2, 14 conditions for these PIs would have had to be opened to provide an indication of the actions that may have been required should the fishery have been certified. However, as it is not recommended to award the MSC certificate to this fishery, no conditions have been opened.

Appendix 2 Peer Review Reports

(PCDR AND ALL SUBSEQUENT REPORTS)

The report shall include the unattributed reports of the peer reviewers in full using the 'MSC peer review template' available on the MSC website forms and templates page here.

The report shall also include the explicit responses of the team that include:

a. Identification of specifically what (if any) changes to scoring, rationales, or conditions have been made.
b. A substantiated justification for not making changes where peer reviewers suggest changes but the team makes no change.

[*Note that if undertaking peer reviews before Peer Review College is operational; CABs shall ensure that the 'Contact information' table in the Peer Review report is removed before inserting in this report.*]

(Reference: FCR 7.14.11 and sub-clauses)

Appendix 3 Stakeholder submissions

1. The report shall include:

a. All written submissions made by stakeholders during consultation opportunities listed in FCR 7.15.4.1.
b. All written and a detailed summary of verbal submissions received during site visits regarding issues of concern material to the outcome of the assessment *(Reference FCR 7.15.4.2)*
c. Explicit responses from the team to stakeholder submissions included in line with above requirements *(Reference: FCR 7.15.4.3)*

Nothing was sent out prior to publication and no report was published.

Appendix 4 Surveillance Frequency

1. The report shall include a rationale for any reduction from the default surveillance level following FCR 7.23.4 in Table 4.1.
2. The report shall include a rationale for any deviations from carrying out the surveillance audit before or after the anniversary date of certification in Table 4.2
3. The report shall include a completed fishery surveillance program in Table 4.3.

Table 4.1 : Surveillance level rationale

Year	Surveillance activity	Number of auditors	Rationale
e.g.3	*e.g.On-site audit*	*e.g. 1 auditor on-site with remote support from 1 auditor*	*e.g. From client action plan it can be deduced that information needed to verify progress towards conditions 1.2.1, 2.2.3 and 3.2.3 can be provided remotely in year 3. Considering that milestones indicate that most conditions will be closed out in year 3, the CAB proposes to have an on-site audit with 1 auditor on-site with remote support – this is to ensure that all information is collected and because the information can be provided remotely.*

Table 4.2: Timing of surveillance audit

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
e.g. 1	*e.g. May 2014*	*e.g. July 2014*	*e.g. Scientific advice to be released in June 2014, proposal to postpone audit to include findings of scientific advice*

Table 4.3: Fishery Surveillance Program

Surveillance Level	Year 1	Year 2	Year 3	Year 4
e.g. Level 5	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit & re-certification site visit*

Appendix 5 Objections Process

(REQUIRED FOR THE PCR IN ASSESSMENTS WHERE AN OBJECTION WAS RAISED AND ACCEPTED BY AN INDEPENDENT ADJUDICATOR)

The report shall include all written decisions arising from an objection.

(Reference: FCR 7.19.1)