



FISHERY IMPROVEMENT PROJECT

**PROGRESS REPORT
- SECOND YEAR -**



DECEMBER 2020

Guayaquil - Ecuador

Report prepared by:

Jimmy Anastacio, National Chamber of Fisheries of Ecuador
Viviana Jurado, National Fisheries Institute of Ecuador
Gabriela Ponce, Small Pelagics Sustainability - Fishery Improvement Project
Karina Solis, Small Pelagics Sustainability - Fishery Improvement Project
Teddy Escarabay, Sustainable Fisheries Partnership
Tito Navia, Global Marine Commodities Project
Carolina De La Torre, Global Marine Commodities Project

Updated March 2021

Table of contents

Figures and tables	4
Acronyms	6
1. Introduction	7
1.1 Background	7
1.2 Date SPS-FIP launched	8
1.3 Name of Species – common and Latin name of the species	8
1.4 Summary of Fishery Action Plan objectives	9
1.5 Last MarinTrust IP assessment	9
1.6 Reporting period	9
2. Fishery action plan (FAP) - Progress report	10
FAP milestones resume.....	10
2.1 FAP Objective 1: Decision making process on fishery management is transparent, inclusive and participatory.....	16
2.1.1 Improvement recommendation	16
2.1.2 Activities and results	16
2.1.2.1 Support legislation to improve the legal framework of the participatory decision-making process	16
2.1.2.2 FAP Activity 1.4 Attend Sustainable Marine Commodities Platform meetings to discuss harvest control rules, CMMs related to ETP interactions and ecosystem impacts, and other management issues.....	18
2.2 FAP Objective 2: Fishery data, species, habitats, and environmental information is collected, published and publicly available	32
2.2.1 Improvement recommendations.....	32
2.2.2 Activities and results	32
2.2.2.1 FAP Activity 2.1: Establish an office with equipment and a research team which will develop a research program in order to assess both the small pelagic fish stocks and the fishery impacts on ETP species and the ecosystem.....	32
2.2.2.2 FAP Activity 2.2: Review and evaluate all the historical information / data related to the Ecuadorian small-scale fishery existing at the INP.	33
2.2.2.3 FAP Activity 2.3: Recollect all the relevant legislation and normative related to the Ecuadorian small pelagic fishery.....	33
2.2.2.4 FAP Activity 2.4: Design a research project in order to define and conduct stocks assessment models, which may take into consideration oceanographic particularities.	34
2.2.2.5 FAP Activity 3.1: Implement electronic logbooks for all the industrial boats targeting small pelagic, including interaction with ETPs.	44

2.2.2.6	Develop a system, endorsed by the research team, to calculate withdrawals (catches per specie).	52
2.2.2.7	FAP Activity 4. Establish a biological data gathering system through the observers' program.	52
2.3	FAP Objective 3: Stock assessments of relevant species to the fishery are conducted on regular bases, following scientific methodology and their results are published and publicly.	53
2.3.1	Improvement recommendations.	53
2.3.2	Activities and results	53
2.3.2.1	FAP Activity 5.1.1 - 5.1.9: Establish a periodic stock assessments system	53
2.3.2.2	Ensure the stock assessments are made publically available.	61
2.4	FAP Objective 4. Management Measures (CMMs) are adopted by fishery managers accordingly to the Stock Assessments outcomes and recommendations.	61
2.4.1	Improvement recommendations.	61
2.4.2	Activities and results	62
2.4.2.1	FAP Activity 7. Identify and establish biological reference points (target and limit) as well as related Harvest Control Rules, based on data already available and results of the 1st Stock Assessment for this specie.	62
2.5	Further impacts.	65
2.5.1	Improvement recommendations.	65
2.5.2	Activities and results	66
2.5.2.1	FAP Activity 3.1. Fishery interactions with ETP are registered by concerned fleets and managers adopt CMMs accordingly. Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs.	66
2.5.2.2	FAP Activity. 14.1 ETP Assessment developed on yearly bases and available publicly	67
2.5.2.3	FAP Activity. 14.2 CMMs related to ETP based on existing assessment adopted by managers	68
2.5.2.4	FAP Activity. 19. Provide evidence that habitat interactions are minimal	70
2.5.2.5	FAP Activity. 15.1 - 16.1 Ecosystems Impact Assessment developed and available publicly	72
2.5.2.6	FAP Activity. 15.2 - 16.2 CMMs related to Ecosystem Impact based on existing assessment adopted by managers.	72
3.	References	77
4.	Annexes	79

Figures and tables

Table 1. Species covered by SPS-FIP	8
Table 2. Summary of FAP objectives.....	9
Table 3. Milestone status.....	10
Table 4. SPS-FIP: FISHERY ACTION PLAN TRACKING, Dec 2020. (1/2)	14
Table 5. SPS-FIP: FISHERY ACTION PLAN TRACKING, until Dec 2020. (2/2)	15
Table 6. SPFDLP meeting in 2020 and total attendees. Source: GMC.....	19
Table 7. Prioritization criteria for the determination of key species in the small pelagic fishery of Ecuador. Source: GMC (2020)	19
Table 8. Management importance - scores range. Source: GMC (2020).....	20
Table 9. Results of participatory prioritization of small pelagic species. Source: GMC (2020)	21
Table 10. NPOA MLG-1 Objective. Have a legal framework that includes long-term objectives and operational objectives of the fishery.	25
Table 11. NPOA MLG-2 Objective. Have a defined governance scheme that establishes procedures that promote stakeholder participation.	25
Table 12. NPOA IMO-1 Objective. Have adequate information to support the management strategy.	26
Table 13. NPOA SCV-1 Objective. Ensure that the management and conservation measures of Ecuador's small pelagic fishery are applied and complied, while avoiding or minimizing IUU fishing.	28
Table 14. Small pelagic fishery management plan.	30
Table 15. Stock assessment models. Source: Canales <i>et al</i> (2020) and Canales <i>et al</i> (2019)	41
Table 16. SPS-FIP Guidelines designed for responsible fishing training process. Source: SPS-FIP	43
Table 17. Number of electronic logbooks generated by SPS-FIP fleet	47
Table 18. BEP success rate by SPS-FIP fleet. Source: SPS-FIP	48
Table 19. List of trained captains during electronic logbook implementation (August-December 2020). Source: SPS-FIP	49
Table 20. Comparative table of the diagnostic indicators of the small pelagic stocks of Ecuador 2019-2020. B / B0 values greater than 0.4 are highlighted in bold. Source: Canales <i>et al</i> (2020)	60
Table 21. Biological Reference Points of the 6 main species of small pelagic fish in Ecuador. As proxy for RMS, the criterion 40% of B0 is considered. Source: Canales (2020)	62
Table 22. Prioritization of small pelagic species. Source: Canales (2020)	63
Table 23. Conditions with stabilizer to adjust the fishing effort in the small pelagic fishing fleet of Ecuador. Source: Canales (2020).	64
Table 24. Total fishing closure days per year in the small pelagic fishery (2017-2020). Elaborated by SPS-FIP staff.	65
Table 25. Species, interactions, interaction rate per trip, and IUCN red list status of different species. The species with status VU, EN and CR are categorized as ETP. Source: Jurado <i>et al</i> (2020)	67
Table 26. FMP objective and activities related to ETP species.	70
Table 27. FMP objective and activities related to habitat.	70
Table 28. NPOA, activities related to fishery research	73
Table 29. Small pelagic fishery management plan.	74

Figure 1. SPFDLP structure. Source. GMC (2020)	17
--	----

Figure 2. Results of Eighth dialogue table: Validation of the Management Plan. Source: GMC	24
--	----

Figure 3. Screenshot of BEP login web platform, administrative interface. Source: http://bitacora.produccion.gob.ec/bitacora/	44
Figure 4. Support material designed for captain training. “How electronic logbook works?” (1/2). Source: SPS-FIP.....	45
Figure 5. Support material designed for captain training. “How electronic logbook works?” (2/2). Source: SPS-FIP.....	46
Figure 6. Catches by species and month. Source: BEP System (period August 8 until December 15, 2020)	48
Figure 7. Catches by month and day. Source: BEP System (period August 8 until December 15, 2020)	49
Figure 8. BEP sampling analysis. Fishing sets (red/green crosses) and tracking (blue lines). Elaborated by SPS-FIP staff.....	50
Figure 9. Kobe plot for frigate tuna. Source: Canales et al (2020).....	54
Figure 10. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of frigate tuna assessment. Source: Canales et al (2020).....	54
Figure 11. Kobe plot for pacific chub mackerel. Source: Canales et al (2020).....	55
Figure 12. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of pacific chub mackerel assessment. Source: Canales et al (2020)	55
Figure 13. Kobe plot for pacific anchoveta. Source: Canales et al (2020)	56
Figure 14. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of pacific anchoveta assessment. Source: Canales et al (2020)	56
Figure 15. Kobe plot for thread herring. Source: Canales et al (2020)	57
Figure 16. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of thread herring assessment. Source: Canales et al (2020)	57
Figure 17. Kobe plot for shortfin scad. Source: Canales et al (2020).....	58
Figure 18. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of shortfin scad assessment. Source: Canales et al (2020)...	58
Figure 19. Kobe plot for round herring. Source: Canales et al (2020)	59
Figure 20. Log recruitment anomalies, virginal spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of round herring assessment. Source: Canales et al (2020) .	59
Figure 21. Type of interaction, the species with the highest number of interactions with the fishery during 2019 are shown. Source: Jurado et al (2019)	68
Figure 22. Main areas of concentration of fishing sets and seabed type during 2019. Source: Jurado et. al (2019)	72

Acronyms

CNP	National Chamber of Fisheries
FAP	Fishery Action Plan
FMP	Fishery Management Plan
HCR	Harvest Control Rules
IPIAP	Public Institute for Aquaculture and Fisheries Research (formerly INP)
GMC	Global Marine Commodities Project
MAE	Ministry of Environment of Ecuador
MCPEIP	Ministry of Production, Foreign Trade, Investment and Fisheries of Ecuador
NPOA	National Plan of Action
SFP	Sustainable Fisheries Partnership
SMCP	Sustainable Marine Commodities Platform
SPFDP	Small Pelagic Fishery Dialogue Platform
SPS-FIP	Small Pelagic Sustainability Fishery Improvement Project
SRP	Undersecretariat of Fisheries Resources
UNDP	United Nations Development Programme
VAP	Vice Ministry of Aquaculture and Fisheries

1. Introduction

1.1 Background

The Ecuadorian small pelagic fishery is economically and socially important for the country. Industrial fishing began in the 1950s, but only started to grow into a substantial activity in the 1970s. Total reported landings reached a peak of nearly 1 million tonnes in the mid-1980s, but in recent years have generally fluctuated between 200,000-300,000t. The catches are influenced by oceanographic and environmental variables, both in terms of total volume but also catch composition (De la Cuadra, 2010; Ormaza Gonzales et al, 2016). There is extensive evidence to indicate that there is high natural variability in the relative sizes of the stocks targeted by the fishery, and therefore their relative prevalence in landings. Natural variability also affects whether certain species occur in the catch at all.

De la Cuadra (2010) point out that in front of the Ecuador, the small pelagic fish species landed by the industrial fleet are strongly influenced by the short-term thermal changes that occur in the ocean, such as the warm and cold phase of the ENSO cycle (El Niño / Southern Oscillation). While, Ormaza Gonzalez et al. (2016), analyzing the landings of small pelagic species between 1981 and 2012 and comparing them with different oceanographic indices such as ONI, MEI and PDO, point out that in the long-term fluctuations the small pelagic landings decrease under a warm PDO and increase of a cold PDO.

According to Ormaza, Anastacio&Velasco (2019), exports of small pelagic fishery products averaged around US\$235 million per year between 2015-2017, and generates employment for around 25 thousand people. In small pelagic fishery, the most relevant supply chain is the production of marine ingredients. Fishmeal is the second most important fishing product in Ecuador, but frozen production is having a growing dynamic.

In this context, shipowners and producers know that the only way to guarantee their companies, employees and families a future is through sustainable fishing. The same happens in the market, the global awareness of sustainability is growing, which generates even greater responsibility among supply chain stakeholders, including governments.

But the insufficient economic resources allocated to fishery research by the Ecuadorian government represent an important challenge, in terms of greater knowledge of the state of exploitation of these resources. This is also a challenge to the industry's efforts to move towards sustainability certification.

In a historical moment when producers and customers demand sustainability, it was a call to action to promote from the industry itself the changes that the fishery needs.

Since 2016, various actions of stakeholders in the supply chain have converged towards the search for sustainability of the small pelagic fishery.

- In 2016, at the National Chamber of Fisheries, created the Small Pelagic Commission to promote the required changes to the government.
- In the same way, the feed producers approached the fishing sector to show their interest to promote sustainability certifications.

- Also, in 2017 the Ecuadorian government prioritized the small pelagic fishery in the Global Sustainable Supply Chains for Marine Commodities Project coordinated by the United Nations Development Program and implemented by Sustainable Fisheries Partnership.

The convergence of these actions created synergies among the different stakeholders in the supply chain that were consolidated in a Fishery Improvement Project.

At the beginning of 2018 with the technical assistance of Sustainable Fisheries Partnership the CNP developed the pre FIP phase. During this phase, the pre-assessment and the working plan were prepared and presented to IFFO RS (now known as MarinTrust). The working plan stablished improvements in science, and governance. Once IFFO RS accepted the working plan into its fishery improvement program, the Small Pelagic FIP started its implementation at the end of 2018.

The project currently coordinates public and private actions in the priority areas identified, together with the fisheries administration, the National Fisheries Institute, and key stakeholders such as National Chamber of Fisheries in Ecuador, the United Nation Development Program and Sustainable Fisheries Partnership (GMC Project).

1.2 Date SPS-FIP launched

The MOU for FIP implementation was signed on August 22, 2018, and the project was accepted in the IFFO Improver Programme (now known as MarinTrust IP) on October 12th of the same year.

1.3 Name of Species – common and Latin name of the species

The scope of the FIP covers the 95% of the catches of the coastal purse seine fleet, which includes the following species:

Table 1. Species covered by SPS-FIP

Common name	Scientific name
Pacific chub mackerel (macarela)	<i>Scomber japonicus</i>
Frigate tuna (botellita)	<i>Auxis spp.</i>
Shortfin scad (picudillo)	<i>Decapterus macrosoma</i>
Largedhead hairtail (corbata)	<i>Trichiurus lepturus</i>
Thread herrings (pinchagua)	<i>Opisthonema spp.</i>
Pacific anchoveta (chuhueco)	<i>Cetengraulis mysticetus</i>
Pacific cornetfish (trompeta)	<i>Fistularia corneta</i>
Round herring (sardina redonda)	<i>Etrumeus acuminatus</i>
Yellowstripe grunt (roncador)	<i>Haemulopsis axillaris</i>
Longnose anchovy	<i>Anchoa nasus</i>
Pacific harvestfish (pámpano)	<i>Peprilus medius</i>
Drums (barriga juma)	<i>Larimus spp.</i>
Jack Mackerel (jurel)	<i>Trachurus murphyi</i>

It is important to note not all species are used for fishmeal production according to Ecuadorian law and not all are classified as small pelagic fish.

1.4 Summary of Fishery Action Plan objectives

According to the FAP approved, the objectives of the fishery improvement project are:

Table 2. Summary of FAP objectives

6 months	1. Decision making process on fishery management is transparent, Inclusive and participatory 2. Fishery data, species, habitats and environmental information is collected, published and publicly available.
1 year	3. Stock assessments of relevant species to the fishery are conducted on regular bases, following scientific methodology and their results are published and publicly available. 4 Conservation and Management Measures (CMMs) are adopted by fishery managers accordingly to the Stock Assessments outcomes and recommendations
2 years	3. Stock assessments of relevant species to the fishery are conducted on regular bases, following scientific methodology and their results are published and publicly available. 4 Conservation and Management Measures (CMMs) are adopted by fishery managers accordingly to the Stock Assessments outcomes and recommendations 5. Fishery interactions with ETP are registered by concerned fleets and managers adopt CMMs accordingly
3 years	3. Stock assessments of relevant species to the fishery are conducted on regular bases, following scientific methodology and their results are published and publicly available.

Updated FAP is detailed in Annex 1.

1.5 Last MarinTrust IP assessment

The last MarinTrust IP assessment covered the activities realized by the SPS-FIP since its acceptance into the Improver Programme on October 12th, 2018 until December 31st, 2019.

The report and results of the assessment are detailed in the following links:

- [Ecuadorian small pelagics FIP - 1 year report](#)
- [Ecuadorian small pelagics FIP - 1 year Milestone review](#)

1.6 Reporting period

This progress report covers the activities realized by the SPS-FIP since January 1st, 2020 until December 31st, 2020.

2. Fishery action plan (FAP) - Progress report

FAP milestones resume

Table 3. Milestone status

Activities	Milestone status	Evidence detailed in progress report:
1.1 Identify all members that will participate on the " Sustainable Marine Commodities Platform" (Intersectional working group), with membership composed of the public and private sector stakeholders directly concerned by the small pelagics fishery, and established by the Article number 7 of the Ministerial Agreement N 047 of April 9th, 2010.	First year Milestone completed	First-year Progress report section 2.1.3 Annex 4.1.1: "Root Cause Analysis for the small pelagic fishery in Ecuador" "Analysis on the establishment of the platform" Annex 4.1.2.: Summary of the technical meeting-SMCP Structure
1.2 Develop a statute or norm defining the way on which the referred "Sustainable Marine Commodities Platform" will operate.	First year Milestone completed	First-year Progress report section 2.1.4 Annex 4.2: Summary of the technical meeting-participation requirements of stakeholders
1.3 Define a calendar for yearly regular meetings, the standard agenda of items to be discussed and specify, at least, the next two meetings dates.	First year Milestone completed	First-year Progress report section 2.1.5 Annex 4.3 SMCP calendar
1.4.1 Participate in the launch of the Sustainable Marine Commodities Platform (SMCP)	First year Milestone completed	First-year Progress report section 2.1.6.1 Annexes 4.4.1 -4.4.2 - 4.4.3 and 4.4.4
1.4.2 Participate in the first SMCP meeting in order to approve its status and its strategic plan	First year Milestone completed	First-year Progress report section 2.1.6.2 1st Steering Committee meeting- 1st review- Annexes 4.5.1 and 4.5.2
1.4.3 Participate in the second SMCP meeting in order to discuss Small Pelagic Harvest Control Rules (HCR)	Second year Milestone completed	Second-year Progress report section 2.1.2.2 Annex 4. GMC report - SPFDP meetings http://pesqueriassostenibles.produccion.gob.ec/plataforma-de-pelagicos-pequenos/#1549424427385-86c0e7e1-2747
2.1 Establish an office with equipment and a research team which will develop a research program in order to assess both the small pelagic fish stocks and the fishery impacts on ETP species and the ecosystem. *	First year Milestone completed	First-year Progress report section 2.2.2.1 Second-year Progress report section 2.2.2.1 Annex 2. Agreements for public-private cooperation Annex 5. Technical staff
2.2 Review and evaluate of all the historical information / data related to the Ecuadorian small-scale fishery existing at the INP, for scanning it into an electronic format, allowing its further publication on the webpage of the INP and / or CNP. To assure that all the new documentation originated,	First year Milestone completed	First-year Progress report section 2.2.2.2 http://www.smallpelagics.org/fishery-data/ http://www.institutopesca.gob.ec/peces-pelagicos-pequenos/



relevant to the fishery, will be uploaded to the same place, including assessments.		
2.3 Recollect (scanning into electronic format if needed) all the relevant legislation and normative related to the Ecuadorian small pelagics fishery and to place it all together in the web page of the CNP. To ensure all the relevant new issued legislation is uploaded as well.	First year Milestone completed	First-year Progress report section 2.2.2.3 http://www.smallpelagics.org/fishery-data/ http://www.institutopesca.gob.ec/peces-pelagicos-pequenos/
2.4 Design a research project in order to define and conduct stocks assessment models, which may take into consideration oceanographic particularities. This project has to determine the stock structure and its distribution and will be the basis of the management strategy.	First year Milestone completed	First-year Progress report section 2.2.2.4 Second-year progress report section 2.2.2.4
2.5. Support legislation in order to improve the legal framework of the participatory decision making process.	Second year Milestone completed	Second-year Progress report section 2.1.2.1 Annex 3. Participatory decision-making process https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf https://camaradepesqueria.ec/wp-content/uploads/2020/07/ACUERDO-PLATAFORMA-MPCEIP-SRP-2020-0054-A.pdf
3.1 Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs. Research team and the authorized department of the Secretary of Fisheries will receive data automatically from the boat. System will be connected to GPS, so position is part of the provided data.	Second year Milestone completed	Second-year Progress report section 2.2.2.5 Annex 9. Electronic logbook (BEP) http://bitacora.produccion.gob.ec/bitacora/
3.2 Develop a system, endorsed by the research team, to calculate withdrawals (catches per specie) from the artisan fleets operating on the same stocks than the industrial vessels, and to incorporate this data to the stocks assessments or biomass estimations.	First year Milestone completed	First-year Progress report section 2.2.2.6 Annex 10. Artisanal fishery research protocol
4. Establish a biological data gathering system through the observers program. Samples will include, but not limited to, size, maturity, gonads status, stomachs contents, etc. Sampling frequency and size (number of individuals analyzed) will be determined by INP. Samplers will be hired by INP.	First year Milestone completed	First-year Progress report section 2.2.2.7 Annex 10. Artisanal fishery research protocol Annex 11. On board observer program Improvement Second-year Progress report section 2.2.2.7 Annex 11. On board observer program improvement
5.1.1 - 5.1.9 Establish a periodic stock assessments system (every three	First year Milestone completed	First-year Progress report section 2.3.2.1 Annex 7. Stock assessment models for the main small pelagic species



years): To carry out the 1st Stock Assessment		
5.2.1 - 5.2.9 Establish a periodic stock assessments system (every three years): To commit, via agreement with assessors, for the 2nd Stock Assessment.	Second year Milestone completed	Second- year progress report section 2.3.2.1 Annex 7. Stock assessment, Control Rules and Management Plan http://www.institutopesca.gob.ec/wp-content/uploads/2015/11/INFORME-EVAL_STOCK_PP_ECUADOR_2020_WEB.pdf
2.2 Review and evaluate of all the historical information / data related to the Ecuadorian small-scale fishery existing at the INP, for scanning it into an electronic format, allowing its further publication on the webpage of the INP and / or CNP. To assure that all the new documentation originated, relevant to the fishery, will be uploaded to the same place, including assessments.	Recurrent activity	Second-year Progress report section 2.2.2.2 http://www.smallpelagics.org/fishery-data/ http://www.institutopesca.gob.ec/peces-pelagicos-pequenos/
7.1 -7.9 Identify and establish biological reference points (target and limit) as well as related Harvest Control Rules, based on data already available and results of the 1st Stock Assessment for this specie. If Stock Assessment recommends it, to Establish a TAC (Total Admissible Catches).	Second year Milestone completed	Second-year progress report section 2.4.2.1 Annex 7. Stock assessment, Control Rules and Management Plan http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%CC%81a-de-Peces-Pela%CC%81gicos-Pequen%CC%83os.pdf
18.Provide evidence from INP showing that catches are negligible (jack mackerel)	First year Milestone completed	First-year Progress report section 2.2.2.8 Annex 12. Biological fishing aspects of Jack Mackerel (Trachurus murphyi) in Ecuadorian waters
3.1 Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs. Research and the authorized department of the Secretary of Fisheries will receive data automatically from the boat. System will be connected to GPS, so position is part of the provided data.	Second year Milestone completed	Second-year Progress report section 2.2.2.5 Second-year progress report section 2.5.2.1 Annex 9. Electronic logbook (BEP) http://bitacora.produccion.gob.ec/bitacora/ Annex 14.1 ETP Annex 11.1.2 Research protocol for on board observers and biological sampling Annex 8. Guide to the handling and release of marine fauna in the small pelagic fish fishery in Ecuador. https://drive.google.com/file/d/1QnqRjNbl47xw0Sio5znbuJQ2fURMqA7R/view Poster of main marine fauna in Ecuadorian sea. https://drive.google.com/file/d/1Pe2oL-1J1CaKMLmzSjE8lOnVB1cSK7ox/view?usp=sharing Record form for the release of marine fauna for the Ecuadorian small pelagic fishery.



		https://drive.google.com/file/d/18kwwlh6I06KQLQTGzScIsaNcoPrU7AHU/view?usp=sharing Record form for sightings in the small pelagic fishery in Ecuador. https://drive.google.com/file/d/11aP2_RJC8Q7Oag6usLZIPXglTQWQb1bh/view?usp=sharing Identification guide for marine fauna of Ecuador. https://drive.google.com/file/d/1uVYWM52IAQRaANCOJpe1wS5M1f3KB8o/view?usp=sharing
14.1 ETP Assessment developed on yearly bases and available publicly	Second year Milestone completed	Second-year progress report section 2.5.2.2. Annex 14.1.1 ETP
14.2 CMMs related to ETP based on existing assessment adopted by managers	Milestone completed	Second-year progress report section 2.5.2.3 http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%CC%81a-de-Peces-Pela%CC%81gicos-Pequen%CC%83os.pdf https://www.wwf.org.ec/bibliotecavirtual/publicacionesec/?uNewsID=364191 http://acuaculturaypesca.gob.ec/wp-content/uploads/2018/03/3-ACUERDO-196-BALLENAS-RO.pdf https://www.derechoecuador.com/registro-oficial/2014/11/registro-oficial-no-371---lunes-10-de-noviembre-de-2014-suplemento https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf
19. Provide evidence that habitat interactions are minimal	First year Milestone completed	First-year Progress report section 2.5.2.2. Annex 14. Further impacts
15.1 - 16.1 Ecosystems Impact Assessment developed and available publicly	Scheduled, third year milestone	Second-year Progress report section 2.5.2.5.
15.2 - 16.2 CMMs related to Ecosystem Impact based on existing assessment adopted by managers	Scheduled, third year milestone	Second-year Progress report section 2.5.2.6.

Table 4. SPS-FIP: FISHERY ACTION PLAN TRACKING, Dec 2020. (1/2)



Assessment Area	Activities	2018		2019												2020											
		NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC
	2.2 Review and evaluate of all the historical information / data related to the Ecuadorian small-scale fishery existing at the INP, for scanning it into an electronic format, allowing its further publication on the webpage of the INP and / or CNP. To assure that all the new documentation originated, relevant to the fishery, will be uploaded to the same place, including assessments.																										
	7.1 - 7.9 Identify and establish biological reference points (target and limit) as well as related Harvest Control Rules, based on data already available and results of the 1st Stock Assessment for this specie. If Stock Assessment recommends it, to Establish a TAC (Total Admissible Catches).																										
Category C Species. Less than 5% of landings & subject to a species-specific management regime	18. Provide evidence from INP showing that catches are negligible (jack mackerel)																										
Category D Species. Less than	Not Applicable																										
Further Impacts	3.1 Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs. Research and the authorized department of the Secretary of Fisheries will receive data automatically from the boat. System will be connected to GPS, so position is part of the provided data.																										
	14.1 ETP Assessment developed on yearly bases and available publicly																										
	14.2 CMMs related to ETP based on existing assessment adopted by managers																										
	19. Provide evidence that habitat interactions are minimal																										
	15.1 - 16.1 Ecosystems Impact Assessment developed and available publicly																										
	15.2 - 16.2 CMMs related to Ecosystem Impact based on existing assessment adopted by managers																										

For full timeline see annex 1.

Table 5. SPS-FIP: FISHERY ACTION PLAN TRACKING, until Dec 2020. (2/2)

2.1 FAP Objective 1: Decision making process on fishery management is transparent, inclusive and participatory

2.1.1 Improvement recommendation

Ensure stakeholder engagement mechanisms are functional.

2.1.2 Activities and results

2.1.2.1 Support legislation to improve the legal framework of the participatory decision-making process

Since April 21, 2020 and through official Registry No. 187, the Organic Law for the Development of Aquaculture and Fisheries of Ecuador is in force. The purpose of this Law (Article 1) is to *“establish the legal regime for the development of aquaculture and fishing activities in all its phases of extraction, collection, reproduction, breeding, cultivation, processing, storage, distribution, internal and external commercialization, and related activities such as promoting the production of healthy food; the protection, conservation, research, exploitation and use of hydrobiological resources and their ecosystems, through the application of the fisheries ecosystem approach in such a way that sustainable and sustainable development is achieved that guarantees access to food, in harmony with the principles and rights established in the Constitution of the Republic, and respecting traditional and ancestral knowledge and forms of production”*.

In terms of fisheries management, the Organic Law, in its Article 96, states that: *“the fisheries management measures will be established under the principle of governance, sustainability and sustainability of hydrobiological resources, with the greater social, economic and environmental, with an ecosystem approach”*.

Article 97 establishes that: *“For the management of fisheries of hydrobiological resources that are not under the jurisdiction of a regional fisheries management body, the governing body in coordination with the Public Institute for Aquaculture and Fisheries Research, in accordance within the scope of their powers, will establish the management plans”*. In these plans, goals, objectives and terms must be established in the biological, fishing and socioeconomic fields, identifying the strategies and measures for the management, regulation and management of fishing to achieve the proposed objectives, research requirements and consultation mechanisms between the different fishing sectors involved in the fishery, among other elements.

The law establishes governance as a principle: *“it creates the normative and regulatory frameworks; develops short- and long-term policies through conventional forms of administration or through modern forms with participatory decision-making processes; connects government with civil society, harmonizing individual, sectoral and social perspectives; maintains coherence between jurisdictional, spatial and temporal levels; legitimizes and balances the interaction of stakeholders; enforces decisions and regulations; defines the rules for the allocation of attributions, resources and benefits; and, it maintains the capacity for continuous improvement”*.

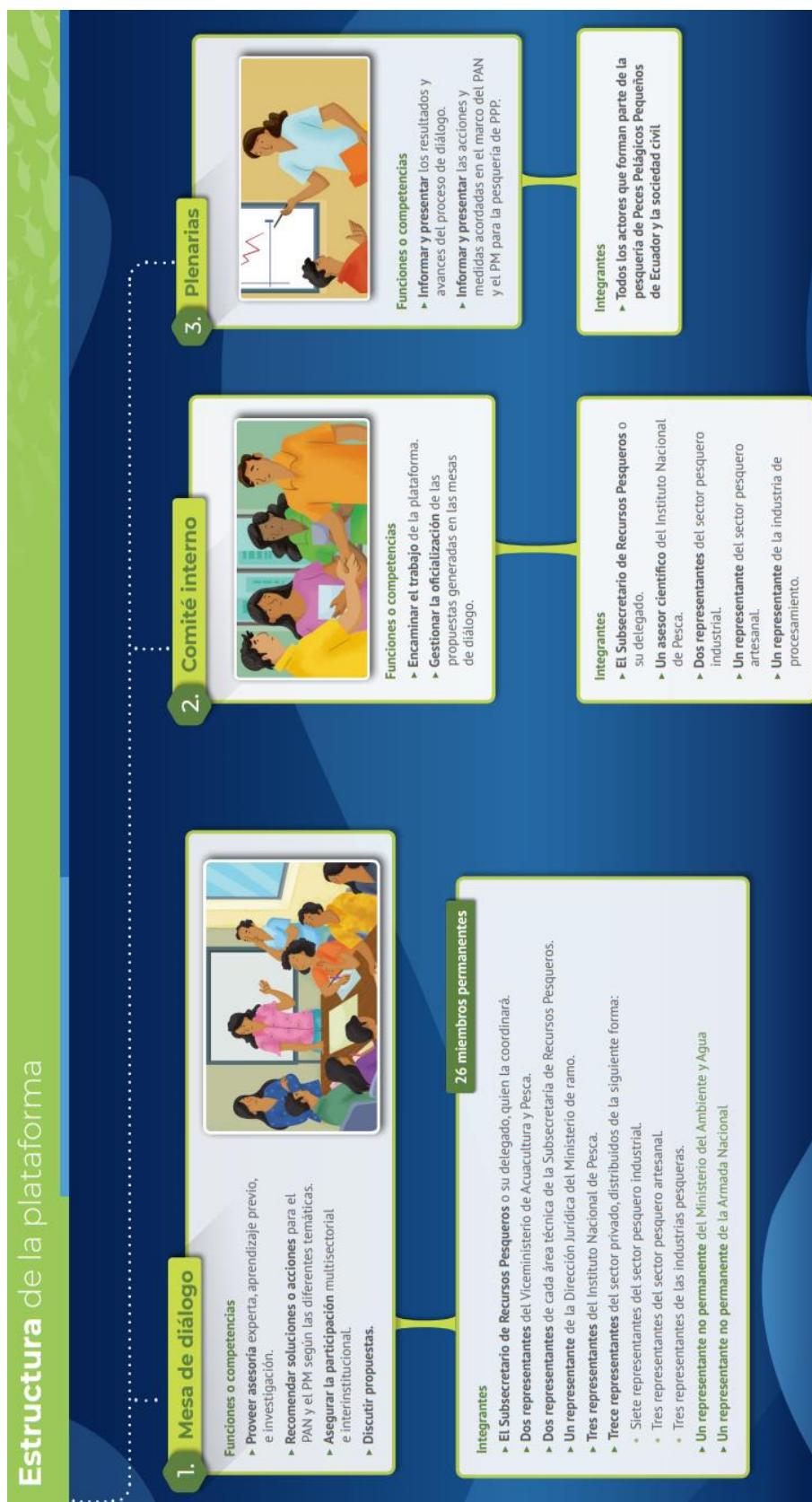


Figure 1. SPFDP structure. Source. GMC (2020)

Based on the principle of Governance, the Ecuadorian Small Pelagic Fishery Dialogue Platform SPFDP was established through **Ministerial Agreement No. MPCEIP-SRP-2020-0054-A**, *“as an instrument of agreement between the public and private sectors, on issues related to the conservation, management, planning and sustainable use of these bioaquatic resources”*. The SPFDP has the character of a cooperative body of the Ministry of Production, Foreign Trade, Investments and Fisheries, in the elaboration of a proposal for a National Action Plan (NPOA) and Fishery Management Plan (FMP). The SPFDP also will play a key role in the implementation, evaluation, adaptation, and update of the NPOA and FMP

It is important to highlight that the CNP contributed to the discussion and development of the new Law for the Development of Aquaculture and Fisheries in Ecuador, in order to incorporate participatory mechanism as part of the decision making process and management plan regulations.

Support information in **annex 3**.

2.1.2.2 FAP Activity 1.4 Attend Sustainable Marine Commodities Platform meetings to discuss harvest control rules, CMMs related to ETP interactions and ecosystem impacts, and other management issues

The development of the strategic guidelines for the construction of the Small Pelagic Fishery National Plan of Action (NPOA) considered the bases of the existing management system, both from the normative point of view and the institutional functioning, as well as the perspective of the different stakeholders about the future development of the fishing activity. These elements made it possible to generate a general proposal that was subsequently analyzed, modified, and validated by the decision-making mechanisms defined by **Ministerial Agreement No. MPCEIP-SRP-2020-0054-A**.

Also, the establishment of rules that will achieve the sustainable development of the fishery in the bio-fishing, ecological and socioeconomic dimensions, was approached through the development of a general proposal of a Fishery Management Plan (FMP) based on international recommendations and available scientific information. This general proposal was socialized and analyzed through sectoral meetings, and later adapted and validated at the SPFDP.

In terms of the methodological approach for the collaborative development of this Plan, the framework proposed by FAO (Cochrane & García, 2009) has been considered, where everything is framed in the country's fisheries policy, which in this case is given by the Organic Law for the Development of Aquaculture and Fisheries of Ecuador. In this sense, the structuring of the Plan considers the Ecosystem Approach, which assumes that fisheries are socioeconomic complexes and therefore must incorporate different dimensions (biological, environmental, socioeconomic, among others) to achieve effective management. In addition to a precautionary approach that promotes the implementation of management actions, even when the information is limited.

The entire decision-making process was constructed from a guided process, where the participants become part of reality and seek concerted solutions to address management problems. The background of the fishery was presented at the SPFDP and discussed during different sessions. Finally, the decision-making processes were carried out through an approval equal to or greater than two thirds of the representatives present at the SPFDP according to **Ministerial Agreement No. MPCEIP-SRP-2020-0054-A**.

In 2020, a total of 9 meetings of the SPFDP were held to build the NPOA and FMP. All the reports for these meetings are detailed in **Annex 4.1**:

Table 6. SPFDP meeting in 2020 and total attendees. Source: GMC

Meeting date	Topic	Total attendees
January 31, 2020	Governance mechanism	36
February 28, 2020	Diagnosis of the fishery and prioritization	31
July 9, 2020	Proposal of the National Plan of Action NPOA	42
July 23, 2020	Validation of the NPOA	25
August 4, 2020	Management Plan Design: Bio-fishing Dimension	43
August 25, 2020	Management Plan Design: Socio-Economic Dimension and Ecological-Fishing Dimension	48
September 29, 2020	Management Plan Design: Management Strategies	39
October 28, 2020	Validation of the Management Plan and management strategies	30
November 16, 2020	Presentation of results of the dialogue process	40

i. 01/31/2020 First dialogue table: Governance Mechanism.

During the SPFDP first meeting held on January 31, 2020, the following topics were discussed : number of participants to set up a minimum quorum and a decision-making quorum, minimum period for notice of a meeting,, average duration of meetings, causes to leave off a delegation, and place of the meetings.

This meeting had 36 attendees, 18 from the public sector and 18 from the private sector. As a result of this meeting, the participatory governance scheme was validated (**Ministerial Agreement No. MPCEIP-SRP-2020-0054-A**).

ii. 02/28/2020 Second dialogue table: Diagnosis and prioritization of the fishery.

This meeting aimed to prioritize the umbrella species to manage this multispecies small pelagics fishery. The management of the multispecies fishery implies great complexity. It requires a large amount of information to achieve a global assessment of the target species. Trying to evaluate each species is though, due to the fishing effort is exerted indistinctly on all species (Newman, 2018). Thus, the strategy is using indicator species (umbrella) whose conservation is expected to confer protection to the rest number of naturally co-occurring small pelagic in order to establish the indicator species, a participatory prioritization of all the fishery's target species was carried out, based on the criteria of intrinsic vulnerability of the species, population status and importance of their management.

The main criteria and sub-criteria of participatory prioritization are detailed in table below:

Table 7. Prioritization criteria for the determination of key species in the small pelagic fishery of Ecuador. Source: GMC (2020)

Vulnerability	Productivity <ul style="list-style-type: none"> longevity asymptotic size
---------------	---

	<ul style="list-style-type: none"> • maturity age • size maturity • Growth rate • fertility • trophic level • reproductive period • Recruitment period Susceptibility <ul style="list-style-type: none"> • Resource availability • Selectivity
Stock status	<ul style="list-style-type: none"> • Results of the fishery Stock assessment. • Stakeholders perception of the stock status
Management importance	<ul style="list-style-type: none"> • Comercial value • Management information • Captures uses • Cultural importance • Probability of appearance of the resource

According to the available information of the small pelagics resources, vulnerability and stock status criteria were assessed by SRP, IPIAP technical staff, and technical advisors. On the other hand, fishers assessed "management importance" criteria according to qualitative scales (Table 8) in regards with: Commercial value; perception of the current stock status concerning the origin of the fishery (based on yields and sizes); probability of appearance during the fishing operation (%); destination of the captures (direct consumption or fish meal); and cultural importance (local and indigenous livelihoods).

Table 8. Management importance - scores range. Source: GMC (2020)

Level	Perception of the current status of the species (based on yields and sizes)	Probability of appearance in the fishing trips (%)	Destination of the catches / potential uses for direct consumption	Cultural importance (livelihoods)
1	There are no decreases in yields or sizes	80-100	All for fishmeal	Not relevant, virtually unimportant
2	There is some perception of decreased performance and / or sizes	60 - 80	Mainly fishmeal	There is some probability that the scarcity of the species could cause changes in the forms of life
3	Slight decreases in performance and / or sizes are perceived	40 - 60	One half to fishmeal and another half to direct human consumption	It is likely that the scarcity of the species can cause changes in the forms of life

4	Noticeable decreases in yield and / or sizes are perceived	20 - 40	Mainly for direct human consumption	It is highly probable that the scarcity of the species can cause changes in the forms of life
5	A severe decrease in yield and sizes is perceived	< 20	All for direct human consumption	It is certain that the scarcity of the species would cause severe changes in the forms of life

The result of this meeting was the prioritization detailed in table below, an important input for the design of the NPA and FMP of the small pelagic fishery, like a multispecies fishery.

Table 9. Results of participatory prioritization of small pelagic species. Source: GMC (2020)

Species	Vulnerability	Stock Status	Management importance	Ranking
Pacific chub mackerel	4.1	2.5	4.3	3.62
Thread herring	3.5	2.0	4.2	3.23
Shortfin scad	3.2	3.3	3.0	3.16
Pacific anchoveta	2.8	3.0	3.4	3.08
Frigate tuna	3.3	1.5	4.0	2.94
Round herring	3.3	2.0	1.6	2.31

In this meeting participated nine delegates from the private sector and seven from the public sector. Four principal and two alternates delegates from the National Chamber of Fisheries participated in this meeting. Also, the SPS-FIP Coordinator participated as an observer and advisor.

iii. 07/09/2020 Third dialogue table: Construction of the National Action Plan.

Due to COVID-19 lockdown, the SPFDP meetings were on standby until July 9. The dialogue table meetings were reactivated virtually. The first virtual meeting was attended by delegates from different sectors of the small pelagic fishery. This meeting aimed to review the proposal for the National Plan of Action Plan (NPOA) of the Ecuador's small pelagic fishery. This meeting had 42 attendees, 25 of whom were permanent delegates from the SPFDP. Four principal and three alternates CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

iv. 07/23/2020 Fourth dialogue table: Construction of the National Action Plan.

This meeting's main objective was to validate the proposal for a Small Pelagics' NPOA with platform participants after its presentation on July 9. Twenty-five delegates participated. Four principal and three alternates CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

The result was to adopt the strategic guidelines to implement the following NPOA components:

- Governance and legal framework.
- Research and data collection.
- Monitoring, control, and surveillance.
- Extension, dissemination, and education.

v. 08/04/2020 Fifth dialogue table: Construction of the Management Plan: biological-fishing dimension.

In this meeting, the co-management process to develop the management plan and management strategies started. This meeting aimed to discuss:

- The proposed bio-fishing strategies, objectives, and indicators.
- The proposed harvest control rules (HCR) and the available indicators which will trigger them.
- The methodology to assess the fishing management measures (monitoring and compliance feasibility).

The meeting had 43 attendees, of whom 23 were permanent delegates from the SPFDP and two alternate delegates. Five principal and one alternate CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

During this meeting, a proposal for the following structure of each management plan's dimensions was presented: targets, objectives, indicators, reference points and control rules.

vi. 08/25/2020 Sixth dialogue table: Construction of the Management Plan: socioeconomic and ecological dimensions.

The objectives of this meeting were: (a) To present and discuss the proposed ecological and socioeconomic targets, objectives, and indicators, (b) to present the functioning of decision-making rules and the performance of available indicators, (c) to analyze the fishing management measures alternatives. Five principal and three alternate CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

During this meeting, the following targets, objectives, and indicators for the ecological and socioeconomic dimension were presented:

Ecological target 1:

- Minimize impacts on non-target species

Objectives:

- Reduce the capture of no target species by 2025
- Minimize ETP mortality by implementing a good practice protocol in the fleet by 2025

Ecological target 2:

- Minimize impacts on habitat in which the fishery operates

Objective:

- Minimize the interactions of the fishery operation with habitats by 2025

Socioeconomic target:

- Maximize the socio/economic benefits of the small pelagic fishery without jeopardizing biological sustainability objectives

Objectives:

- Maintain or increase net profits of the fishery
- Maintain livelihoods associated with licensed beach bug fishing

vii. 09/29/2020 Seventh roundtable: Construction of the Management Plan: Management Strategies for the PPP fishery.

During this meeting, the small pelagics' HCRs alternatives were presented, and one was selected. For this meeting, 39 attendees participated, of whom 22 were formal delegates (19 officers and two alternates) of the SPFDP and ten guests. Five principal and two alternate CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

During this meeting, the most relevant performance indicators to evaluate the management strategies were presented. The management strategy assessment was carried out using the most relevant performance indicators chosen by the SPFDP delegates

The two most relevant performance indicators, according to the perception of attendees, were

- Lower risk of exploitation
- Higher levels of capture

viii. 10/28/2020 Eighth dialogue table: Validation of the Management Plan.

This meeting aimed to present and validate the management plan proposal that was discussed at the previous dialogue meetings. The meeting had 30 attendees, of whom 22 were delegates from the SPFDP (20 permanent delegates and two alternates). Five principal and two alternates CNP delegates participated in this meeting. Also, the SPS-FIP Coordinator and the CNP's executive manager participated as observers.

During this meeting each delegate vote for the the management plan's targets that they believed are better to achieve the fishing objectives.

The results of this vote are shown in the following graphic:

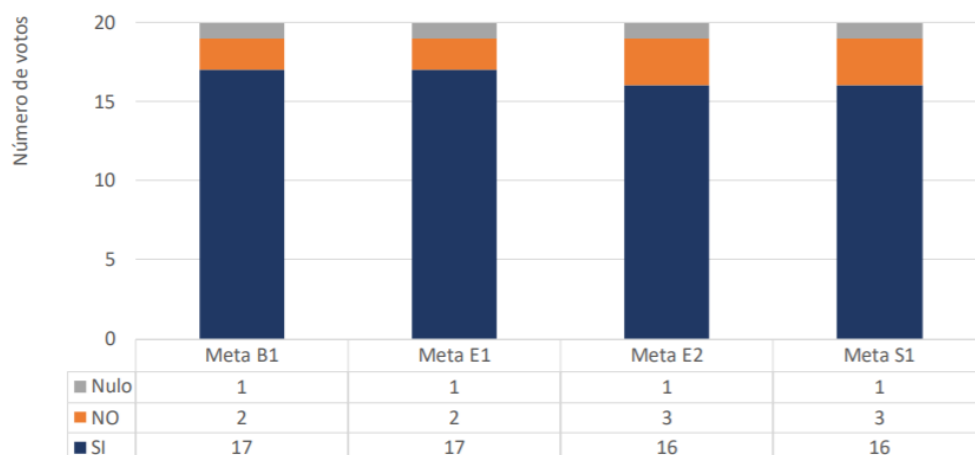


Figure 2. Results of Eighth dialogue table: Validation of the Management Plan. Source: GMC

Detail of the proposal presented and approved: http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Presentacio%CC%81n-8va-mesa_1.pdf

The control rules discussed in the SPFDP are detailed in ***FAP Objective 4. Management Measures (CMMs) are adopted by fishery managers accordingly to the Stock Assessments outcomes and recommendations***

ix. 11/16/2020 Plenary information on the 2020 dialogue process.

As a closing activity of 2020, an information plenary was held aimed to present a) the dialogue process implemented in 2020, b) conduct an awareness-raising process on gender equity issues within the framework of the dialogue table, c) present the proposal of the NPOA and FMP and the formation of the Internal Committee of the SPFDP. Twenty-three delegates and 17 guests attended this meeting.

The results of the process of construction of the NPOA and FMP plan are presented below:

SMALL PELAGICS' NATIONAL PLAN OF ACTION

NPOA Strategic guideline 1: Legal Framework and Governance (MLG)

The set of actions and activities to achieve compliance with the specific objectives proposed for the Legal Framework and Governance (MLG) strategic guideline is detailed below, as well as the compliance verifiers, managers, collaborators, and execution deadlines.

Table 10. NPOA MLG-1 Objective. Have a legal framework that includes long-term objectives and operational objectives of the fishery.

Action	Activity	Checker	Responsible	Collaborators	Execution year
MLG-1.1. Set long-term objectives for the fishery	MLG-1.1.1. Design high-level fisheries policy or laws that define long-term goals	Organic Law for the Development of Aquaculture and Fisheries	SRP	Apollo Lawyers	2020
MLG-1.2. Develop short-term operational objectives for the fishery	MLG-1.2.1. Develop a management plan that includes specific objectives of the fishery, which serve as an operational interpretation of the long-term objectives. These must be realistic and quantifiable	Small Pelagic Fishery Management Plan	SRP / IPIAP	SPFDP	2020

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Lineamientos-estrategicos-de-la-pesqueria.pdf>

Table 11. NPOA MLG-2 Objective. Have a defined governance scheme that establishes procedures that promote stakeholder participation.

Action	Activity	Checker	Responsible	Collaborators	Execution year
MLG-2.1. Generate a clear and legally established governance scheme, whose operation is understood by the main stakeholders	MLG-2.1.1. Establish the SPFDP with defined roles and responsibilities in order to generate an effective and systematic dialogue between the actors	Ministerial Agreement that establishes the Dialogue Table	SRP	Dialogue table	2020
		Minutes of at least 2 annual meetings of the dialogue table	SRP	Dialogue table	Annually between 2020 - 2025
	MLG-2.1.2. Establish a decision-making process that considers the roles of the dialogue table and the National	Regulation of the Organic Law for the Development of	SRP	National Aquaculture and Fisheries System / SPFDP	2021



Action	Activity	Checker	Responsible	Collaborators	Execution year
	Aquaculture and Fisheries System	Aquaculture and Fisheries			
	MLG-2.1.3. Establish a mechanism for conflict resolution at each of the relevant levels of the management process (eg at the fleet level or at the local, provincial, national level)	Regulation of the Organic Law for the Development of Aquaculture and Fisheries	SRP	National Aquaculture and Fisheries System / SPFDP	2021
MLG-2.2. Encourage stakeholders participation	MLG-2.2.1. Generate permanent instances that allow a broader participation of interested parties in consultation processes	Minutes of at least one annual plenary meeting and of other participation instances	SRP	SPFDP	Annually between 2020 - 2025
	MLG-2.2.3. Incorporate participation of women in decision-making bodies and consultation processes	Percentage of participation of women in the meetings of the dialogue table, plenary or other instances	SRP	SPFDP	Annually between 2020 - 2025

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Lineamientos-estrategicos-de-la-pesqueria-CC%81a.pdf>

NPOA Strategic Line 2: Research and Monitoring (IMO)

The set of actions and activities to achieve compliance with the specific objectives proposed for the Strategic Research and Monitoring (IMO) are detailed below:

Table 12. NPOA IMO-1 Objective. Have adequate information to support the management strategy.

Action	Activity	Checker	Responsible	Collaborators	Execution year
IMO-1.1. Maintain a bio-fishery monitoring program for the fishery	IMO-1.1.1. Estimate the abundance and acoustic spatial distribution of the main species of the fishery in Ecuadorian waters and their relationship with oceanographic and biological variables	At least one annual report from IPIAP	IPIAP	Shipowners as collaborators in the execution of monitoring	annually between the years 2020 - 2025



Action	Activity	Checker	Responsible	Collaborators	Execution year
	IMO-1.1.2. Monitor the fishing operation (effort, catches, yields, size structure, incidental catch, discard, impact on habitat, among others)	At least one annual report from IPIAP	IPIAP	SRP, shipowners and processors, as data facilitators to complement the IPIAP information	annually between the years 2020 - 2025
	IMO-1.1.3. Monitor the socioeconomic performance of the fishery (beach prices, direct and indirect employment, socioeconomic characterization of the fishermen, destinations of the catches)	At least one annual report from IPIAP	IPIAP	SRP Universities	annually between the years 2022 - 2025
IMO-1.2. Evaluation of the effectiveness of the exploitation strategy in the PPP fishery	IMO-1.2.1. Stock assessment based on the Maximum Sustainable Yield Benchmark	One IPIAP technical report every two years	IPIAP	-	Perform in 2020 years, 2022 and 2024
	IMO-1.2.2. Evaluation of the Management Strategy	One IPIAP technical report every five years	IPIAP	-	Carry out in 2020 and 2025
IMO-1.3. Implement a scientific research program	IMO 1.3.1. Update life history parameters of the species that make up the fishery	At least 2 annual research reports (technical documents, thesis) and / or Scientific Publications	IPIAP	Universities	annually between the years 2022 - 2025
	IMO 1.3.2. Determine the trophic role of the target species of the fishery in the ecosystem	At least 2 annual research reports (technical documents, thesis) and / or Scientific Publications	IPIAP	Universities	annually between the years 2023 - 2025



Action	Activity	Checker	Responsible	Collaborators	Execution year
	IMO 1.3.3. Analysis of management strategies with an ecosystem approach	A technical report from IPIAP	IPIAP	Universities	2025

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Lineamientos-estrategicos-de-la-pesqueria.pdf>

NPOA Strategic line 3: Monitoring, Control and Surveillance (SCV)

The set of actions and activities to achieve compliance with the specific objectives proposed for the strategic guideline of Monitoring, Control and Surveillance (MCS) are detailed below.

Table 13. NPOA SCV-1 Objective. Ensure that the management and conservation measures of Ecuador's small pelagic fishery are applied and complied, while avoiding or minimizing IUU fishing.

Actions	Activities	Checker	Responsible	Collaborators	Execution year
SCV-1.1. Develop an integrated Monitoring, Control and Surveillance (MCS) system	SCV-1.1.1. Strengthen the measures that are being applied under a cost-effective perspective	An internal document of the Directorate of Fisheries Control (DCP), which provides recommendations with cost-effective considerations to strengthen measures	DCP - SRP	Ecuadorian Navy	2021
	SCV 1.1.2 Design new tools / measures or update existing ones to ensure compliance with the management strategy and avoid IUU fishing	An internal document of the DCP, which details the MCS system and incorporates a section on roles and responsibilities of the parties involved in the application of the system	DCP - SRP	Ecuadorian Navy	2021
	SCV 1.1.3 Implement the MCS system	An annual report of MCS activities developed	DCP - SRP	Ecuadorian Navy	Annually between the years 2021 - 2025
	SCV 1.1.4 Build capacities in the inspection staff	An annual report of training activities	DCP - SRP	Ecuadorian Navy	Annually between the years



Actions	Activities	Checker	Responsible	Collaborators	Execution year
	in accordance with the applicable regulations and the MCS system				2021 - 2025
	SCV 1.1.5 Strengthen the official traceability system to prove the legal origin of the catch	A diagnostic report and improvement proposals for the traceability system that has an implementation plan	DCP - SRP	-	2023
SCV-1.2. Establish the probability of non-compliance with the management strategy and the existence of IUU fishing, to focus control and surveillance efforts	SCV-1.2.1. Develop a fishing census that allows quantifying the entire fleet that is operating and its characteristics	An official census report	DCP - SRP - Artisanal Fisheries Directorate (DPA) - Industrial Fisheries Directorate (DPI)	IPIAP	2023
	SCV-1.2.2. Develop and maintain a database integrated with the record of compliance with the management strategy and existence of IUU fishing	An internal protocol of the DCP - SRP to manage the compliance database	DCP - SRP	Ecuadorian Navy	2021
	SCV-1.2.3. Identify critical points in compliance with the management strategy and the existence of IUU fishing	An annual internal document of the DCP - SRP, which establishes the critical points of non-compliance, either spatially or along the supply chain	DCP - SRP	Ecuadorian Navy	Annually between the years 2022 - 2025
	SCV-1.2.4. Prioritize critical points to focus control and surveillance efforts	Annual protocol to redistribute inspection capacity towards critical points, considering the efficient use of	DCP - SRP	Ecuadorian Navy	Annually 2022-2025



Actions	Activities	Checker	Responsible	Collaborators	Execution year
		available resources			
SCV-1.3. Develop a mechanism for evaluating the performance of the MCS system	SCV-1.3.1 Prepare an annual report of activities and inspection actions carried out in the previous year	Creation of the staff position in the DCP - SRP to prepare the annual performance reports of the MCS system	DCP - SRP	Ecuadorian Navy	2021
		An annual and public report of activities and inspection actions carried out in the previous year, results of the inspection actions carried out and compliance with the administration and conservation measures of the previous year	DCP - SRP	Ecuadorian Navy	Annually 2022-2025
	SCV-1.3.2 Perform periodic internal and external audits of the performance of the MCS system to adjust	Agreement with internal or external reviewers to carry out periodic audits of the performance of the MCS system	DCP - SRP	Ecuadorian Navy	2021
		Carrying out audits and incorporating the results of internal and external audits in the adaptation of the MCS system	DCP - SRP	Ecuadorian Navy	2022 and 2025

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Lineamientos-estrategicos-de-la-pesqueria.pdf>

SMALL PELAGIC FISHERY MANAGEMENT PLAN:

Table 14. Small pelagic fishery management plan.

Bio-Fishing Dimension (BP)
BP-1. Maintain the species of the Ecuadorian Small Pelagic fishery at a sustainable production level



Objective	Indicator	Reference point	Source
BP-1.1. Achieve a yield according to the MSY of the main species of the fishery by 2025.	BP-1.1.1. Quotient between the average CPUE (CPUE-P) of the last two fishing seasons and the expected CPUE at RMS (CPUE _{BRMS}) of the indicator species. CPUE-P (species) / CPUE _{BRMS} (species)	Greater than or equal to 1	Standardized fleet CPUE, estimated by IPIAP
	BP1.1.2. Quotient between the average catch of the last two fishing seasons and the expected catch at MSY of the indicator species.	Less than or equal to 1	Estimated fleet catch, estimated by IPIAP
BP-1.2. Reach a sustainable level of spawning biomass of the fishery stocks by 2025.	BP1.2.1. Population status of each species in the fishery (Biomass of the species / Biomass of the species at MSY). Status = B (species a) / B _{RMS} (species a)	Greater than or equal to 1	Stock assessment by IPIAP
	BP1.2.2. Average population status of the main species in the PPP fishery.	Greater than or equal to 1	
Ecological Dimension (EC)			
EC-1. Minimize impacts on non-target species of the small pelagic fishery			
Objective	Indicator	Reference point	Source / observation
EC. 1.1. Reduce the capture of by-catch species by 2025.	EC-1.1.1. Percentage of by-catch of the total captures.	Less than 20% of the total catches.	Integrated catch database managed by IPIAP, which considers information from electronic logbooks, on-board observers (SRP-IPIAP), monitoring of the fishery and production form declared by the companies.
EC-1.2. Reduce severe impact interactions with ETP species by 2025.	EC-1.2.1. Percentage of the fleet with the protocol of good practices implemented.	More than 80% of the fleet with an implemented protocol.	Fishing observer program, electronic fishing logs.
	EC-1.2.2. Variation in severe impact interactions.	Stable trend or decrease in severe interactions.	Fishing observer program, electronic fishing logs.
EC-2.1. Reduce the interaction of the fishery with the habitat by 2025.	EC-2.1.1. Area of overlap of the fishery with the seabed.	50% decrease in the level of interaction registered in 2019.	SRP Satellite Monitoring Center, observers. Purse seine net interaction with habitat.
Socioeconomic Dimension (SE)			

SE-1. Maximize the socio / economic benefits of the small pelagic fishery without compromising biological sustainability			
Objective	Indicator	Reference point	Source / observation
SE-1.1. Maintain or increase the net benefits from the fishery by 2025.	SE-1.1.1. Total Industrial Net Profit of each category.	Current value	Collect information to develop the indicators and establish the corresponding Reference Points
	SE-1.1.2. Artisan Total Net Profit.	Current value	
SE-1.2. Maintain livelihoods associated with authorized “chinchorro de playa” fishing by 2025.	SE-1.2.1. Number of workers associated directly and indirectly with “chinchorro de playa” fishing.	Current value	Collect information to develop the indicators and establish the corresponding RP.
	SE-1.2.2. Number of fishermen using traditional fishing gear (without technological innovation).	Current value	Collect information to develop the indicators and establish the corresponding RP.

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%C3%A1-de-Peces-Pela%C3%81gicos-Peque%C3%B1os.pdf>

2.2 FAP Objective 2: Fishery data, species, habitats, and environmental information is collected, published and publicly available

2.2.1 Improvement recommendations

- *“Ensure reports relating to management activities, stock assessments, data collection, control and enforcement, and other key areas of the fishery management process are made publicly available.”*
- *“Collect landings data to indicate total landings from the stock. This also requires an understanding of the biological stock, such that removals by other fisheries can be included if necessary.”*
- *“Collect other stock data sufficient to determine the current stock status – most commonly, an estimate of biomass.”*

2.2.2 Activities and results

2.2.2.1 FAP Activity 2.1: Establish an office with equipment and a research team which will develop a research program in order to assess both the small pelagic fish stocks and the fishery impacts on ETP species and the ecosystem.

Under the framework of technical cooperation between IPIAP, SRP, VAP and CNP, the SPS-FIP technical staff in 2020 was integrated by:

- Engineer Gabriela Ponce, fishery and acoustic oceanography research.
- Lcda. Karina Solis, process engineering and datamanager.
- Biologist Guillermo Gilbert, MRes, fishery researcher and database manager.
- Biologist Gabriela Ayora, MSc, ichthyoplankton research

- Biologist Carlos Aleman, fishery research

The project also had the technical assistance of the following advisors:

- Dr. Cristian Canales. Technical assistance to the IPIAP to carry out the stock assessment of the main small pelagic resources of Ecuador.
- Dr. Juan Carlos Saavedra. Technical assistance to IPIAP to determine a new methodology for estimating by species and fleet segment of purse-seine vessels in the small pelagic fishery.
- Engineer, Juan Diego Carrera. Migration and construction of the IPIAP small pelagic database
- Engineer, Rosa Vinatea. Design and implement a fleet-based management system, in close coordination with the national research institute IPIAP, that enables: a) the continuous monitoring of the interactions of the for the Small Pelagic fishery with the ecosystems, b) the development of a new responsible fishing behavior and skillsets amongst skippers, crews and vessels owners to engage in responsible fishing operations, and c) mitigating the impact of the fishery on the ecosystems and develop more efficient and less harmful fishing operations. Initially, the system will be designed and adapted to the fleet involved in the Small Pelagics Sustainability-Fishery Improvement Project (SPS-FIP), led by the Cámara Nacional de Pesquería (CNP).

Also, under the GMC project, EKOS consulting group provided technical assistance to SRP and IPIAP in the improvement process to:

- Construction of a participatory process to create the NPOA and FMP, the consulting group was integrated by Felipe Thomas Álvarez, Miguel Espíndola Rojas, Gonzalo Olea Stranger.
- Definition of Management Control Rules for the small pelagic fishery in Ecuador: Dr. Cristian Canales.

The support information is detailed in **Annex 5**.

2.2.2.2 FAP Activity 2.2: Review and evaluate all the historical information / data related to the Ecuadorian small-scale fishery existing at the INP.

All the information related to the small pelagic fishery, including bulletins and technical reports, journal articles and scientific articles. As a result, a list of publications and scientific reports related to the small pelagic fishery was prepared with its respective link, which is uploaded to the FIP project website (<http://www.smallpelagics.org/fishery-data/>), and in the IPIAP website (<http://www.institutopesca.gob.ec/peces-pelagicos-pequenos/>), in such a way that the information is public and available.

2.2.2.3 FAP Activity 2.3: Recollect all the relevant legislation and normative related to the Ecuadorian small pelagic fishery

All the regulations related to the small pelagic fishery is public and available in the digital platform of the FIP (<http://www.smallpelagics.org/fishery-data/>), and in the IPIAP website (<http://www.institutopesca.gob.ec/peces-pelagicos-pequenos/>), in such a way that the information is public and available.

2.2.2.4 FAP Activity 2.4: Design a research project in order to define and conduct stocks assessment models, which may take into consideration oceanographic particularities.

2.2.2.4.1 Develop a scientific strategic plan in order to conduct stock assessments and evaluate the impacts of the fishery on ETP species and the ecosystem.

During the second year of the improvement process, the IPIAP and the SPS-FIP carry out several activities to strengthen data collection and analysis to increase knowledge about the dynamics of small pelagic fish populations. These activities were based on the fishery research plan established by IPIAP in the first year of the SPS-FIP (Annex 6). The activities are detailed below:

a. Determine the spatial and temporal variability of landings of the coastal purse seine fleet (small pelagics).

Indicator	<ul style="list-style-type: none"> Monthly field visits to landing ports, fishmeal factories and port captaincies. Data collected analyzed and stored in the IPIAP biological-fishing database. Workshops developed to present the results achieved during the data collection phase
Results	<ul style="list-style-type: none"> During 2020, 7 field trips were carried out, 500 data were collected, including georeferenced catches total caught in tones, species caught by fisheries from the landings of the fleet. The daily landings of 7 industries dedicated to catching small pelagic species for different purposes were collected, registering 7 600 data on catches from the small pelagic fleet.

b. Determine the growth parameters of the main species.

Indicator	<ul style="list-style-type: none"> Monthly frequency histograms with biological have been made by species and landing port data of small pelagic The growth parameters determined have been determined from the recorded lengths. Four internal workshops developed have been held to discuss results.
Results	<p>This activity was part of the report of Second Stock Assessment of Small Pelagic Fish on the Ecuadorian coast, for which the following was prepared (Canales et al, 2020):</p> <ul style="list-style-type: none"> 9 histograms for the period 2013 - 2019, with the modal compositions by age group, for the species Pacific thread herring, Frigate tuna, Red-eye round herring, Shortfin scad, Pacific anchoveta, Pacific cornetfish, Large head hairtail, Grey grunt and Chub mackerel . 9 histograms for the period 2013 - 2019, with the relative ages and catches by age group, for the species Pacific thread herring, Frigate tuna, Red-eye round herring, Shortfin scad, Pacific anchoveta, Pacific cornetfish, Large head hairtail, Grey grunt and Chub mackerel. 9 histograms for the period 2013 - 2019, with the length compositions of the exploitable population by age group, for the species Pacific thread herring, Frigate tuna, Red-eye round herring, Shortfin scad, Pacific anchoveta, Pacific cornetfish, Large head hairtail, Grey grunt and Chub mackerel.

- 19 histograms for the period 2013 - 2019, with the length compositions for Frigate tuna species
- 37 histograms for the period 1982– 2019, with the length compositions for Chub mackerel species
- 37 histograms for the period 1982– 2019, with the length compositions for Pacific anchoveta species
- 38 histograms for the period 1981–2019, with the length compositions for Pacific thread herring species.

c. Establish the reproductive conditions of the main small pelagic species.

- Indicator**
- Data collection of the field trips, organized, processed, and validated.
 - The mean length of sexual maturity of the main species recalculated.
 - Two internal workshops to discuss results.

Results

R software was used to recalculate the mean length (Lm) of sexual maturity for the main small pelagic species, which were the input for the stock assessment, carried out in 2019.

Recalculation of the Mean Length of Sexual Maturity for the main small pelagic species.

SPF species	Previous Lm50%	Recalculated Lm 50%
Frigate tuna	26.2 cm LF (2015)	25.33 cm LF
Pacific anchoveta	16.00 cm LT (2000)	14.7 cm LT
Chub mackerel	28.6 cm LF (2000)	23.02 cm LF
Shortfin scad	-	17.6 cm LT
Pacific thread herring	21.6 cm LT (2000)	21.0 cm LT
Red-eye round herring	-	17.40 cm LT

The second stock assessment these values were maintained according to analysis of scientists, for 2021 they will be recalculated again.

d. Disseminate research activities and technical results on the population status of the main species.

- Indicators**
- At least 20 representatives of companies, cooperatives and ship owners participate in workshops to disseminate results.
 - Two workshops to disseminate results and activities

Results

During 2020, due to the COVID-19 pandemic, the meetings to disseminate results were limited, reactivated in person and in separate groups in September to publicize the results of the reproductive status of the species and determine closure season for 2021.

The meetings to prepare the Management Plan and Action Plan were held virtually (ZOOM platform), which were as follows:

- 07/09/2020 Construction of the National Action Plan with the participation of 25 delegates (12 fishing organizations, representatives of fishmeal companies, canning companies, 13 authorities and technicians of the research institute)
- 08/04/2020 to analyze the proposal for bio-fishing goals, objectives and indicators and the operation of decision rules and the performance of the indicators with the participation of 23 delegates (10 fishing organizations, representatives of fishmeal companies, canning companies, 13 authorities and technicians of the research institute).
- 09/29/2020 presentation of the evaluation of strategies applicable to the fishery and the selection of an appropriate management strategy for the fishery with the participation of 19 delegates (6 fishing organizations, representatives of fishmeal companies, canning companies, 13 authorities and technicians of the research institute).
- 09/30/2020. Fishing closure season scenarios for the second semester 2020, with the participation of 40 delegates (34 fishing organizations, representatives of fishmeal companies, canning companies, 6 authorities and technicians of the research institute).
- 10/28/2020 presentation and validation of the Management Plan proposal that was analyzed in the previous dialogue meetings, with the participation of 22 delegates (10 fishing organizations, representatives of fishmeal companies, canning companies, 12 authorities and technicians of the research institute).

e. Collect additional data for stock assessment of main small pelagic species via hydroacoustic cruises with public-private cooperation.

- Indicators**
- At least 6 meetings with members of the CNP and independent shipowners to plan each research cruise
 - At least 6 workshops to publicize the methodology proposed to participating ships.
 - Two hydroacoustic cruises during this year
 - At least 22 eco-integration transects are carried out.
 - At least 15 evidence fishing sets are made
 - Data obtained in the two research cruises is analyzed and stored in the biological-fishing database.
 - SPF biomass and abundance are estimated every year

Results

In Ecuador, the lockdown due to the Covid-19 pandemic began in February, preventing the execution of the acoustic cruise scheduled for March 2020, while the second cruise scheduled for the end of the year was rescheduled to January 2021, in accordance with the first closure season in 2021.

f. Review of the biological sampling system to expand coverage from on-board observers.



- Indicators**
- Length frequencies per set and trip for each target species and other species associated with the fishery, are obtained.
 - Sample units of small pelagics are collected
 - New indices (Hepatosomatic and Condition Factor) are calculated from the taking of eviscerated weight and liver variables.
 - Temperature validated from in situ and satellite sea surface
 - Worksheets with information on ETP species

Results

According to the improvements established in the protocol for obtaining data from on-board observers in 2019, for 2020 data collection continued, especially in relation to ETP species and in the same way to be able to know the interaction of the fishing activity with the habitat.

Similarly, due to the Covid-19 pandemic, the boarding of observers was restricted, creating new guidelines for boarding such as: the observer had to stay in the same boat for the entire time of the Fishing activity and limit rotation between boats to a minimum established by the authority.

g. Improve reports and its focus about the fishing and biological data of the fishery.

- Indicators**
- Stratified information on fishing areas / sizes / reproductive conditions of the target species of the fishery has been included

Results

Based on the data collected by on-board observers, the report Analysis of catches and sets of the coastal purse seine fleet during 2018 was prepared, which includes:

- Estimation of total catches
- Characteristics of sets for each of the four classes of vessels by fishing zone and target species
- Estimation of total by-catch by fleet classification.
- Monthly distribution maps of the fleet catch composition.

This report is under review by IPIAP

h. Correlate biological aspects of fisheries with environmental variables.

- Indicators**
- Temporal and biological variables are defined
 - Information downloaded from satellites are stored in a database.

Results

The results of the correlations between the biological and environmental variables are available as part of a thesis work "" showing how the environment influences the normal development of these species. Main results are detailed below:

- There is a direct relationship between altimetry and maturity.
- The individuals of pinchagua that inhabit the Gulf of Guayaquil are of greater length and are associated with habitats where the SST and the NMM are low and with a high concentration of chlorophyll, unlike those found in the north of Manabí.
- The results of the study found negative correlations between catch and weight of the gonad, so it cannot be ruled out that the reproductive processes of *Opisthonema* spp may also be affected by the stress caused by fishing effort.

By 2021, work will begin for mackerel and frigate tuna. Currently, there are databases of environmental variables downloaded monthly for the period 1995 - 2020, for the variables Sea Surface Temperature, Chlorophyll, Mean Sea Level, as well as the coordinates of each data, with a spatial resolution of 9 km.

i. Increase the efficiency of on-board observer sampling capabilities.

Indicators	<ul style="list-style-type: none"> On-board trained observers. The knowledge of the Observers on board has been evaluated.
Results	As part of new management model, a socialization workshop was held for the 22 observers designated for the small pelagic fishery, where the Data Collection Protocol was again explained, reinforcing the knowledge previously acquired. As part of this workshop (January 2020), it was obtained a diagnostic test. (Annex. 11.3 – 11.4)

j. Implement improvements to the Small Pelagic Fishery Database System.

Indicators	<ul style="list-style-type: none"> A diagnosis of the fisheries information system. Data modeling has been designed according to INP's needs.
Results	<p>A new methodology for catches estimations was developed using R script. It has the benefit of automation, which can reduce human error by improving repeatability and reproducibility. The statistical capacity is also much more advanced than the previous model based on MS Excel spreadsheets, with greater accuracy and precision in its calculations. While the structure of R (script) allows the modification and improvement of the functions elaborated by altering the code to apply them to the needs of the IPIAP.</p> <p>With this new process, automation in R will allow:</p> <ul style="list-style-type: none"> Data validation based on a percentage of relative differences Statistical Confidence limits for the estimations. Methodological proposal for estimating total landings in the small pelagic fishery disaggregated by species and temporal strata (month, year) and operational stratum (fleet segment). Automation of total landings estimation: Monthly landings by species and fleet segment (ship class, landing areas, active ships, among others).

k. Implement electronic Logbook

Indicators	<ul style="list-style-type: none"> An interface for data entry on board, with validation on land designed. Tests have been run on the interface and its results. A developed protocol for using the interface.
Results	By 2020, the electronic logbook has been implemented in the SPS-FIP fleet. The IPIAP has collaborated with the following:

- Validation of captures
- List of incidents to improve the application
- Data exchange
- Data processing of fishing effort.

I. Assess the population status of the species that are part of the fishery.

- Indicators**
- Biological and fishery data for each species under evaluation is reviewed and validated.
 - A defined index that expresses in a best mood the abundance of resources.
 - An assessment model established
 - It has been applied assessment models stock
 - Estimates of virgin, exploited biomass, biomass projections and limit and biological reference points are obtained

- Results**
- As part of the improvement process, the second stock assessment of 9 species was carry out: Pacific thread herring, Frigate tuna, Red-eye round herring, Shortfin scad, Pacific anchoveta, Pacific cornetfish, Large head hairtail, Grey grunt and Chub mackerel, for these species the following results were obtained:
- Abundance indices for 8 species from 1983 - 2019 (Chub mackerel , Pacific thread herring); 1986 - 2019 (Pacific anchoveta); 1999 - 2017 (Frigate tuna); 1991 - 2019 (Red-eye round herring); 2004 - 2019 (Large head hairtail, Shortfin scad, Pacific cornetfish).
 - Life history parameter calculations: Maximum length, L_{50} , K, M.
 - Length compositions of the average catches of the last 7 years of the nine species analyzed.
 - Length compositions of the exploitable population of the nine species.
 - Relative yield curves and spawning biomass reduction per recruit with respect to fishing mortality for the nine species analyzed.
 - Biomass Charts, fishing mortality, recruitment anomaly, % spawning potential for Frigate tuna, Chub mackerel, Pacific thread herring, Pacific anchoveta. Shortfin scad, Red-eye round herring.
 - Main population indicators of Frigate tuna, Chub mackerel, Pacific thread herring, Pacific anchoveta, Shortfin scad, Red-eye round herring resources for the period 1997 - 2019.
 - Kobe Plot diagram for Frigate tuna, Chub mackerel, Pacific thread herring, Pacific anchoveta, Shortfin scad, Red-eye round herring.
 - Plots of yield per recruit (YPR) vs virginal biomass reduction ratio (SPR) curves for Pacific cornetfish, Large head hairtail, Gray grunt
 - Determination of the Biological Reference Points for Frigate tuna, Chub mackerel, Pacific thread herring, Pacific anchoveta, Shortfin scad, Red-eye round herring.

m. Propose and evaluate HCR and management scenarios for small pelagic fishery

- Indicators**
- *Decision rules for the fishery*
 - *Performance indicators*
 - *Population indicators*
 - *Treatment of uncertainties*
 - *Biological reference points*
 - *Scenarios for correcting fishing effort*

Results

In collaboration with consultant Dr. Cristian Canales, a proposal for exploitation strategies was developed, targeting mechanisms to control fishing effort (days of operation or restriction of access). The exploitation strategies considered Biological Reference Points (PBR) and population indices related to the population condition.

The proposal to establish a PBR 40% of the virgin spawning biomass (B_0) as a management criterion for the small pelagic fisheries in Ecuador, and its corresponding level of related fishing mortality (fishing effort) was ratified. Four exploitation strategies were proposed considering a multi-specific approach, and aimed at monitoring the variations in catch per unit of effort (CPUE) of the most vulnerable species or those of commercial interest. The differences between these lay in the order in which the priority species were considered in decision-making. These strategies were evaluated considering scenarios of stabilization of the fishing effort (stabilizer), in which the reduction of the effective effort should occur only when the average catch exceeds the MSY reference value (overfishing) and the population presents evidence of overexploitation ($CPUE < CPUERMS$).

Main products obtained were:

- Number of individuals (N) and total mortality rate (Z) at the beginning for the simulations of the multispecies fishery for small pelagic fish in Ecuador
- Mono-specific model with constant fishing mortality
- Multi-species model
- Control rules with stabilizer relating to captures vs RMS

2.2.2.4.2 Define stock status models for all species on the basis of historical data and management regulations.

The IPIAP together with Dr. Cristian Canales carry out the second stock assessment of small pelagic fishes in Ecuador. The main activities of the technical assistance were:

- Update of the length frequencies of the catches on an annual scale for the main small pelagic species of Ecuador. This activity will be in charge of the IPIAP in coordination with the executing agency of the project.
- Update (when appropriate) of the biological parameters of the main small pelagic species in Ecuador. This activity will be in charge of the IPIAP in coordination with the project executor
- Update of the series of landings of the catches on an annual scale for the main small pelagic species of Ecuador. This activity will be in charge of the IPIAP in coordination with the project executor.

- Update of the daily fishing logs for the main small pelagic species of Ecuador. This activity will be in charge of the IPIAP in coordination with the project executor.
- Updating of general linearized models (GLM) for the generation of abundance indices. This activity will be in charge of the IPIAP in coordination with the executing agency of the project.
- Acoustic biomass series and their size compositions of the main pelagic resources of Ecuador. This activity will be in charge of the IPIAP in coordination with the executing agency of the project.
- Updating of the data files and execution of the MODACT and MESTOCKL models. This activity will be in charge of the IPIAP in coordination with the executing agency of the project.
- Generation of reports, graphs, tables, data analysis and final report. This activity will be in charge of the project executor in coordination with the IPIAP.
- All of the above activities implicitly involved training for IPIAP researchers.

Considering IPIAP has substantial information on the size compositions of the catches and that the sampling design has been maintained over time, the performance of three variants of statistical models of dynamics analysis in ages and observations was explored in lengths: A first model considered an exploratory analysis for limited data where it is assumed that only the length compositions are informative of the fishing pressure, LBPA (Canales *et al.*, in press). A second population dynamic biomass (MBD) model is Schaefer, for data on landings and CPUE abundance index, and a third model, in which all pieces of historical information are integrated to generate appreciations about the status of the MESTOCKL populations. This last model was applied in those resources considered with higher quality of data.

Table 15. Stock assessment models. Source: Canales *et al* (2020) and Canales *et al* (2019)

Year of Assessment	Canales <i>et al</i> (2020)	Canales <i>et al</i> (2019)
Species	Model	Model
Frigate tuna	Mestockl	Mestockl
Pacific anchoveta	Mestockl	Mestockl
Pacific chub mackerel	Mestockl	Mestockl
Thread herrings	Mestockl	Mestockl
Shortfin scad	Mestockl	LBPA
Round herring	Mestockl	LBPA
Pacific cornetfish	MBD ^(a)	LBPA
Largedhead hairtail	MBD	LBPA
Yellowstripe grunt	LBPA ^(b)	LBPA

(a) Sheffer's Dynamic Biomass Model. (b) Ex MODACT

The stock assessment models defined for the species covered in this project are defined in **Annex 7.1**

2.2.2.4.3 Develop training workshops for observers, fishing inspectors and captains on data collection.

Due to COVID-19 lockdown there were several meeting restrictions in 2020 to perform this activity after the training process carried out in 2019 and reported in the first-year progress report. However, the project hired the specialist Rosa Vinatea (**TOR in annex 5.10**) to develop a training process for the SPS-FIP fleet in coordination with the IPIAP on issues related to sustainable fishing. The consultant has previous experience in the implementation of CUIDAMAR Sustainable Fishing Model in Peru.

As an initial activity, a total of 33 surveys were carried out among fishermen and administrative staff of the fishing companies, in order to identify the level of knowledge and awareness in sustainable fishing concepts and practices. The largest number of interviewees were captains, fleet managers, and to a lesser extent, fishing technicians, biologists and administration staff. In order to have sufficient information on the opportunities and challenges to implement the model, the surveys were structured in the following sections: (I) Fisherman's information, (II) Fishing operation, (III) Fauna identification, and (IV) Sustainable fishing. The surveys were conducted by telephone and lasted from 30 to 60 minutes. (**Annex 8.2**)

In addition, a survey was conducted to 21 fishermen, among captains and fishing technologists, with the aim of knowing the level of recognition of the species in the fishery and its common names.

The results of the interviews about sustainable fishing were positive, in terms of the importance of sustainable practices during fishing tasks. Most of the interviewees answered that to carry out sustainable fishing, species must be captured responsibly so that there is fishing in the future, respecting sizes and closures. However, 35% of interviewees answered that they did not know what the term means and what it leads to. There are certain sustainable fishing practices that are carried out on board, the main ones were: Do not fish juveniles, release species and fish outside the 8mn. Several interviewees answered that they release the bycatch, sometimes stop the fishing maneuver or release the net, but that these cases are not registered anywhere. As part of their sustainable activity, they respond that waste management is effective, and that the sea is not being polluted.

The 69% of interviewees indicated that few trainings have been received on issues of sustainable fishing or ecosystem and marine fauna by their current organizations, the difference has received training when they work in another fishery.

The target species that interviewees correctly recognized by their common name were the botella (*Auxis thazard*), macarela (*Scomber japonicus*), pinchagua (*Opisthonema spp*), chuhueco (*Cetengraulis mysticetus*), and rollizo (*Anchoa nasus*). While the species that were least recognized by their common name are the picudillo (*Decapterus macrosoma*), jurel (*Trachurus murphyi*), and chumumo (*Anchoa spp.*). However, 10 of 12 species have not been identified in about 20% of those interviewed. Species that have been incorrectly identified have been called by other common names, in some cases confusing them with other common names on the list.

With these results, a training process to SPS-FIP fleet will be carry in February 2021, with the following topics:

- Basic principles of the Ecuadorian marine ecosystem.
- Identification of the main species of the most representative marine fauna of Ecuador (small pelagic fishes, by-catch species and ETP species).

- Criteria for the conservation status of the main species of the most representative marine fauna of Ecuador.
- Correct handling and release techniques for seabirds, sea turtles, sea lions, sharks and rays.
- Correct protocol and record of sighting and release (ETP species).

The following support material for crew and captains training period has been developed (**annex 8.1**):

Table 16. SPS-FIP Guidelines designed for responsible fishing training process. Source: SPS-FIP

Guideline	Definition	Document
Guide to the handling and release of marine fauna in the small pelagic fish fishery in Ecuador	It shows the practices of manipulation, rehabilitation, and release of marine fauna, such as seabirds, sea turtles, marine mammals, sharks, and rays.	https://drive.google.com/file/d/1QnqRjNbL47xw0Sio5znbuJQ2fURMqA7R/view
Poster of main marine fauna in Ecuadorian sea.	The poster will serve as identification guide for species, as well as their state of conservation.	https://drive.google.com/file/d/1Pe2oL-1J1CaKMLmzSjE8IONVB1cSK7ox/view?usp=sharing
On-board sampling forms for Ecuador's small pelagic fishery	Provides the guidelines for the correct registration of the sampling form, as well as the forms that will be filled out during each fishing-set.	https://drive.google.com/file/d/1Pe2oL-1J1CaKMLmzSjE8IONVB1cSK7ox/view?usp=sharing
Record form for the release of marine fauna for the Ecuadorian small pelagic fishery	Provides guidelines for the correct registration of marine fauna releases, mainly to determine the condition and destination of marine fauna; in addition to indicators of the impact of the habitat during fishing operations.	https://drive.google.com/file/d/18kwwlh6I06KQLQTGzScIsaNcoPrU7AHU/view?usp=sharing
Record form for sightings in the small pelagic fishery in Ecuador	Provides the protocol for registering sightings during navigation, as well as the form that will be filled out during each day of operation.	https://drive.google.com/file/d/11aP2_RJC8Q7Oag6usLZlPXglTQWQb1bh/view?usp=sharing
Identification Guide of main fishes in the Small Pelagic Fishery	It contains information to be able to identify the main target and secondary species in the Ecuadorian small pelagic fishery.	https://drive.google.com/file/d/1oDI6NK4mW-hKfCDrOesavJAK1uBtJgT/view?usp=sharing
Identification guide for marine fauna of Ecuador	It contains information to identify and find the main characteristics of the most representative marine fauna in the small pelagic fishery in Ecuador.	https://drive.google.com/file/d/1uVYWM52IAQRaANCOJipe1wS5M1f3KB8o/view?usp=sharing
On-board sampling manual for the Ecuadorian small pelagic fishery	Contains the protocol to determine the catch composition, size structure, and sexual stage	https://drive.google.com/file/d/1HygT9XDax6tHjJ1rotj4GbN_HKwz93eM/view?usp=sharing

Around 170 crew members of the SPS-FIP fleet are scheduled to be trained. The trainings were initially scheduled for January 2021 but had to be rescheduled to February 2021 due to government restrictions related to COVID-19 announced in December 2020.

2.2.2.5 FAP Activity 3.1: Implement electronic logbooks for all the industrial boats targeting small pelagic, including interaction with ETPs.

In the first quarter of 2020, the Ecuadorian small pelagic fleet was able to operate for one month (February) due to management measures requested by shipowners to extend the November-December 2019 closure. A new closure began in March 2020 which was extended until the middle of May due to the COVID-19 spread. This caused delays in the implementation of the electronic logbook (BEP) in the fleet. There was also a delay due to some health problems of the SRP technician in charge of the BEP development. After the first pilot in December 2019, and some changes incorporated to the app, National Authority re-activated the process for the BEP implementation on July 15 to implement it in the FIP fleet as detailed in the memorandum MPCEIP-SRP-2020-1113-O (**annex 9.1**).



Figure 3. Screenshot of BEP login web platform, administrative interface. Source: <http://bitacora.produccion.gob.ec/bitacora/>



Bitácora Electrónica de Pesca





INSTITUTO ECUATORIANO DE INVESTIGACIÓN Y ACUICULTURA



SMALL PELAGICS
SUSTAINABILITY

Esta bitácora electrónica de pesca ha sido adaptada para la pesquería de pequeños pelágicos en base al sistema diseñado por WWF Ecuador en colaboración con la Subsecretaría de Recursos Pesqueros SRP y el sector pomadero arrastjero industrial entre el 2016 y 2018.

Preguntas, comentarios y sugerencias

fip@smallpelagics.org

Pasos previos de instalación



La aplicación móvil debe ser instalada en un dispositivo que utilice el sistema operativo Android en versión 6 o superior.



El dispositivo móvil debe tener su GPS con un funcionamiento apropiado. Valídelo siempre que pueda.



El aplicativo móvil (app) no está diseñado para sistemas operativos Windows o IOS. Puede presentar inconsistencias, por lo que no se sugiere su instalación en equipos de escritorio o sistemas operativos Mac.



Debe ser un usuario registrado en el Módulo Administrador de la plataforma de la Bitácora electrónica de Pesca. De ser el caso, solicite soporte al fip@smallpelagics.org

Instalación



El aplicativo móvil lo puedes encontrar en la siguiente dirección electrónica: <http://bitacora.produccion.gob.ec/bitacora/>



Ingrese a esta dirección desde su móvil y seleccione el botón DESCARGAR APLICACIÓN.



Ejecute el archivo descargado.

Nota: En algunos dispositivos debe superar el bloqueo de seguridad para la instalación de archivos con extensión .apk, para lo que se requiere aceptar los cuadros de diálogo que aparezcan con estas advertencias. El proceso difiere entre modelos de dispositivos móviles. Busque en su dispositivo el icono del aplicativo y ejéctelo.



After this, the authority established by memorandum MPCEIP-SRP-2020-1298-O (**annex 9.2**) an implementation period. The implementation ranged from August 6 to December 15, 2020 and in the vessels of companies registered in the FIP, except those that due to damage are not operating in that period of time.

The electronic logbook system has two components: the administrative one where shipowners, fleet managers or administrative workers can register the captains and vessels that will use the app to record catches in real time; and the mobile app that is a system for electronic devices (tablets or cell phones) that work under Android OS. The system records trips, sets per trip and catches by species during fishing trips. Likewise, captains record the number of species sighted near of the vessels, keeping the technical and scientific group informed about what is happening at sea.

The process of implementing the electronic logbook (BEP) involves both the fishing authority (SRP) and the scientific authority (IPIAP) who are users of the data generated, in order to analyze, process and manage data that allow making decisions for the improvement of the fishery. (<http://bitacora.produccion.gob.ec/bitacora/>)

The SPS-FIP trained fleet managers so that they can manage the administrative BEP platform in terms of: entry of vessels, captains login, link between captains and boats, log reports, review of sets on the sensitive map, report of captures.

The captains of each vessel were trained in the use of the BEP app, through practical exercises that included: login, identification of the BEP app menu, start and end of sets, species registry (Objective, Incidental, ETP), sending and reviewing the log history.

A total of 986 electronic logbooks (BEP) were generated since August 8 until December 15.

Table 17. Number of electronic logbooks generated by SPS-FIP fleet

SHIPOWNERS	REGISTERED VESSELS	ACTIVE VESSELS	VESSELS USING BEP	NUMBER OF ELECTRONIC LOGBOOKS GENERATED (BEP)					TOTAL
				AUG 2020	SEP 2020	OCT 2020	NOV 2020	DEC 2020 UNTIL DEC, 15	
NIRSA	7	7	7	72	74	79	71	49	345
POLAR	10	8	8	64	62	66	53	28	273
FORTIDEX	4	4	4	46	40	36	43	25	190
PROMARVI	3	2	2	25	18	16	20	10	89
TRANSMARINA	3	3	2	0	0	18	26	15	59
DIMOLFIN	1	1	1	0	0	10	11	6	27
HERCO	6	6	1	0	3	0	0	0	3
EXU	1	1	0						0
OPTIMARINE	1	1	0						0
Total	36	33	25	207	197	225	224	133	986

As part of the performance analysis of the BEP app, a skills measurement was carried out based on the logs generated and correctly filled out by the captains, evaluating factors such as: appropriate starting and closing of the log, incidence of errors such as observations in species, registration and

closing of sets. It was obtained that 892 logs generated from the BEP app were correctly filled out and without observations, this was determined as a 90% of training success rate. Regarding the 10% of logs with observations (94 in total), it presented inconsistencies such as: truncated data, geographic coordinates at the same start and end point, data transmission problems, identification species error, omission of set records, omission of closing the fishing sets, excessive use of observations field. The 94 BEPs are under review by technical staff.

Table 18. BEP success rate by SPS-FIP fleet. Source: SPS-FIP

SHIPOWNERS	TOTAL BEP	BEP UNDER REVIEW	BEP CORRECTLY FILLED OUT	% BEP SUCCESS RATE	MONTHS OF PARTICIPATION / MONTHS OF EVALUATION
NIRSA	345	9	336	97%	5/5 months
POLAR	273	26	247	90%	5/5 months
FORTIDEX	190	24	166	87%	5/5 months
PROMAVI	89	17	72	81%	5/5 months
TRANSMARINA	59	18	41	69%	3/5 months
DIMOLFIN	27	0	27	100%	3/5 months
HERCO	3	0	3	100%	1/5 months
Total	986	94	892	90.4%	

During the period since August 8 until December 15, 2020, a total catch of 32,772.1 t was recorded in BEP system. The catch composition is detailed in the figures below:

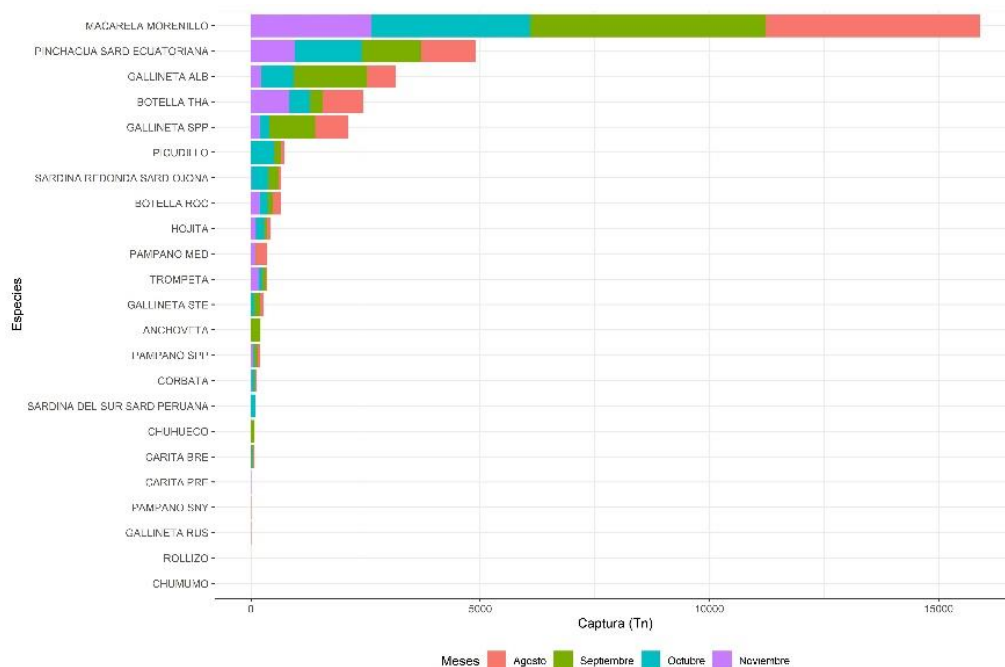


Figure 6. Catches by species and month. Source: BEP System (period August 8 until December 15, 2020)

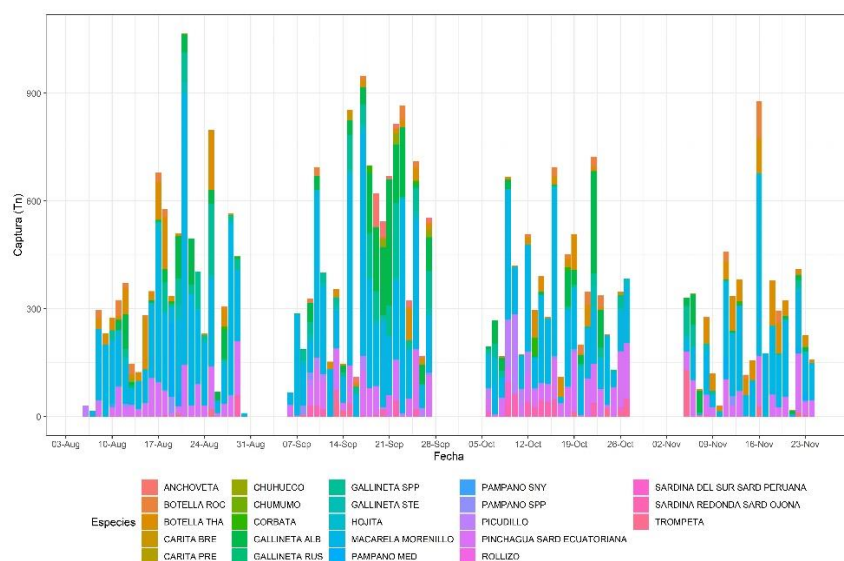


Figure 7. Catches by month and day. Source: BEP System (period August 8 until December 15, 2020)

Until the end of the year, the SPS-FIP trained a total of 30 captains in the use of the BEP app:

Table 19. List of trained captains during electronic logbook implementation (August-December 2020). Source: SPS-FIP

Citizen ID	Last name	Name	Cellphone	E-mail
1310182454	ALCIVAR SANCHEZ	GEORGE GREGORIO	0985895421	georgealcivar1980@hotmail.com
0907617930	ANASTACIO BANCHON	JOSE CAMILO	09901514456	control.flota@fortidex.com
0907193288	BOHORQUEZ BENITES	HORACIO ROBERTO	0993220354	horacio.rbohorquez@gmail.com
0703746594	CORREA FLORES	RENAN OLMEDO	0939056521	correafloresrenanolmedo@gmail.com
0911841161	CRUZ TOMALA	WILSON URBANO	0992093829	wilsoncruz45@gmail.com
0922420864	CUCALON CACAO	EDUARDO JACINTO	0989240523	e_du_duck@hotmail.com
0918259060	GARCIA GRANADOS	VICTOR BENITO	0990469934	control.flota@fortidex.com
0908223001	GARCIA PALACIOS	NEWTON	0990350091	nilahueherco@gmail.com
0921535720	GAVIN MOROCHO	LUIS WILLIAM	0997362030	gavin-luis@hotmail.com
0920513884	GUTIERREZ GUADAMUD	GEOVANNY ALEJANDRO	0967588051	control.flota@fortidex.com
1310895337	HOLGUIN DELGADO	SIFREDO FERNANDO	0990558220	sifredoholguind@gmail.com
0913336780	LUCAS DELGADO	MARCO ALEX	0991844932	marcolucas1997@hotmail.com
1311166225	MACIAS ZAMBRANO	DARWIN RICARDO	0969606134	surf.ron@hotmail.com
0928501329	MALDONADO LINO	JUAN CARLOS	0985047201	jcar_jl@hotmail.com
0914806633	MARCILLO BARRENA	MILCIADES GASTON	0991230095	mamerro71@gmail.com
0926816653	MAXIMI MENENDEZ	JONATHAN JOSE	0969326073	jonmaxi.89@hotmail.com

0909152852	MERA TORRES	JUAN FRANCISCO	0939872299	control.flota@fortidex.com
2450599820	MERO	MANUEL MOISES	0987104651	operaciones@optimarine.com.ec
0916107261	MEZA SOLORIZANO	LUIS LEONEL	0967916438	luismezasolorzano72@gmail.com
0909237661	MONTENEGRO GONZALEZ	HECTOR IVAN	0999354701	himontenegrog@hotmail.com
0913096293	MORILLO VALLEJO	BAYRON HUMBERTO	0960652616	morillobayron@yahoo.es
0927263251	MUÑOZ FRANCO	JONATHAN ORLANDO	0969672515	PIPO_LEN@HOTMAIL.COM
0910454750	NAVARRETE LOOR	RUBEN DARIO	0993837741	runaloor@gmail.com
0800900003	OCHOA ALARCON	BYRON MANUEL	0968812123	bm.ochoa@hotmail.com
0926916149	OLAVE MERO	ALVARO JOSE	0992224608	bpmariaemilia@gmail.com
0912539319	PEREZ ALFONSO	JOSE OSWALDO	0960040689	oswaldo2470@hotmail.com
0905213377	SALVATIERRA ANTON	GALINDO PERFECTO	0969742411	galindosalvatierra@gmail.com
1304284910	SERRANO GONZALEZ	EDISON MIGUEL	0988946625	gydherco@gmail.com
0924495187	SOLIS VERA	RAFAEL ANTONIO	0991415131	raphasolis@hotmail.com
0929017689	TUMBACO RODRIGUEZ	EITHEL DEMESIO	0992439240	control.flota@fortidex.com

Also, the project carried out an evaluation of the BEP georeferencing precision, analyzing the track of two vessels during the months of August and October, as well data provided by the satellite monitoring system of SRP, which showed that there is high precision on the georeferencing provided by the BEP app. The following graphs show the route recorded by the satellite monitoring center (blue lines) and the points where sets recorded in the BEP (red / green crosses). As can be seen, the fishing sets record are shown on the route registered by the SRP monitoring center, so it is evident that there is a good level of reliability in the coordinates captured by the mobile devices that used the app BEP.

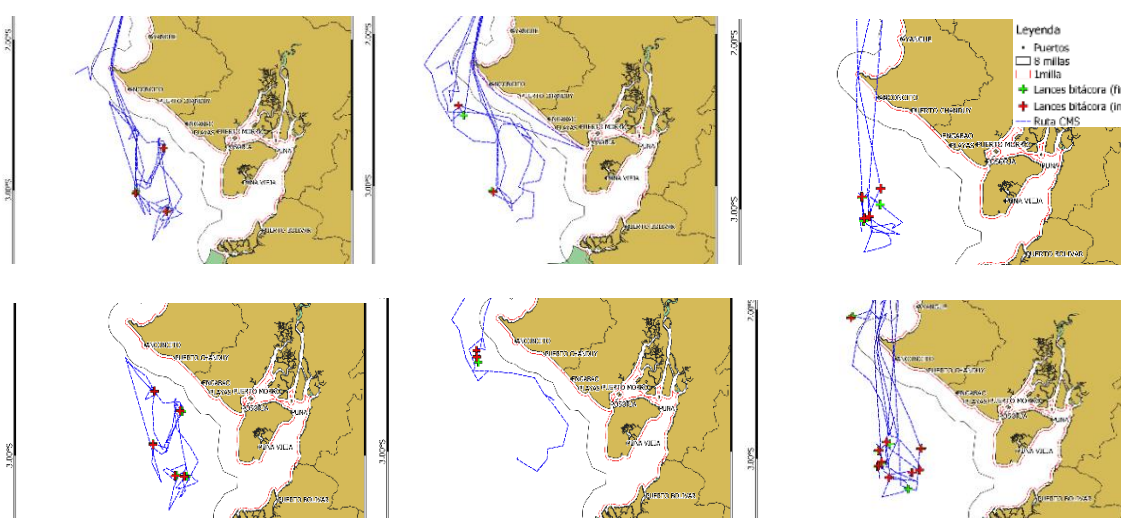


Figure 8. BEP sampling analysis. Fishing sets (red/green crosses) and tracking (blue lines). Elaborated by SPS-FIP staff

Each captain and fleet manager received 24/7 technical support to overcome any inconvenience during the months of implementation. An important part of the implementation process was feedback with the users of the system. In the closure of October / 2020, meetings were held with the captains, in order to promote feedback. The results and feedback show that the progressive use of the BEP app has been positive, in various aspects such as:

For the fisherman and the fleet support team:

- Saving times in the generation of reports that the captain must generate.
- Improved control and organization of data regarding trips, captains and landing records.
- BEP report is also useful for the landing of fishing,
- The captain's catch estimates have progressively improved, going from an 8% difference to a 2% with the real weights,
- The continuous use of the app favors the learning of the captains.
- The empowerment of the captain has made it possible to identify details of the fisherman's usual activities on board that are useful for a progressive improvement of the app;

Regarding the BEP app:

- Their performance has satisfactorily exceeded expectations regarding the fisherman's use response and offshore work,
- The performance evaluation against the registration of the geographic coordinates provided by the fishing authority (CMS) versus the coordinates registered with mobile devices (of any range) show a very high level of reliability,

Regarding the information system of the BEP platform:

- The concept of the BEP is focused on the fast, practical, simple work that the fisherman must perform,
- The design (front end) of the BEP uses an accessibility concept adapted to the physical characteristics of the fisherman's hands, which has been of great help at the time of training and the required technical support,
- Technical support organized by response levels has been critical to supporting the night-time fishery. The successful implementation is based on the timely response to the user's requirements before, during and after training, creating an environment of trust and support at all times.

The need for technical improvement was included in a report to the SRP technicians and they are being incorporated into a schedule of changes that is expected to be ready in January 2021. **(Annex 9.5)**

Examples of BEP output can be found in annexes 9.7.1 and 9.7.2

2.2.2.6 Develop a system, endorsed by the research team, to calculate withdrawals (catches per specie).

As part of the cooperation with IPIAP, SPS-FIP hired a technical assistance for the development of a new methodology for estimating the total landings by species and fleet segment in the small pelagic fishery, with the following objectives:

- Define a new methodological proposal for the estimation of total landings in the small pelagic fishery disaggregated by species and temporal strata (month, year) and operational stratum (fleet segment).
- Estimate landings by species and fleet segment of vessels in the small pelagic fishery for the period from 2004 to 2019.
- Train IPIAP pelagic program staff and FIP staff in the estimation methodology.

The technical assistance was developed by Ing. Juan Carlos Saavedra and IPIAP/SPS-FIP staff (**annex 5.5 and annex 10.1**). Until December 2020, 2 workshops (Zoom platform) have been done in order to train IPIAP and SPS-FIP staff. The new model for estimation was designed in R code (**annex 10.2**).

All the reports generated by the consultant until December 2020 are detailed in **annex 10.3**, and the assistance will finish in January 2021.

2.2.2.7 FAP Activity 4. Establish a biological data gathering system through the observers' program.

As reported in first-year progress report, on December, 2019, the SRP approved (MPCEIP-SRP-2019-2363-O) the management model and research protocol for the observer programme (biological and fishing data, and ETP interactions), in charge of the SRP in order to articulate the data transfer to the IPIAP staff, as an instrument to help improve coordination, monitoring and information exchange processes between INP and SRP. In compliance with the execution of the instruments mentioned, the Fisheries Control Department of the SRP was delegated, through the technical focal points designated for this purpose. (**Annex 11.1 and 11.2**)

As part of new management model, a socialization workshop was held for the 22 observers designated for the small pelagic fishery, where the Data Collection Protocol was again explained, reinforcing the knowledge previously acquired. As part of this workshop (January 2020), it was obtained a diagnostic test. (**Annex. 11.3 – 11.4**)

Due to COVID-19 restrictions and extension of fishing season closure, the fleet reactivated its operations in mid-June 2020. The Observer Program identified viable mechanisms to work under the corresponding biosecurity protocols, according to the measures implemented by shipowners.

Regarding the transfer of data to the IPIAP, the observer program maintained the delivery of data since July to date, the transfer of data is now more accessible for the IPIAP, since the databases are available in an online repository of the Fishing Authority, which includes shipping agreements that have been made, sampling forms and the updated database.

2.3 FAP Objective 3: Stock assessments of relevant species to the fishery are conducted on regular bases, following scientific methodology and their results are published and publicly

2.3.1 Improvement recommendations

- *“Conduct a stock assessment at least every 3 years, which considers all fishery removals and the biological characteristics of the species.”*
- *“Ensure the stock assessments are made publically available.”*

2.3.2 Activities and results

2.3.2.1 FAP Activity 5.1.1 - 5.1.9: Establish a periodic stock assessments system

The stock assessment prepared by Canales, et al. (2019) was updated, based on the analysis of the biological information available between 1975 and 2019. For this evaluation, the short-term improvements suggested in the peer review conducted by Minte-Vera (2019). In this way, the evaluation of the small pelagic stock of Ecuador has been supported by the best use of the available data series, the modifications were the following:

- Analysis model adapted/modified to include more sources of information, the biomasses obtained by acoustics cruises were included, together with the composition of sizes, creating the index from the data of the Gulf of Guayaquil, which is where most of the removable biomass from pelagic fisheries is located.
- Inclusion of databases of fishing operation of the observer program.
- Update of the series of landings and size compositions of the catches 2018-2019.
- Review of biological parameters.

Depending on the quality of the data of each stock, the analyzes were carried out based on three types of models:

- The number of species analyzed as “data-rich” increased (from 4 to 6): MESTOCKL model: Frigate tuna, Pacific anchoveta, Pacific chub mackerel, Shortfin scad, Thread herrings, Round herring. For this last model, the analyzes were extended and sensitized to 5 possible scenarios of hypotheses.
- Two resources were evaluated with “data-intermediate” models: MBD model: Largedhead hairtail, Pacific cornetfish
- Only one resource evaluated as “data-poor”: LBPA model (MODACT): Yellowstripe grunt

Additionally, it should be noted that the Biological Reference Points (PBR) are set, where the Maximum Sustainable Yield was established as a proxy value, it is agreed to maintain a biomass equivalent to 40% of the virginal spawning biomass as a reference for overexploitation. Consequently, the F40% fishing mortality is established as an overfishing criterion.

RESULTS

Frigate tuna

The Kobe diagram indicates that the population of *Auxis spp* would be without evidence of overexploitation ($\% B_0 < 0.4$) or overfishing ($F < F_{40\%}$). Current conditions indicate that the fishing effort would be at 70% of the maximum or limit level and the population at 46% B_0 .

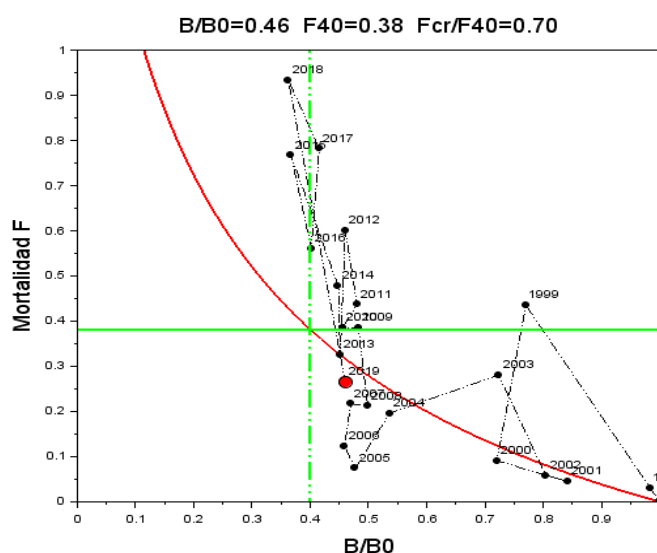


Figure 9. Kobe plot for frigate tuna. Source: Canales et al (2020)

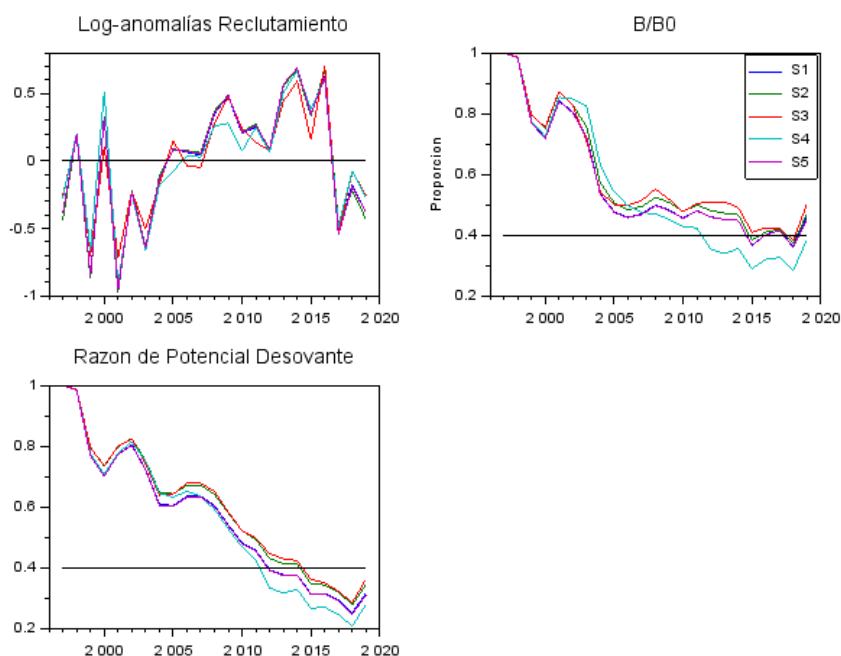


Figure 10. Log recruitment anomalies, virgin spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of frigate tuna assessment. Source: Canales et al (2020)

Pacific chub mackerel

The Kobe diagram places this resource in an overexploited condition (94% probability) if the long-term references are considered. In the same way, it places the fishing mortality below the value $F_{40\%}$ and therefore, outside the overfishing zone. If the current level of fishing mortality is maintained, the population should register a rapid population recovery.

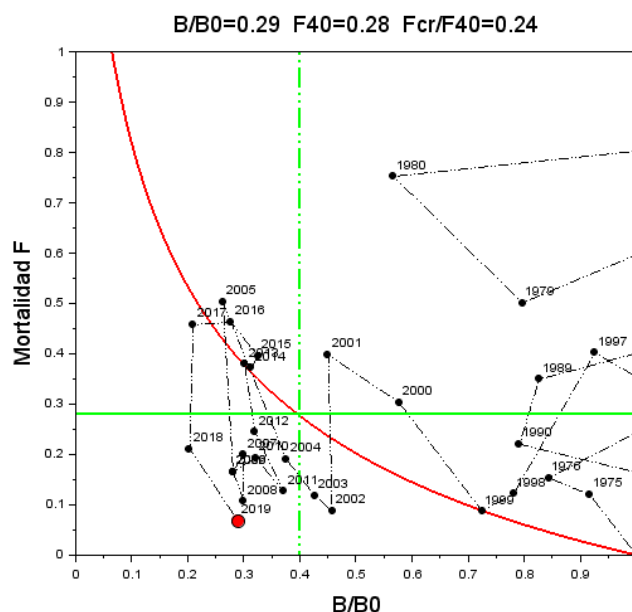


Figure 11. Kobe plot for pacific chub mackerel. Source: Canales et al (2020)

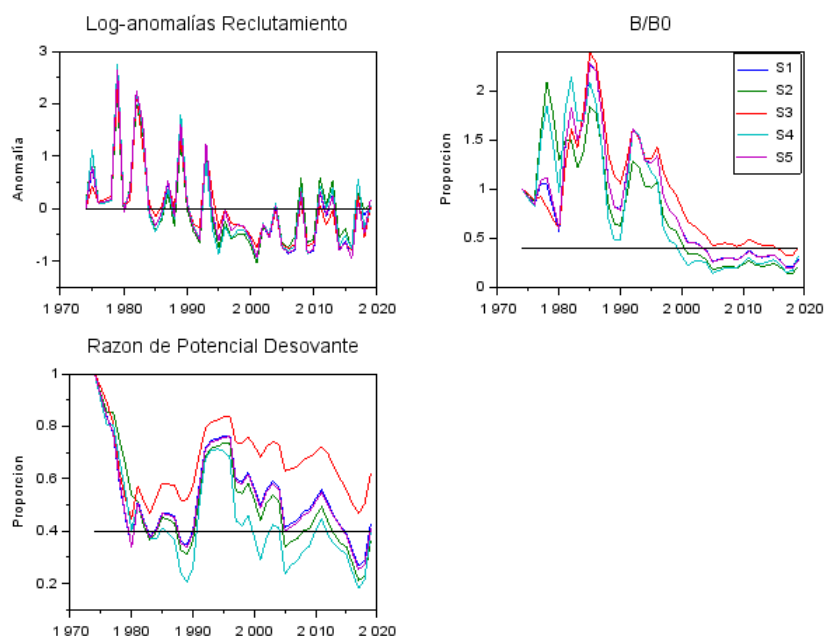


Figure 12. Log recruitment anomalies, virgin spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of pacific chub mackerel assessment. Source: Canales et al (2020)

Pacific anchoveta

The diagnosis seen in the Kobe diagram indicates that although the stock shows evidence of overexploitation with respect to the management objective (40% B0), the fact that fishing mortality is positioned around the reference value determines an ideal condition for the population recovery whose biomass should reach around 40 thousand tons.

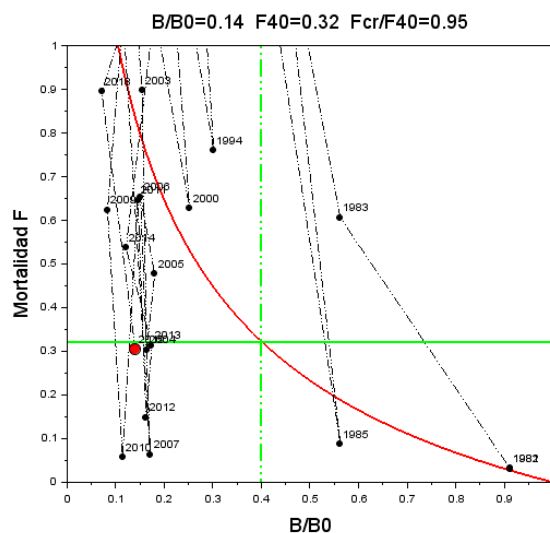


Figure 13. Kobe plot for pacific anchoveta. Source: Canales et al (2020)

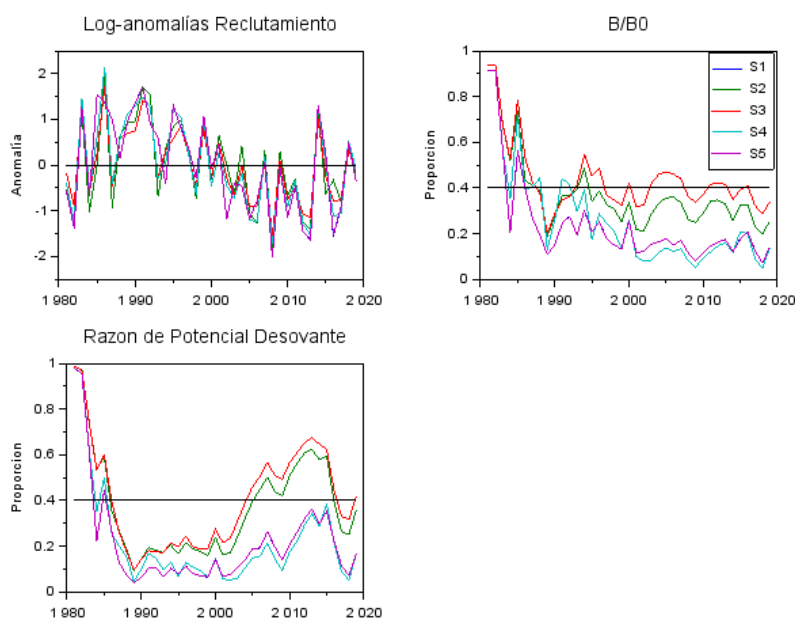


Figure 14. Log recruitment anomalies, virgin spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of pacific anchoveta assessment. Source: Canales et al (2020)

Thread herrings

The relative position of biomass and fishing mortality in the Kobe diagram shows that the pinchagua would not present symptoms of overfishing while the risk of overexploitation would reach 10%. Fishing mortality is less than half the maximum value $F_{40\%}$, which is why the population recovery should be accentuated with B_0 higher than 40%.

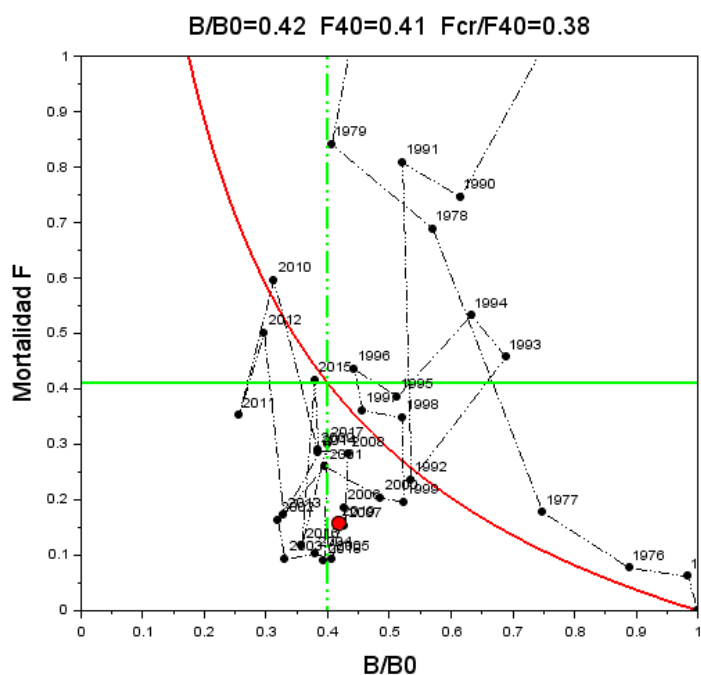


Figure 15. Kobe plot for thread herring. Source: Canales et al (2020)

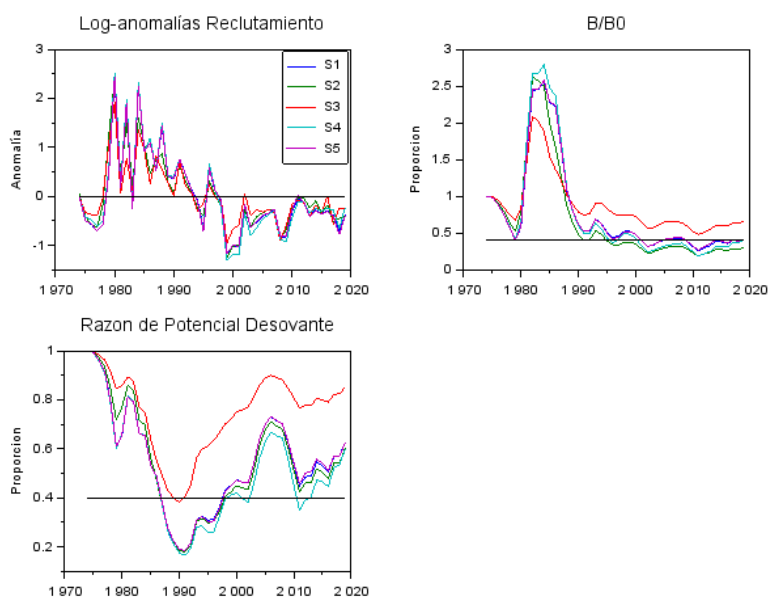


Figure 16. Log recruitment anomalies, virgin spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of thread herring assessment. Source: Canales et al (2020)

Shortfin scad It is estimated that *Decapterus macrosomma* would present a 100% probability of overexploitation given a biomass reduced to 14% of B_0 , but without overfishing ($F < F_{40\%}$).

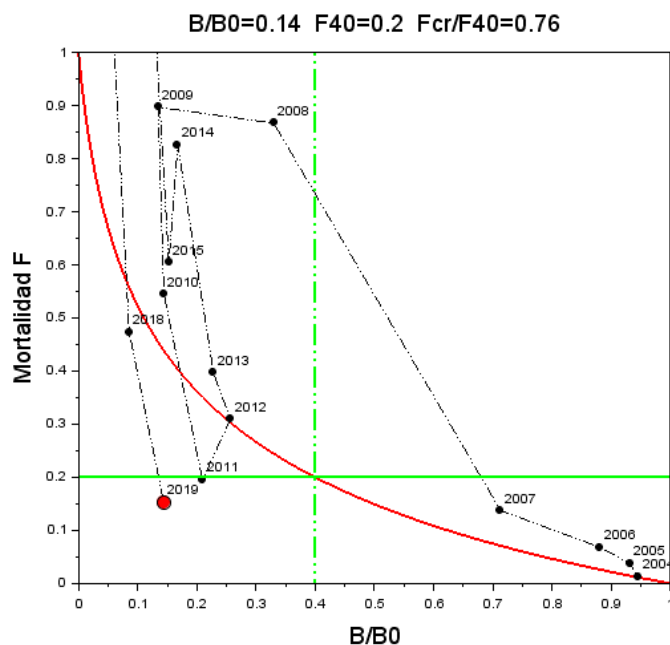


Figure 17. Kobe plot for shortfin scad. Source: Canales et al (2020)

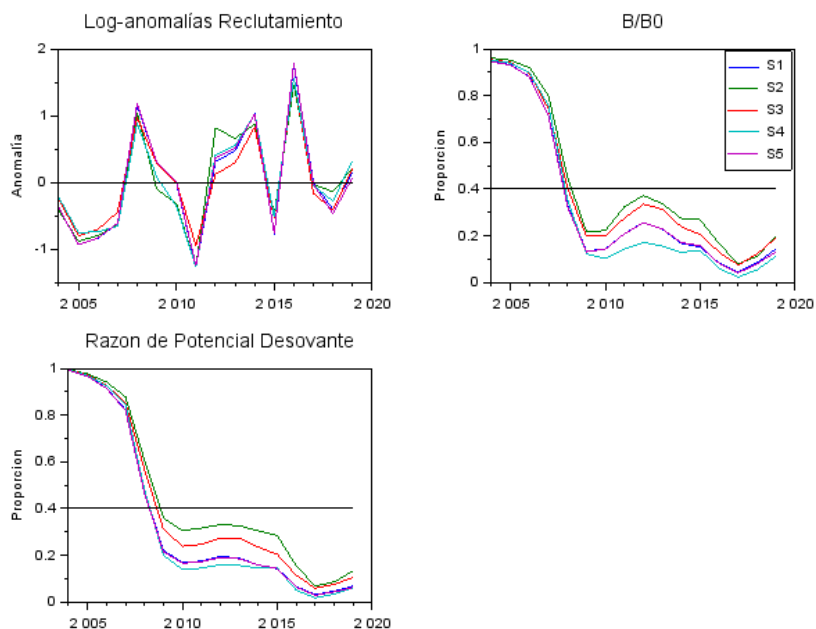


Figure 18. Log recruitment anomalies, virgin spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of shortfin scad assessment. Source: Canales et al (2020)

Round herring

The stock diagnosis based on the Kobe diagram shows that *Etrumeus teres* would be found at 27% of the virginial condition and therefore in the overexploitation zone (100% probability). However, this, the fishing mortality would be below the reference value $F_{40\%}$ and therefore without overfishing. If these conditions are maintained, a rapid recovery in biomass and yields should be registered.

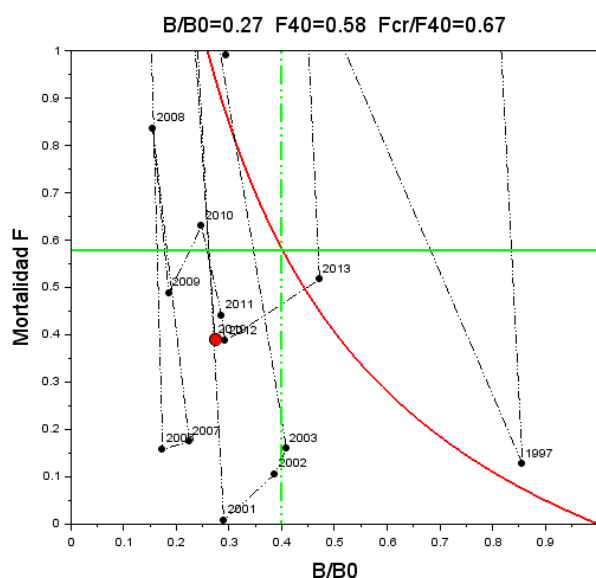


Figure 19. Kobe plot for round herring. Source: Canales et al (2020)

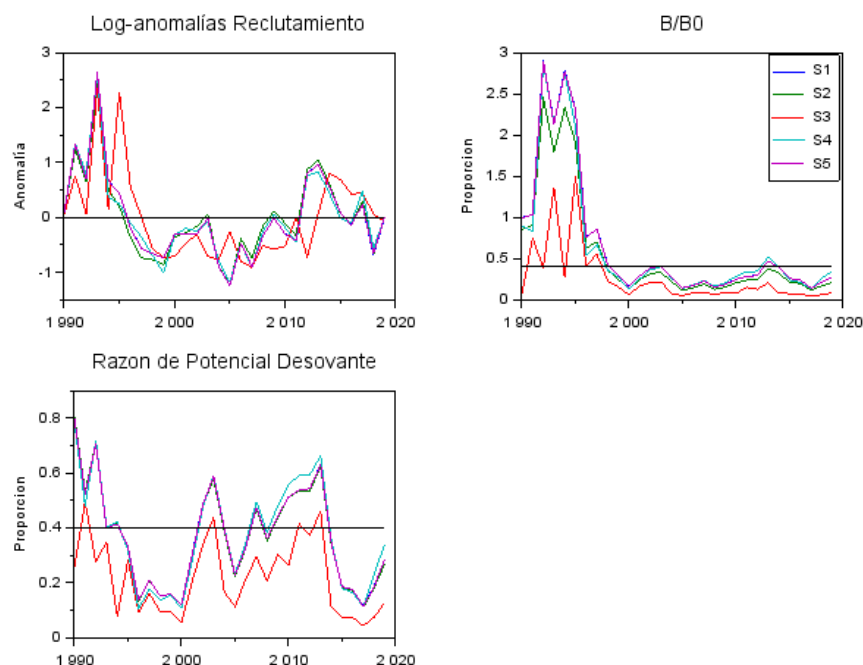


Figure 20. Log recruitment anomalies, virginial spawning biomass proportion and reproductive potential ratio measured in 5 scenarios of round herring assessment. Source: Canales et al (2020)

Other stocks assessed:

Largedhead hairtail	Biomass in 2019 is estimated at around 110 thousand tons and would correspond to 52% of the initial biomass and located above the reference PBR. In turn, the fishing mortality for the years 2018-2019 ($F < 0.07$) is below the reference fishing mortality $F_{40} = 0.37$ and therefore without evidence of overfishing
Pacific cornetfish	The population has decreased and would be close to 47% of the initial condition and therefore above the PBR (40% B_0). On the other hand, the fishing mortality of the last two years ($F < 0.07$) is below the reference level considered overfishing limit $F_{40} = 0.10$
Yellowstripe grunt	The information used is very erratic, insufficient, and only a couple of length compositions of the catches provide any information regarding the effect of fishing mortality and selectivity. The proportion of spawning biomass $SPR = 0.26$ would be below the objective ($SPR = 0.4$) and the fishing mortality would almost double (1.88 times) the reference fishing mortality F_{40} .

Canales *et al.* (2020) concludes:

- Corroborating what is highlighted by Canales *et al* (2019), one of the most notable results is the fact that some of the small pelagic populations have suffered natural reductions as a result of changes in the recruitment scale. These changes were observed in Pacific chub mackerel, Pacific anchoveta, Thread herrings and Round herring, coinciding that a low productivity regime would have started since the late 90s.
- In most of the cases analyzed and regardless of the assumptions and analysis models, the results showed that these resources remain depressed and in the process of overexploitation. Notwithstanding this, and due to the reduction in catches, overfishing processes have been reduced and generated a relative recovery of the stocks.
- The small pelagic of Ecuador generally show an improvement compared to the stock assessment with data up to 2017 as reported by Canales *et al* (2019), which means an increase in the proportion of virginial biomass and a reduction in the Fishing mortality relative to the reference fishing mortality (F_{40}). The overexploitation indicator B / B_0 (biomass) shows that on average, between 2017 and 2019, the populations improved from 0.18 to 0.32 (desirable > 0.4), while the overfishing index F / F_{40} decreased from 1.26 to 0.67 (desirable ≤ 1).
- In order to ensure the recovery of these stocks, it is suggested as far as possible to keep the level of fishing effort reduced and to take advantage of the productivity levels of these resources proportionally. This means not excessively increasing the catches in the face of greater abundance and maintaining the vigilance of population indicators.

Table 20. Comparative table of the diagnostic indicators of the small pelagic stocks of Ecuador 2019-2020. B / B_0 values greater than 0.4 are highlighted in bold. Source: Canales *et al* (2020)

Year of Assessment	Assessment with data until 2019 Canales <i>et al</i> (2020)			Assessment with data until 2017 Canales <i>et al</i> (2019)		
Especie	Modelo	B/B_0	F/F_{40}	Modelo	B/B_0	F/F_{40}
Frigate tuna	Mestockl	0.46	0.69	Mestockl	0.11	4.25
Pacific anchoveta	Mestockl	0.14	0.95	Mestockl	0.17	0.56
Pacific chub mackerel	Mestockl	0.29	0.24	Mestockl	0.23	1.84

Thread herrings	Mestockl	0.41	0.38	Mestockl	0.32	1.57
Shortfin scad	Mestockl	0.14	0.76	LBPA	0.06	0.20
Round herring	Mestockl	0.27	0.67	LBPA	0.03	0.07
Pacific cornetfish	MBD ^(a)	0.47	0.52	LBPA	0.58	2.11
Largedhead hairtail	MBD	0.52	0.01	LBPA	0.11	0.44
Yellowstripe grunt	LBPA ^(b)	0.26	1.88	LBPA	0.07	0.31
Average		0.32	0.67		0.18	1.26

(a) Sheffer's Dynamic Biomass Model. (b) Ex MODACT

2.3.2.2 Ensure the stock assessments are made publically available.

The stock assessment realized under the improvement process are available on:

FIRST STOCK ASSESSMENT

Canales, C., Jurado, V., Peralta, M., Chicaiza, D., Elias, E., Preciado, M., . . . Sandoval, G. (2019). *Evaluación de stock de peces pelágicos pequeños en la costa continental ecuatoriana*. Guayaquil: Sustainable Fisheries Partnership Foundation & Instituto Nacional de Pesca. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Informe-Evaluaci%C3%B3n-2019.pdf>

SECOND STOCK ASSESSMENT

Canales, C. J., Canales, C., Jurado, V., Peralta, M., Chicaiza, D., Elias, E., & Romero, A. (2020). *Evaluación del stock de recursos pelágicos pequeños del Ecuador*. Guayaquil: Informe técnico IPIAP. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2015/11/INFORME-EVAL STOCK PP ECUADOR 2020 WEB.pdf>

2.4 FAP Objective 4. Management Measures (CMMs) are adopted by fishery managers accordingly to the Stock Assessments outcomes and recommendations

2.4.1 Improvement recommendations

[A3.1] Implement a mechanism by which total fishery removals can be limited to the level recommended by stock assessments. This does not necessarily need to take the form of a quota; any effective mechanism can be implemented. The effectiveness will be demonstrated by meeting requirement A3.2.

2.4.2 Activities and results

2.4.2.1 FAP Activity 7. Identify and establish biological reference points (target and limit) as well as related Harvest Control Rules, based on data already available and results of the 1st Stock Assessment for this specie.

As part of the cooperation with GMC project, Dr. Cristian Canales developed together with IPIAP, the Evaluation of Exploitation Strategies (MSE) for the small pelagic fishery of Ecuador, which includes a training process to the IPIAP technical staff for the development of skills. As planned, 5 workshops were held to improve technical skills in modelling and evaluating management strategies. The objective of these workshops was the discussion of technical elements during the development and first simulation tests of the Operating Model. The discussions were also focused on the identification and discussion of the most suitable performance variables to evaluate the different management strategies. The last workshop was dedicated to modeling in the SCILAB environment. **(Annexes 7.1 and 7.2)**

Biological Reference Points

As detailed by Canales (2020) *“the management of the fishery considers as a long-term objective to maintain a spawning biomass value around the Maximum Sustained Yield (MSY) of each species. As proxy BRMS, the criterion of 40% of the virginial spawning biomass (B0) is considered. These values were estimated in the stock assessment of each of the 6 species updated to 2019 (Canales et al., 2020).”*

The assessment concludes that if all species reached the management objective at the same time, the fishery could generate 173 thousand tons per year in a sustained manner (table below). Under these conditions, the main species should be pacific chub mackerel with a contribution of 46% of landings, followed by thread herring and frigate tuna with 21% and 16%, respectively.

Table 21. Biological Reference Points of the 6 main species of small pelagic fish in Ecuador. As proxy for RMS, the criterion 40% of B0 is considered. Source: Canales (2020)

Species	B _{RMS} (t)	MSY (t)	F _{RMS}	CPUE _{RMS}
Pacific chub mackerel	155,912	78,996	0.28	0.49
Thread herring	74,626	37,320	0.41	0.70
Pacific anchoveta	33,537	15,430	0.32	3.70
Round herring	5,176	3,539	0.67	1.34
Frigate tuna	42,310	27,091	0.43	0.31
Shortfin scad	19,970	10,912	0.20	1.79
Total		173,288		

Control rules

Canales (2020) concludes that effort control rules seem to be more feasible and accepted in the Ecuadorian fisheries management framework. The decision rule depends on the variation in CPUE

(Catch per Unit of Effort) as an indicator of population abundance, which is estimated annually in the regular process of analysis of fishery data carried out by IPIAP. The general rule establishes that the fishing effort (E) should be corrected annually (t) according to the average variation of the CPUE of the two most recent years.

The management of the multispecies fishery implies great complexity, given that it requires a large amount of information to achieve a global assessment of the fishery and is logistically impractical, due to the fishing effort it is exerted indistinctly on all species (Newman *et al*, 2018). For this reason, the strategy is based on a management of an indicator species and the assumption is that this will lead to the management objective (BRMS).

To establish the indicator species, a participatory prioritization of all the target species of the fishery was carried out, based on the criteria of vulnerability inherent to the species, stock status and importance of management.

Vulnerability and stock status criteria were assessed by SRP, IPIAP technical staff and technical advisors according to available data of the small pelagics resources. While “management importance” criteria was assessed by the fishers according a qualitative scales to measure “importance” in regards with: i) commercial value, ii) perception of the current stock status concerning the origin of the fishery (based on yields and sizes), iii) probability of appearance during the fishing operation (%), iv) use of the captures (direct consumption or fish meal); v) cultural importance (local and indigenous livelihoods).

The result of the prioritization is detailed bellow, an important input for the design of the NPOA and FMP:

Table 22. Prioritization of small pelagic species. Source: Canales (2020)

Species	Vulnerability	Stock Status	Management importance	Ranking
Pacific chub mackerel	4.1	2.5	4.3	3.62
Thread herring	3.5	2.0	4.2	3.23
Shortfin scad	3.2	3.3	3.0	3.16
Pacific anchoveta	2.8	3.0	3.4	3.08
Frigate tuna	3.3	1.5	4.0	2.94
Round herring	3.3	2.0	1.6	2.31

The design of the control rule for the fishery was based on this prioritization. The control rules are described below:

The control rule allows adjusting the effort measured in total fishing days of the season, according to the state of the small pelagic stocks. This is carried out by adjusting the extension of the current monthly extractive closure known as "*clara*" (full moon period), adjusting the days of closure to achieve the $CPUE_{RMS}$ of the indicator species. The estimate of the duration of the extractive closure will be established by the SRP through Ministerial Agreement and must be based on the estimate and recommendation made by the IPIAP.

This effort control is based on the state of exploitation of the indicator species according to the variation of its Catch per Unit of Effort (CPUE), as a population abundance index, which is estimated annually in the regular data analysis process of fishing activities carried out by IPIAP.

At the beginning of each fishing season, the level of effort must be adjusted for the entire fishery, based on the stock status of the indicator species, considering its Biological Reference Points (table above). However, every two years the status of the fishery must be reviewed, to generate changes or maintain the species that generates the entry into effect of the control rules.

The fishing effort (E) must be adjusted annually (t) considering the variation of the CPUE of the indicator species with respect to the target reference value (CPUE_{RMS}):

$$E_t = \rho_t E_{t-1}$$

$$\rho_t = 0.5 \frac{(CPUE_{t-1} + CPUE_{t-2})}{CPUE_{RMS}}$$

The rule considers the magnitude of the catches that were made in previous years, that means the effort reduction is only generated when the average catches of the last two years are greater than the MSY (stabilizer). The detail of the procedure is provided in table below, and full report Canales (2020) is in **annex 7.2.2**

Table 23. Conditions with stabilizer to adjust the fishing effort in the small pelagic fishing fleet of Ecuador. Source: Canales (2020).

Condition	Decision
If $\rho > 1$ but average catches < RMS	Fishing days is increased ρ times.
If $\rho > 1$ and average catches > RMS	Fishing days remains constant.
If $\rho < 1$ but average catches < RMS	Fishing days remains constant.
If $\rho < 1$ but average catches > RMS	Fishing days is decreased ρ times.

Once the conditions of the indicator species reach 90% of the management objective (CPUE_{RMS}), it will be changed following a prioritization.

The control rules are part of the FMP which was discussed in the SPFDP. The Ministerial Agreement for FMP and NPOA is in elaboration by SRP and VAP as detailed in MPCEIP-SRP-2020-2081-O (**annex 7.3.2**).

The particularities of this rule lie in the selection of species that determine the CPUE values and consequently the corrections to the effort of the immediately following year. The hypothesis to be evaluated is that multi-specific fisheries management can be directed by monitoring the changes in CPUE and catches of the species considered most relevant or representative, and that this would lead the man the objective of BRMS management of all the species. To evaluate the above, four alternative effort control rules were evaluated and after a participatory discussion R2 rule was recommended:

a) R0: It is considered the most vulnerable species of the two most relevant in the fishery (pacific chub mackerel and thread herring) as generators of effort change. The decision rule runs every year, but is reviewed / updated every two years. Upgrading means deciding which species will dominate the changes in fishing effort for the next two years.

b) R1: The control of fishing effort is carried out based on the prioritization of species defined in the dialogue platform. During the first two years, it is considered the most vulnerable species among pacific chub mackerel and thread herring as generators of change. After this and every two years the status of the remaining species is reviewed following the prioritization sequence of species.

c) R2: Similar to R1, but the change of priority of species is carried out once the most vulnerable species of the initials reaches 90% of BRMS.

d) R3: Every two years the decision rule is reviewed and updated. During the first two years, it is considered the most vulnerable species among pacific chub mackerel and thread herring as generators of change. As of the third year, the most overexploited species ($B / B_0 < 0.4$) of the remaining species is considered as a generator of changes in fishing effort during the next two years.

Despite the control rule has just been discussed, fishery stakeholders have been reducing fishing effort in recent years through fishing closures as detailed in the following table, from a total of 61 days in 2017 to 77 days in 2018, 83 days in 2019, and 91 days in 2020, in addition, a seven-day closure at the time of the full moon each month was established. This management measures have been important to improve stock status and get out of overfishing as detailed in the last stock assessment (Canales *et al.*, 2020)

Table 24. Total fishing closure days per year in the small pelagic fishery (2017-2020). Elaborated by SPS-FIP staff.

Year	Fishing closures to protect species reproduction period (days)	Seven-day closure at the time of the full moon each month (days)	Total fishing closure days per year
2017	61	-	61
2018	77	-	77
2019	83	7	90
2020	91	56	147

2.5 Further impacts

2.5.1 Improvement recommendations

- *Require vessels to record and report all interactions with ETP species.*
- *Reviewer remarks that F2.1 should be a GAP, as habitats do not appear to be factored into the small pelagic management process.*

2.5.2 Activities and results

2.5.2.1 FAP Activity 3.1. Fishery interactions with ETP are registered by concerned fleets and managers adopt CMMs accordingly. Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs.

Currently, ETP interaction are registered by on-board observer program and by electronic logbook implemented on board SPS-FIP fleet. The observer program started to collect ETP data as a result of improvement recommendations implemented by SPS-FIP, as detailed in "Data Collection Protocol of the Observer Program of the small pelagic fish industrial fleet" reported in first-year progress report (**Annex 11.1.2**)

In the design of electronic logbooks (BEP), SPS-FIP required to the SRP the option to report ETP interactions, as detailed previously in section

FAP Activity 3.1: Implement electronic logbooks for all the industrial boats targeting small pelagic, including interaction with ETPs.

Also, SPS-FIP hired Ing. Rosa Vinatea, as advisor for the development of a system for the monitoring of the ecosystem, the generation of capabilities for mitigate the impact of the fishery on the ecosystem, and the strengthening of the culture of responsible fishing in the SPS-FIP fleet (TORs in **annex 5.10**).

The technical assistance is coordinated together with IPIAP staff and has developed the following support material for crew and captains training period scheduled in February 2021 (**annex 8**).

- **Guide to the handling and release of marine fauna in the small pelagic fish fishery in Ecuador.** <https://drive.google.com/file/d/1QnqRjNbL47xw0Sio5znbuJQ2fURMqA7R/view>
- **Poster of main marine fauna in Ecuadorian sea.** <https://drive.google.com/file/d/1Pe2oL-1J1CaKMLmzSjE8IOnVB1cSK7ox/view?usp=sharing>
- **On-board sampling forms for Ecuador's small pelagic fishery.** <https://drive.google.com/file/d/1Pe2oL-1J1CaKMLmzSjE8IOnVB1cSK7ox/view?usp=sharing>
- **Record form for the release of marine fauna for the Ecuadorian small pelagic fishery.** <https://drive.google.com/file/d/18kwwlh6I06KQLQTGzScIsaNcoPrU7AHU/view?usp=sharing>
- **Record form for sightings in the small pelagic fishery in Ecuador.** https://drive.google.com/file/d/11aP2_RJC8Q7Oag6usLZIPXgITQWQb1bh/view?usp=sharing
- **Identification Guide of main fishes in the Small Pelagic Fishery.** <https://drive.google.com/file/d/1oDII6NK4mW-hKfCDrOesavJAK1uBtJgT/view?usp=sharing>
- **Identification guide for marine fauna of Ecuador.** <https://drive.google.com/file/d/1uVYWM52IAQRaANCOJpe1wS5M1f3KB8o/view?usp=sharing>
- **On-board sampling manual for the Ecuadorian small pelagic fishery.** https://drive.google.com/file/d/1HygT9XDax6tHj1rotj4GbN_HKwz93eM/view?usp=sharing

After this training, it is expected to replicate it to the On-Board Observers Program to refresh knowledge about the ETP data collection.

2.5.2.2 FAP Activity. 14.1 ETP Assessment developed on yearly bases and available publicly

Based on the data collected by the on board-observer program, it allows the identification and spatial location of the sightings and interactions that existed between the fishing activity carried out by the fleet and the species of seabirds, turtles and marine mammals; calculating the interaction rate for each registered species taking into account the trips and the proportion of species registered during the trip.

Based on this information, Jurado *et al.* (2020) analyzed 1 414 sets corresponding to 363 trips made by 45 vessels belonging to the fleet of the purse-seine fishery in continental Ecuador during the period from June to October 2019 (full fishing season on second half 2019).

The results show that in the analysis period a total of 27 species were sighted, of which 18 registered interactions, 5 of these species being categorized as ETP (*Phoebastria irrorata*, *Lepidochelys olivacea*, *Dermochelys coriacea*, *Chelonia mydas* and *Eretmochelys imbricata*). Although there were interactions, the data analyzed show that their interaction rate was less than 1 and there were no mortality records. Other species not categorized as ETP such as *Fregata magnificens* (common frigatebird) together with *Pelecanus occidentalis* were the ones that presented the highest interaction rates (8.41 and 6.97, respectively).

Based on this analysis, it is recommended that monitoring of the Observer Program be maintained and analyzes of this type are carried out periodically. This type of analysis is part of the FMP that will be in force until 2025.

Table 25. Species, interactions, interaction rate per trip, and IUCN red list status of different species. The species with status VU, EN and CR are categorized as ETP. Source: Jurado et al (2020)

ID	Scientific name	IUCN red list status	Interactions	Interaction rate per trip
1	<i>Fregata magnificens</i>	LC	3054	8.413
2	<i>Pelecanus occidentalis</i>	LC	2531	6.972
3	<i>Fregata minor</i>	LC	695	1.915
4	<i>Otaria flavescens</i>	LC	581	1.601
5	<i>Phoebastria irrorata</i>	CR	110	0.303
6	<i>Pelecanus thagus</i>	NT	55	0.152
7	<i>Sula neboxii</i>	LC	49	0.135
8	<i>Sula sula</i>	LC	29	0.080
9	<i>Creagrus furcatus</i>	LC	26	0.072
10	<i>Lepidochelys olivacea</i>	VU	17	0.047
11	<i>Chelonia mydas</i>	EN	15	0.041
12	<i>Tursiops truncatus</i>	LC	7	0.019
13	<i>Dermochelys coriacea</i>	CR	2	0.006
14	<i>Dasyatis longa</i>	DD	2	0.006
15	<i>Urotrygon chilensis</i>	DD	2	0.006
16	<i>Aetobatus laticeps</i>	NT	2	0.006
17	<i>Rhinoptera steindachneri</i>	NT	2	0.006
18	<i>Eretmochelys imbricata</i>	CR	1	0.003

Type of Interaction

■ Fregata magnificens
 ■ Otaria flavescens
 ■ Pelecanus occidentalis
 ■ Pelecanus thagus
■ Fregata minor
 ■ Phoebeastria irrorata
 ■ Other

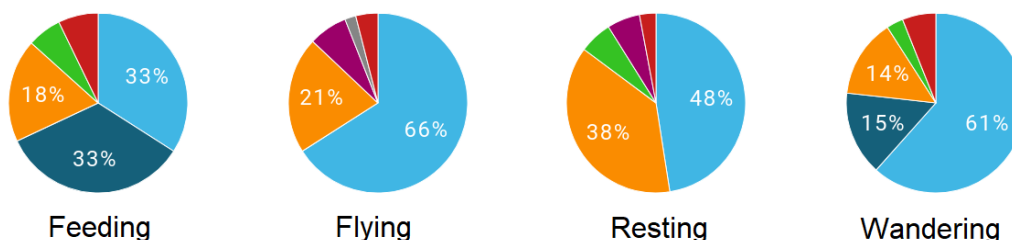


Figure 21. Type of interaction, the species with the highest number of interactions with the fishery during 2019 are shown. Source: Jurado et al (2019)

The full technical report is detailed in **annex 14.1** and public available at <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Interacciones-flota-PPP-con-especies-de-tortugas-aves-mamiferos-ETP-2019.pdf>

In Ecuador, national wildlife species categorization is regulated by:

- List of species from international treaties ratified by Ecuador;
- List of species by the National Environmental Authority;
- Red lists of threatened species from Ecuador and their updates;
- Red books of threatened species from Ecuador and their updates;
- The IUCN red list; and,
- Others recognized by the National Environmental Authority.

The species found in the Observer Program database were categorized according to the IUCN red list, identifying their status in it. IUCN categories VU (vulnerable), EN (endangered) and CR (critical) are those identified like ETP species for purposes of analysis.

2.5.2.3 FAP Activity. 14.2 CMMs related to ETP based on existing assessment adopted by managers

Fishing of all turtle and whale species is permanently prohibited in Ecuadorian waters, as is the capture of giant manta ray (*Manta birostris*), manta rays *Mobula japonica*, *M. thurstoni*, *M. munkiana*, and *M. tarapacana*, whale sharks (*Rhincodon typus*), basking shark (*Cetorhinus maximus*), great white shark (*Carcharodon carcharias*) and sawtooths (*Pristis spp*)¹. There is an extensive National Plan of Action on the Conservation of Marine Turtles, published in 2014, which includes measures intended to

¹ MAP website, summary of fisheries regulations and measures.

<http://www.acuaculturaypesca.gob.ec/subpesca121-medidas-de-ordenamiento-y-regulacion-pesquera.html>

reduce the impact of fisheries on the five turtle species present in Ecuadorian waters². There is also a National Plan for Sharks in force since 2005³.

Also, there are regulations about marine mammals, sharks and marine turtles' species:

- The Organic Law for the Development of Aquaculture and Fisheries of Ecuador establish:
 - Article 213 establish as a *serious fishing infraction* the intentionally carry out fishing activities in interaction with a marine mammal, sea turtle or whale shark. <https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf>
 - Article 152 establish the prohibition of the targeted fishing of sharks, mantas and other elasmobranchs that the governing body determines, as well as the manufacture, transport, import, commercialization of fishing gear used to capture these resources, the mutilation of shark fins and the discard of their body to the sea, the importation, transshipment and internment of whole sharks or shark fins in any state of conservation or processing, even when they have been caught in international waters. <https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf>
- National Plan for marine turtles' conservation, Ministerial agreement 304. October , 2014. <https://www.derechoecuador.com/registro-oficial/2014/11/registro-oficial-no-371---lunes-10-de-noviembre-de-2014-suplemento>
- Protection of whales: Ministerial Agreement 196 Official Registry 458 of June 14, 1990. <http://acuaculturaypesca.gob.ec/wp-content/uploads/2018/03/3-ACUERDO-196-BALLENAS-RO.pdf>
- National plan of action for the conservation, sustainable management and recovery of the populations of sharks, rays, guitars and chimeras found in the Ecuadorian maritime territory <https://www.wwf.org.ec/bibliotecavirtual/publicacionesec/?uNewsID=364191>
- Species around the Galapagos Islands are protected by the 133 thousand square kilometers Galapagos Marine reserve, established in 1998 as an area completely closed to industrial fishing⁴, including the small pelagic fishery. Although the majority of the area is exclusively open to Galapagos artisanal fishing (large pelagic, crustacean and demersal species), there are also several substantial no-take zones⁵. It's important to mention that small pelagic industrial fleet and catches do not take place in Insular ZEE of Ecuador.

² Plan nacional para la conservacion de las tortugas marinas. <http://conservation.org.ec/wp-content/uploads/2014/12/Plan-Nacional-Tortugas-COMPLETO-PdF.pdf>

³ Plan de accion nacional de tiburones.

<http://www.fao.org/tempref/FI/DOCUMENT/IPOAS/national/ecuador/PlandeAccionTiburonesPAT-Ec.pdf>

⁴ Atlas of Marine Protection – Galapagos marine reserve. <http://www.mpatlas.org/mpa/sites/901/> and <https://www.galapagos.gob.ec/en/marine-reserve/>

⁵ Washington Post. Ecuador just created a huge new Galapagos marine reserve – around an island named Darwin. <https://www.washingtonpost.com/news/energy-environment/wp/2016/03/21/this-galapagos-island-named-darwin-will-now-anchor-a-vast-new-marine-reserve>

Although ETP interaction with the fishery is not identified as a big problem, the FMP establish as an ecological objective to minimize the impacts on non-target species of the small pelagic fishery including a metric for ETP species, as detailed below:

Table 26. FMP objective and activities related to ETP species.

EC-1. Minimize impacts on non-target species of the small pelagic fishery			
Objective and actions	Indicator	Reference point	Metric source
EC-1.2. Reduce <i>severe impact</i> interactions with ETP species by 2025:	EC-1.2.1. Percentage of the fleet with protocol of good practices implemented.	More than 80% of the fleet with an implemented protocol.	On-board observer program, electronic logbooks.
	EC-1.2.2. Variation in severe impact interactions.	Stable trend or decrease in severe interactions.	On-board observer program, electronic logbooks.

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%C3%A1-de-Peces-Pela%C3%81gicos-Peque%C3%83os.pdf>

Annually assessment of ETP interaction needs to be done by IPIAP to determine the status of the reference point. Jurado, Gilbert, & Ponce (2020) is the first report and will serve as baseline (**annex 14.1.1**).

Also, as part of SPS-FIP activities, a technical assistance was contracted in order to design together with IPIAP a “GUIDE FOR THE HANDLING AND RELEASE OF MARINE FAUNA IN THE SMALL PELAGIC FISHERY OF ECUADOR”. The guide is a protocol for the proper care of incidentally caught sea turtles, marine mammals, seabirds, sharks and rays. The objective of this is to provide guide of the different techniques and procedures to carry out a successful release of the marine animals interacting with and being caught unwantedly in purse-seine fishing operations. By following the recommendations in this guide, the fisher will be able to collaborate with the conservation of the different species that inhabit the Ecuadorian sea (**annex 14.1.2**). A training period to fishermen about this guide will began in February 2021.

2.5.2.4 FAP Activity. 19. Provide evidence that habitat interactions are minimal

This activity was reported and covered in first-year progress report. However, in second year of the SPS-FIP, measures related to prevent habitat interactions was requested to being part of the strategies in the FMP. The strategies to achieve the goals are the following:

Table 27. FMP objective and activities related to habitat.

EC-2. Minimize impacts on the habitat in which the fishery operates			
Objective and actions	Indicator	Reference point	Metric source



EC-2.1. Reduce the interaction of the fishery with the seabed by 2025	EC-2.1.1. Area of overlap of the fishery with the seabed.	50% decrease in the level of interaction registered in 2019.	SRP Satellite Monitoring Center, on-board observers. IPIAP analysis about purse seine net interaction with habitat.
---	--	--	---

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%C3%A1-de-Peces-Pela%C3%81gicos-Peque%C3%B1os.pdf>

In addition to FMP strategy other measures are in force, established in the Ministerial Agreement MPCEIP-SRP-2020-0056-A (<https://camaradepesqueria.ec/wp-content/uploads/2020/08/REGULACION-PELAGICOS-PEQUENOS-MPCEIP-SRP-2020-0056-A.pdf>), among the main prohibitions are:

- Prohibition of the use of "double bottom line" in nets that catch small pelagic fishes;
- Have a Satellite Positioning Device installed and operational at all times, whose information will be controlled through the control and surveillance system of the SRP Satellite Monitoring Center (CMS).

Also, the Organic Law for the Development of Aquaculture and Fisheries of Ecuador approved in 2020 establish spatial regulation for industrial fishing <https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf>:

- Article 102 establish the prohibition of fishing from the foreshore up to 1 nautical mile.
- Article 104 establish the prohibition of industrial fishing from the foreshore up to 8 nautical miles.

It should be noted that currently there are two studies on the impact of the fishing activity of vessels with purse seines (Jurado, Gilbert, Ponce, & Solis, 2019) (Jurado, Ponce, & Gilbert, 2020), some of their main conclusions are:

- *"Class I boats could present interaction with the seabed, as sets were made in areas less than 25 m in the four study areas (Figure 22). Specifically, off the coast but within 8 nm of Galera, Bahía de Caraquez-Jaramijó and Puerto López-Ayangue. In the case of the Gulf of Guayaquil the fishing sets were located both outside and within 8 nm. In these areas, sandy and silty-type bottoms were identified, which are not classified as fragile-type habitats like the coral reef bottoms".*
- *"In the same way, but to a lesser percentage, sets made by all types of ship, outside of 8 nm, were recorded in areas with depths less than 64 m in the area of the Gulf of Guayaquil; which could present a probable interaction for boats with nets higher than these levels, however, the bottoms identified in this area are sandy and silty types, which do not represent fragile habitats."*

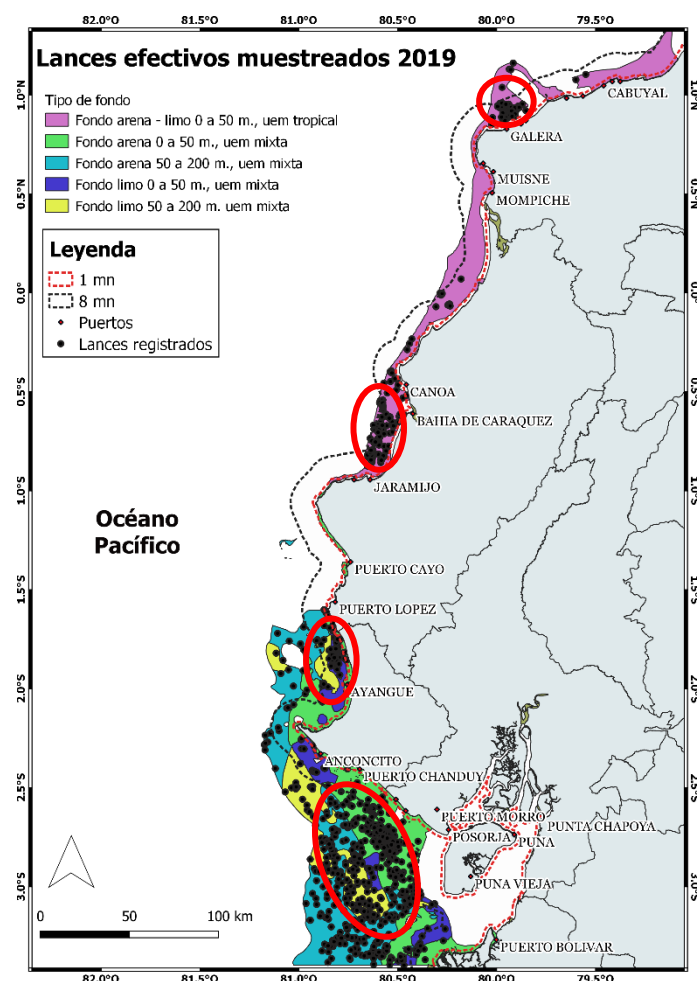


Figure 22. Main areas of concentration of fishing sets and seabed type during 2019. Source: Jurado et. al (2019)

The full technical reports are detailed in **annex 14.2** and public available at <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Informe-Impactos-HABITAT-2019-2.pdf>

2.5.2.5 FAP Activity. 15.1 - 16.1 Ecosystems Impact Assessment developed and available publicly

This activity is scheduled to be done with IPIAP on the third year of the SPS-FIP improvement process. All the data collection system improvements realized on the first and second year will serve to achieve the milestone in the following years. The activity is part of the NPOA designed.

2.5.2.6 FAP Activity. 15.2 - 16.2 CMMs related to Ecosystem Impact based on existing assessment adopted by managers

The new Organic Law for the Development of Aquaculture and Fisheries of Ecuador establishes in article 1: "The purpose of the Law is... the protection, conservation, research, exploitation and use of

hydrobiological resources and their ecosystems, through the application of the fisheries ecosystem approach in such a way as to achieve development sustainable and sustainable that guarantees access to food, in harmony with the principles and rights established in the Constitution of the Republic, and respecting traditional and ancestral knowledge and forms of production ”.

According to the law, the Fisheries Management and Action Plan was prepared, where the general objective indicates:

"Protect, conserve, research and make sustainable use of the resources of the small pelagic fishery of Ecuador and its ecosystems, through the application of the ecosystem approach."

According to this, both the NPOA and FMP in each of its goals are reflected activities and indicators whose main function is to minimize the impact on the ecosystem, related activities are detailed below:

NATIONAL PLAN OF ACTION FOR THE SMALL PELAGIC FISHERY

Table 28. NPOA, activities related to fishery research

Objective	Activity	Checker	Responsible	Collaborators	Execution year
IMO-1.1. Maintain a bio-fishery monitoring program for the PPP fishery	IMO-1.1.1. Estimate the abundance and acoustic spatial distribution of the main species of the small pelagic fishery in Ecuadorian waters and their relationship with oceanographic and biological variables	At least one annual report from IPIAP	IPIAP	Shipowners as collaborators in the execution of monitoring	Annually between the years 2020 - 2025
	IMO-1.1.2. Monitor the fishing operation (effort, catches, yields, size structure, incidental catch, discard, impact on habitat, among others)	At least one annual report from IPIAP	IPIAP	SRP, shipowners and processors, as data facilitators to complement the IPIAP information	Annually between the years 2020 - 2025
	IMO-1.1.3. Monitor the socioeconomic performance of the fishery (beach prices, direct and indirect employment, socioeconomic characterization of the fishermen,	At least one annual report from IPIAP	IPIAP	SRP Universities	Annually between the years 2022 - 2025



Objective	Activity	Checker	Responsible	Collaborators	Execution year
	destinations of the catches)				
IMO-1.2. Evaluation of the effectiveness of the exploitation strategy in the PPP fishery	IMO-1.2.1. Stock assessment based on the Maximum Sustainable Yield Benchmark	One IPIAP technical report every two years	IPIAP	-	2020, 2022 and 2024
	IMO-1.2.2. Evaluation of the Management Strategy	One IPIAP technical report every five years	IPIAP	-	Carry out in 2020 and 2025
IMO-1.3. Implement a scientific research program	IMO 1.3.1. Update life history parameters of the species of the fishery	At least 2 annual research reports (technical documents, thesis) and / or Scientific Publications	IPIAP	Universities	Annually between the years 2022 - 2025
	IMO 1.3.2. Determine the trophic role of the target species of the small pelagic fishery in the ecosystem	At least 2 annual research reports (technical documents, thesis) and / or Scientific Publications	IPIAP	Universities	Annually between the years 2023 - 2025
	IMO 1.3.3. Analysis of management strategies with an ecosystem approach	A technical report from IPIAP	IPIAP	Universities	2025

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%C3%A1-de-Peces-Pela%C3%81gicos-Peque%C3%B1os.pdf>

SMALL PELAGIC FISHERY MANAGEMENT PLAN:

Table 29. Small pelagic fishery management plan.

Bio-Fishing Dimension (BP)
BP-1. Maintain the species of the Ecuadorian Small Pelagic fishery at a sustainable production level



Objective	Indicator	Reference point	Source
BP-1.1. Achieve a yield according to the MSY of the main species of the fishery by 2025.	BP-1.1.1. Quotient between the average CPUE (CPUE-P) of the last two fishing seasons and the expected CPUE at RMS (CPUE _{BRMS}) of the indicator species. CPUE-P (species) / CPUE _{BRMS} (species)	Greater than or equal to 1	Standardized fleet CPUE, estimated by IPIAP
	BP1.1.2. Quotient between the average catch of the last two fishing seasons and the expected catch at MSY of the indicator species.	Less than or equal to 1	Estimated fleet catch, estimated by IPIAP
BP-1.2. Reach a sustainable level of spawning biomass of the fishery stocks by 2025.	BP1.2.1. Population status of each species in the fishery (Biomass of the species / Biomass of the species at MSY). Status = B (species a) / B _{RMS} (species a)	Greater than or equal to 1	Stock assessment by IPIAP
	BP1.2.2. Average population status of the main species in the PPP fishery.	Greater than or equal to 1	
Ecological Dimension (EC)			
EC-1. Minimize impacts on non-target species of the small pelagic fishery			
Objective	Indicator	Reference point	Source / observation
EC. 1.1. Reduce the capture of by-catch species by 2025.	EC-1.1.1. Percentage of by-catch of the total captures.	Less than 20% of the total catches.	Integrated catch database managed by IPIAP, which considers information from electronic logbooks, on-board observers (SRP-IPIAP), monitoring of the fishery and production form declared by the companies.
EC-1.2. Reduce severe impact interactions with HAP species by 2025.	EC-1.2.1. Percentage of the fleet with the protocol of good practices implemented.	More than 80% of the fleet with an implemented protocol.	Fishing observer program, electronic fishing logs.
	EC-1.2.2. Variation in severe impact interactions.	Stable trend or decrease in severe interactions.	Fishing observer program, electronic fishing logs.
EC-2.1. Reduce the interaction of the fishery with the habitat by 2025.	EC-2.1.1. Area of overlap of the fishery with the seabed.	50% decrease in the level of interaction registered in 2019.	SRP Satellite Monitoring Center, observers. Purse seine net interaction with habitat.
Socioeconomic Dimension (SE)			



SE-1. Maximize the socio / economic benefits of the small pelagic fishery without compromising biological sustainability			
Objective	Indicator	Reference point	Source / observation
SE-1.1. Maintain or increase the net benefits from the fishery by 2025.	SE-1.1.1. Total Industrial Net Profit of each category.	Current value	Collect information to develop the indicators and establish the corresponding Reference Points
	SE-1.1.2. Artisan Total Net Profit.	Current value	
SE-1.2. Maintain livelihoods associated with authorized “chinchorro de playa” fishing by 2025.	SE-1.2.1. Number of workers associated directly and indirectly with “chinchorro de playa” fishing.	Current value	Collect information to develop the indicators and establish the corresponding RP.
	SE-1.2.2. Number of fishermen using traditional fishing gear (without technological innovation).	Current value	Collect information to develop the indicators and establish the corresponding RP.

Source: <http://pesqueriassostenibles.produccion.gob.ec/wp-content/uploads/2020/11/Plan-de-Manejo-Pesqueri%C3%A1-de-Peces-Pela%C3%81gicos-Peque%C3%B1os.pdf>

3. References

- Canales, C. (2020). *Desarrollo de competencias al Instituto Público de Investigación de Acuicultura y Pesca (IPIAP) para el diseño e implementación de reglas de decisión de capturas, acordes con los objetivos de manejo propuestos para la pesquería de peces pelágicos*. Guayaquil: Proyecto PNUD - Cadenas Mundiales Sostenibles de Suministro de Productos del Mar.
- Canales, C. J., Canales, C., Jurado, V., Peralta, M., Chicaiza, D., Elias, E., & Romero, A. (2020). *Evaluación del stock de recursos pelágicos pequeños del Ecuador*. Guayaquil: Informe técnico IPIAP. Retrieved from http://www.institutopesca.gob.ec/wp-content/uploads/2015/11/INFORME-EVAL_STOCK_PP_ECUADOR_2020_WEB.pdf
- Canales, C., Jurado, V., Peralta, M., Chicaiza, D., Elias, E., Preciado, M., . . . Sandoval, G. (2019). *Evaluación de stock de peces pelágicos pequeños en la costa continental ecuatoriana*. Guayaquil: Sustainable Fisheries Partnership Foundation & Instituto Nacional de Pesca. Retrieved from <http://smallpelagics.org/evaluacion-de-stocks-de-pelagicos-pequenos-y-revision-de-pares/>
- Cochrane, K., & Garcia, S. (2009). *A Fishery Manager's Guidebook*. Oxford: FAO.
- De la Cuadra, T. (2010). *Comportamiento de las capturas de peces pelágicos pequeños en relación con la temperatura durante 2004*. Revista Ciencias del Mar y Limnología. Retrieved from <https://www.oceandocs.org/handle/1834/4801>
- De la Cuadra, T. (2010). *Variabilidad climática y su efecto en la biología reproductiva de la pinchagua (Opisthonema spp)*. Revista Ciencias del Mar y Limnología. Retrieved from <https://www.oceandocs.org/handle/1834/4800>
- GMC. (2020). *Mecanismo de Gobernanza para la Plataforma Sostenible de Diálogo de la Pesquería de Pelágicos Pequeños Ecuador*. PNUD.
- Jurado, V. (2019). *ASPECTOS BIOLÓGICO PESQUEROS DE JUREL (Trachurus murphyi) EN AGUAS ECUATORIANAS*. Guayaquil: Instituto Nacional de Pesca.
- Jurado, V., Gilbert, G., & Ponce, G. (2020). *Interacción de aves marinas, tortugas y mamíferos marinos con la pesquería de peces pelágicos pequeños en la costa continental de Ecuador durante junio-octubre de 2019*. Guayaquil: IPIAP.
- Jurado, V., Gilbert, G., Ponce Gabriela, & Solis, K. (2019). *PROTOCOLO SISTEMA DE MUESTREO PARA EL ARTE DE PESCA CHINCHORRO DE PLAYA EN ECUADOR*. Instituto Nacional de Pesca, Guayaquil. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Protocolo-Sistema-de-Muestreo-para-Chinchorro.pdf>
- Jurado, V., Gilbert, G., Ponce, G., & Solis, K. (2019). *ASPECTOS BIOLÓGICOS Y PESQUEROS DE PECES PELÁGICOS PEQUEÑOS DURANTE 2019*. Instituto Nacional de Pesca, Guayaquil. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Ana%CC%81lisis-biolo%CC%81gicos-y-pesqueros-durante-2019-Observadores.pdf>

- Jurado, V., Gilbert, G., Ponce, G., & Solis, K. (2019). *INTERACCIÓN DE LA PESQUERÍA DE RED DE CERCO DE PECES PELÁGICOS PEQUEÑOS CON EL HÁBITAT*. Guayaquil: Instituto Nacional de Pesca.
- Jurado, V., Gilbert, G., Ponce, G., & Solis, K. (2019). *PROTOCOLO DE OBTENCIÓN DE DATOS DEL PROGRAMA DE OBSERVADORES DE LA FLOTA INDUSTRIAL DE PECES PELÁGICOS PEQUEÑOS*. Instituto Nacional de Pesca, Guayaquil. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Protocolo-sistema-de-muestreo-observadores.pdf>
- Jurado, V., Gilbert, G., Solsi, K., & Ponce, G. (2019). *Estimación de las capturas provenientes de la pesca artesanal de Peces Pelágicos Pequeños durante 2018 y 2019 en Ecuador*. Instituto Nacional de Pesca, Guayaquil. Retrieved from <http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Estimacio%CC%81n-de-las-capturas-de-pesca-artesanal-Peces-Pela%CC%81gicos-Pequen%CC%83os-2018-y-2019.pdf>
- Jurado, V., Ponce, G., & Gilbert, G. (2020). *Análisis exploratorio de la interacción de la pesquería de red de cerco con jareta de peces pelágicos pequeños y el hábitat físico, durante 2019*. . Guayaquil: IPIAP.
- Ministerio del Ambiente y Agua. (2019, Febrero 19). *40 especies en peligro crítico de extinción en el Ecuador*. Retrieved from <https://www.ambiente.gob.ec/40-especies-en-peligro-critico-de-extincion-en-el-ecuador/>
- Minte-Vera, C. (2019). *Revisión de las evaluaciones de stocks de las principales especies de pelágicos menores de Ecuador*. Cadenas Mundiales Sostenibles. Honolulu: Sustainable Fisheries Partnership Foundation & Instituto Nacional de Pesca. Retrieved from <http://smallpelagics.org/content/uploads/documents/publications/Evaluacion-de-stocks-de-del%3%A1gicos-peque%C3%B1os-y-revisi%C3%B3n-de-pares.pdf>
- Newman, S., Brown, J., Fairclough, D., Wise, B., Bellchambers, L., Molony, B., . . . Wakefield, C. (2018). A risk assessment and prioritisation approach to the selection of indicator species for the assessment of multi-species, multi-gear, multi-sector fishery resources. *Marine Policy*, 11-22.
- Ormaza, F., Anastacio, J., & Velasco, M. (2019). *Análisis de Causa Raíz para la Pesquería de Peces Pelágicos Pequeños en Ecuador*. Proyecto Cadenas Mundiales Sostenibles, Programa de las Naciones Unidas para el Desarrollo, Guayaquil. Retrieved from <https://info.undp.org/docs/pdc/Documents/ECU/PRODUCTO%203%20ACR%20V1.pdf>
- Ormaza, F., Mora, A., Bermudez, R., Hurtado, M., Peralta, M., & Jurado, V. (2016). *Can small pelagic fish landings be used as predictors of high-frequency oceanographic fluctuations in the 1–2 El Niño region?* Retrieved from https://www.researchgate.net/publication/306920340_Can_small_pelagic_fish_landings_be_used_as_predictors_of_high-frequency_oceanographic_fluctuations_in_the_1-2_El_Nino_region
- Registro Oficial Suplemento 507. (2019). *Reglamento al Código Orgánico del Ambiente*.

TULAS. (2010, Mayo). Retrieved from <http://ecuadorforestal.org/wp-content/uploads/2010/05/Libro-IV.pdf>

4. Annexes

- Annex 1. Fishery Action Plan SPS-FIP
- Annex 2. Agreements for public-private cooperation
- Annex 3. Participatory decision-making process
- Annex 4. GMC report – SPFDP meetings
- Annex 5. Technical staff
- Annex 6. Small Pelagic Fishery Scientific Program - Improvement Plan
- Annex 7. Stock assessment, Control Rules and Management Plan
- Annex 8. Captains and observers' workshops and training material
- Annex 9. Electronic logbook (BEP)
- Annex 10. Methodology for landing estimation
- Annex 11. On board observer program improvement
- Annex 12. Biological fishing aspects of Jack Mackerel (*Trachurus murphyi*) in Ecuadorian waters
- Annex 13. Research cruises / Hydroacoustic Surveys
- Annex 14. Further impacts

Click here to download the annexes:

https://drive.google.com/drive/folders/1QuXXml32CMpRmkalI1UHv29Zxen5_dAM?usp=sharing