

FISHERY IMPROVEMENT PROJECT PROGRESS REPORT - FOURTH YEAR -

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Guayaquil - Ecuador



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Iditional Information





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





MarinTrust Improver Programme Milestone Report

Applicant Overview

Fishery under assessment	Ecuadorian Small Pelagic Fishery			
Applicant details	National Chamber of Fisheries			
Management authority (Country/State)	Ministry of Production, Foreign Trade, Investment and Fisheries. Ecuador			
Species	Pacific chub mackerel (macarela)Scomber japonicusFrigate tuna (botellita)Auxis spp.Shortfin scad (picudillo)Decapterus macrosomaLargedhead hairtail (corbata)Trichiurus lepturusThread herrings (pinchagua)Opisthonema spp.Pacific anchoveta (chuhueco)Cetengraulis mysticetusPacific cornetfish (trompeta)Fistularia cornetaRound herring (sardina redonda)Etrumeus acuminatusYellowstripe grunt (roncador)Haemulopsis axillarisLongnose anchovyAnchoa nasusPacific harvestfish (pámpano)Peprilus mediusDrums (barriga juma)Larimus spp.Jack Mackerel (jurel)Trachurus murphyi			
Fishery location	Ecuador EEZ. FAO87			
Gear type(s)	Industrial purse seine			
Date of acceptance into MarinTrust IP	October 2018			
Original projected IP completion date	October 2023			





IP Milestone report

M – Management Framework and Surveillance, Control and Enforcement

MT clause (if relevant)	M1.5 and M1.6			
Action in plan				
FAP Activities 1.1-1.4. Decision making process on fishery management is transparent, inclusive,				
and participatory				
Progress against milestor	 1es			

The milestone was already achieved. This report includes an update of new supporting evidence.

The new Organic Law for the Development of Aquaculture and Fisheries of Ecuador Act is in force since April 21, 2020. 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".

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 with 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, 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.

As previously reported, 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 bio aquatic resources". The SPFDP also will play a key role in the implementation, evaluation, adaptation, and update of the National Action Plan (NPOA) and Fishery Management Plan (FMP).

Also on February 25, 2022, the Ecuadorian government published new regulations to the law fisheries act to enforce implementation of the new fishing law, in Chapter II of it, the government regulates the operation of roundtables or dialogue platform under *governance's principle of the fishing law*.

As part of the SPFDP implementation, on October 28, 2021, a new meeting was hold in order to discuss fishing closure measures for 2022, then established by MPCEIP-SRP-2021-0241-A:

• From December 8, 2021 to January 24, 2022, for vessels provided with a purse seine net with the following capacities: 36 TRN to 70 TRN, 71 TRN to 104 TRN, and vessels greater





than 105 TRN. From February 9 to March 26, 2022, for vessels equipped with a purse seine net with a capacity of 00 TRN to 35 TRN and fishing gear called "beach dinghies"

• RECRUITMENT BAN aimed at protection of juveniles, spawning biomass and recruits, important for the renewal of the stocks that make up the small pelagic fishery; from June 15 to July 15, 2022 applied to ALL vessels equipped with a purse seine, also including beach seine fishing gear

At the end of October 2022, it's expected a new SPFDP meeting for the discussion of fishing measure for the season 2023.

Outstanding actions and rationale

Evidence

Organic Law for the Development of Aquaculture and Fisheries of Ecuador: https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf

Regulations to the law fisheries act

https://camaradepesqueria.ec/wp-content/uploads/2020/08/REGULACION-PELAGICOS-PEQUENOS-MPCEIP-SRP-2020-0056-A.pdf

Fishery management plan, Ministerial Agreement No. MPCEIP-SRP-2021-0073-A.: https://drive.google.com/file/d/llguOBlLr5wvxsN7sZdgtIsc5WpotezZZ/view

Ministerial Agreement Nro. MPCEIP-SRP-2020-0054-A (SPFDP) https://camaradepesqueria.ec/wp-content/uploads/2020/07/ACUERDO-PLATAFORMA-MPCEIP-SRP-2020-0054-A.pdf

Resume of SPFDP meeting (October 2022)

http://smallpelagics.org/content/uploads/documents/laws/ACTA-DE-SESIÓN-PLATAFORMA-DE-DIÁLOGO-PECES-PELÁGICOS-PEQUEÑOS-JUEVES-28-10-2021.pdf

Ministerial Agreement Nro. MPCEIP-SRP-2021-0241-A (Fishing closure 2022) http://smallpelagics.org/content/uploads/documents/laws/MPCEIP-SRP-2021-0241-A.pdf

Progress report in the implementation of the National Plan of Action and management plan of the small pelagic fishery in Ecuador:

http://smallpelagics.org/content/uploads/documents/laws/REPORTE-AVANCES-PLAN-ACCI%C3%93N-NACIONAL-Y-MANEJO-PPP-06-10-2022.pdf

Videos about SPFDP

https://drive.google.com/file/d/1 xk7Y59utAVoOVlt3etZMyT9zRnYRIIJ/view?usp=sharing https://www.facebook.com/globalmarinecommodities/videos/992844211130965 https://youtu.be/nF3jiZNIw8w

Status of action

Completed. Evidence Updated.



Progress Report (Fourth Year) | 7



A – Category A: Data Collection, Stock Assessment, Harvest Strategy and Stock Status

MT clause (if relevant) A1.1-1.2

Action in plan

FAP activity 3.1 Implement electronic logbooks for all the industrial boats targeting small pelagics, including interaction with ETPs.

Progress against milestones

The milestone was already achieved. SPS-FIP continues using electronic logbooks.

Outstanding actions and rationale

Evidence

Electronic logbook (Government of Ecuador): http://bitacora.produccion.gob.ec/bitacora/ http://smallpelagics.org/bitacora-electronica/ http://smallpelagics.org/content/uploads/2021/06/triptico-bitacora-electronica-depesca Brochure-Inside-2048x1447.jpg

Photo evidence of new app testing period under ACIIS-SIAP system by National Authority <u>https://twitter.com/PesqueriaEc/status/1440828287102570497</u>

Logbook generated by BEP system

https://drive.google.com/file/d/1J7RPgjZ5hprxjGNHjaBtllkG-iHTzf_l/view?usp=sharing

Logbook generated by new ACIIS-SIAP system

https://drive.google.com/file/d/1WVAeCF0ZTnZAx3Xn4U37dRsbdZlx1kX2/view?usp=sharing

Status of action

Completed. Evidence Updated.





MT clause (if relevant) A1.1-1.2

Action in plan

FAP activity 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 analysed) will be determined by IPIAP. Samplers will be hired by INP.

Progress against milestones

The milestone was already achieved. This report includes an update of new supporting evidence.

The Ministerial Agreement MPCEIP-SRP-2020-0056-A in article 13.- Establish, through the Undersecretariat for Fishery Resources, a "Mandatory Program for On-Board Fisheries Observers" for vessels with purse seines that catch small pelagic fish, which must randomly cover 30% of the fleet, in technical coordination with the Public Institute for Aquaculture and Fisheries Research.

In 2022, the Public Institute for Aquaculture and Fisheries Research (IPIAP), has carried out two training processes aimed at servers who are part of the Small Pelagic Fish Fisheries Observer Program managed by the Undersecretary of Fisheries Resources, in order to strengthen and update knowledge related to the survey and registration of fishing and biological information of these fishing resources.

Data collected by observers is used for research as stock assessment, control rule evaluation, ETP and habitat interactions, among others.

Outstanding actions and rationale

Evidence

Progress report in the implementation of the national plan of action and management plan of the small pelagic fishery in Ecuador 2022

http://smallpelagics.org/content/uploads/documents/laws/REPORTE-AVANCES-PLAN-ACCI%C3%93N-NACIONAL-Y-MANEJO-PPP-06-10-2022.pdf

Data Collection Protocol for Observer Program

https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/PROTOCOLO-DE-OBTENCI%c3%93N-DE-DATOS-DEL-PROGRAMA-DE-OBSERVADORES-DE-LA-FLOTA-INDUSTRIAL-DE-PECES-PEL%c3%81GICOS-PEQUE%c3%91OS.pdf

Ministerial Agreement Nro. MPCEIP-SRP-2020-0056-A (May 2020) https://camaradepesqueria.ec/wp-content/uploads/2020/08/REGULACION-PELAGICOS-PEQUENOS-MPCEIP-SRP-2020-0056-A.pdf

Observer Program training process 2022

https://drive.google.com/file/d/1QVRhnWEr0TdGrBbeSNbPlIZDJZyty1oL/view?usp=sharing https://drive.google.com/file/d/1MpMqNgC6_a05HhD1_ehjsVN1d2PcLIor/view?usp=sharing

Status of action

Completed. Evidence Updated.



Progress Report (Fourth Year) | 9



MT clause (if relevant)	A2.1-2.5
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Action in plan FAP Activities 5.1.1 - 5.1.9 / 5.2.1 - 5.2.9 Establish a periodic stock assessments system (every three years) and 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.

Progress against milestones

The milestone was already achieved. This report includes an update of new supporting data.

A new small pelagics stock assessment was carried out by Canales and Jurado (2022), the authors conclude:

"The diagnosis and evaluation of the stock of small pelagic fish in Ecuador is carried out with fishery biological information updated to 2021. The scenarios analyzed showed that the populations of small pelagic fish in Ecuador generally maintain their improvement, explained by levels of relative biomass similar to those reported for the year 2020, despite the notable increase in fishing mortality compared to the reference fishing mortality (Figure I). This situation has been mainly due to the increase in the catches of Picudillo and Macarela, with respect to biomass levels that were reduced below their reference value. Between 2017 and 2021-2022, the small pelagic populations doubled their biomass and whose relative indicator B/BMSY increased from 0.38 to 0.83 (ideal is equal to or greater than 1.0), while the rate of overfishing F/FMSY in the last years increased by almost double from 1.02 to 1.84 (ideal is less than 1.0). The level of success or general health status is determined if the biomass does not fall below 95%BMSY, as well as a level of fishing mortality that does not exceed 5% above the FMSY criteria. In this sense, the success of not falling into overexploitation (B/BMSY>0.95) increased from 0% in 2017 to 83% in 2021, while 50% of the species analyzed in 2021 remained in the process of overfishing (F /FMSY>1.05). Of the latter, the Picudillo and Macarela resources stand out, whose reference fishing mortality was exceeded in 2021 by 5.2 and 1.8 times. The levels of fishing mortality of these last two species have increased and determine relative biomasses B/BMSY of 0.17 and 0.55, respectively (Table I, Figure I).

A sensitivity analysis of the results to different parameter hypotheses indicates that the population diagnosis is sensitive to individual growth assumptions, so it is suggested to carry out studies aimed at improving/precising the value of these parameters used to date. An extension to the analyzes shows that population trends could also be determined by environmental conditions. The variability of sea surface temperature (SST) and Chlorophyll-a (Clo-a) exhibits slightly warm anomalies in SST and markedly negative anomalies in Clo a for the last decade, despite the increase in the years 2020-21. The results show that the recruitments of small pelagics seem more related to Clo-a fluctuations than SST. In this regard, it is highlighted that the recruitment anomalies of pinchagua increase with SST, while in bottle they decrease with the increase of Clo-a (r=0.42), this if a one-year lag between the environmental variable and recruitment is considered. In the same way, but considering two years of lag, the recruitments of pinchagua and picudillo are positively correlated (r>0.33) with increases in Clo-a. The latter would partially explain the state of the weevil population as previously highlighted.

Finally, and in order to safeguard the level and/or recovery of these populations, it is suggested to manage the increases in the level of fishing effort through the proposed control rule and take





advantage of the productivity levels of these resources, in this way. way to ensure stability/recovery in the most diminished species. In this process, the permanent surveillance of the population indicators carried out by IPIAP through the monitoring of these fisheries in Ecuador must be reinforced."

Tabla I. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2021. Nivel de éxito es la proporción de especies cuya biomasa es mayor al $95\%B_{rms}$, o niveles de mortalidad por pesca inferiores al 5% por sobre F_{rms} .

Especie	201	2017		2019		2020		2021	
	B / B _{rms}	F/F _{rms}							
Botella	0.28	4.25	1.15	0.69	0.95	2.04	0.99	1.10	
Chuhueco	0.43	0.56	0.35	0.95	1.38	0.14	1.28	0.31	
Macarela	0.58	1.84	0.73	0.24	0.78	1.03	0.55	2.80	
Picudillo	0.15	0.20	0.35	0.76	0.23	2.45	0.17	6.17	
Pinchagua	0.80	1.57	1.03	0.38	1.10	0.16	0.98	0.35	
Sardina	0.08	0.07	0.68	0.67	0.58	0.27	0.98	0.27	
Promedio	0.38	1.42	0.71	0.62	0.83	1.02	0.83	1.84	
Prob éxito	0%	50%	33%	100%	33%	67%	67%	50%	



Figura I. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2021.

Source: Canales & Jurado (2022)







Figura II. Diagrama de Kobe por año para las principales 6 especies de pelágicos pequeños del Ecuador. Se destaca el estado poblacional de las especies de pelágicos pequeños respecto de las variaciones en la biomasa desovante y la mortalidad por pesca relativas al objetivo de manejo RMS. Area naranja: sobrepesca y sobreexplotación. Area amarilla: en proceso de sobrepesca o sobreexplotación, Area verde: Sin sobrepesca ni sobreexplotación

Source: Canales & Jurado (2022)

Also, as part of the external peer review process, Dr. Luis Cubillos and Dra. Maria Jose Cuevas realized a peer review of Canales and Jurado (2022), which concludes "The MESTOCKL model is very well coded, with enough flexibility to test alternative structural hypotheses on either life history parameters or abundance indices, as well as environmental effects on growth, mortality, catchability, and/or recruitment. It is recommended to validate its performance with the configuration of an already consolidated external model, such as Stock Synthesis, CASAL or another. However, the evaluation of the pelagic fish fisheries is well under way and allows knowing the status of the resources, whether these models are used for the technical assistance of management measures; or to validate control rules based on status indicators." In the case of resources as pacific chub mackerel and shortfin scad, Cubillos and Cuevas (2022) concludes:

"For Pacific chub mackerel, the comparison of the time series between the estimator and the simulator is shown in Figure 19. A tendency to underestimate spawning biomass and overestimate fishing





mortality is observed. The comparison of SSB2021 and SSB0 shows the bias of the estimator (Fig. 20), a situation that can be better observed in the relative error time series with bias outside \pm 15% (Fig. 21)."



Figura 19. Macarela, biomasa desovante (A), reclutamiento (B), razón biomasa desovante a biomasa desovante no explotada (C), y mortalidad por pesca (D) del estimador (área gris: límites de confianza de 95%, línea segmentada con puntos blancos: mediana), y del simulador (área rosa: límites de confianza de 95%, línea contínua: mediana).



Source: Cubillos, L, Cuevas, M. (2022)







Source: Cubillos, L, Cuevas, M. (2022)

While in the case of shortfin scad Cubillos and Cueva (2022) concludes: "The uncertainty associated with the evaluation of shortfin scad (picudillo) is low compared to that of the simulator, and greater uncertainty tends to be observed in the estimation of recruitment (Fig. 28). Overlap is observed in the spawning biomass of the most recent year SSB2021, but it is observed that the unexploited spawning biomass SSB0 tends to be overestimated compared to the spawning biomass of the most recent year (Fig. 29). The relative error time series shows that the bias has a tendency towards underestimation of spawning biomass, around -25% in the most recent year. In turn, recruitment shows more pronounced biases and even a relative error greater than 100% in some years. Fishing mortality shows opposite trends to spawning biomass, showing a decreasing trend from 2018 to 2021 (Fig. 30)."







Figura 28. Picudillo, biomasa desovante (A), reclutamiento (B), razón biomasa desovante a biomasa desovante no explotada (C), y mortalidad por pesca (D) del estimador (área gris: límites de confianza de 95%, línea segmentada con puntos blancos: mediana), y del simulador (área rosa: límites de confianza de 95%, línea contínua: mediana).



Source: Cubillos, L, Cuevas, M. (2022)







Figura 30. Picudillo, serie de tiempo del error relativo para la biomasa desovante (A), reclutamiento (B), razón biomasa desovante a biomasa desovante no explotada (C), y mortalidad por pesca (D) del estimador.

Source: Cubillos, L, Cuevas, M. (2022)

Outstanding actions and rationale

As part of this peer review, a workshop will be held by IPIAP and Cristian Canales in November 2022, in which the estimates of the life history parameters, antecedents/information related to the population structure, calculation of PBR and attention/implementation of the suggestions made in the peer review (Cubillos and Cueva (2022)) of the stock assessment will be reviewed for two relevant species. The proposed species are *Scomber japonicus* and *Decapterus macrosoma in order to reevaluate their status*.

Evidence

Canales C. M., V. Jurado, 2022. Evaluación del stock de recursos pelágicos pequeños del Ecuador. Año 2022. Informe Técnico. Guayaquil, julio 2022. 126 p <u>https://institutopesca.gob.ec/wp-content/uploads/2022/10/Informe_Eval_Final_2022.pdf</u>

Cubillos, L, Cuevas, M. (2022). Revisión experta de las evaluaciones de stock de las principales especies pelágicas pequeñas en Ecuador. Boletín Técnico del Centro de Evaluación Pesquera y Manejo de Recursos SpA.

https://drive.google.com/file/d/1oPUR3z_tldR369V2kYYFAcigHs-XaQ-4/view?usp=sharing





Canales C. M., V. Jurado, 2021. Evaluación del stock de recursos pelágicos pequeños del Ecuador. Año 2021. Informe Técnico. Guayaquil, julio 2021. 123 p <u>https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/IPIAP-Evaluacion-</u> pel%c3%a1gicos-del-Ecuador.pdf

Canales, C. M., Jurado, V., Peralta, M., Chicaiza, D., Elías, E., Romero, A. 2020. Evaluación de stock de peces pelágicos pequeños en la costa continental ecuatoriana. Informe Técnico. Instituto Nacional de Pesca. 102 pp

https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/INFORME-EVAL STOCK PP ECUADOR 2020 WEB.pdf

Canales, C. M., Jurado, V., Peralta, M., Chicaiza, D., Elías, E., Preciado, M., Hurtado, M., Landívar, E., Alemán, C., Sandoval, G. 2019. Evaluación de stock de peces pelágicos pequeños en la costa continental ecuatoriana. Cadenas Mundiales Sostenibles—Informe Científico No. 1. Honolulu: Sustainable Fisheries Partnership Foundation & Instituto Nacional de Pesca. 82 pp http://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Informe-Evaluaci%C3%B3n-2019.pdf

Status of action	Completed.
	Evidence Updated.

MT clause (if relevant) A3.1 – 3.3

Action in plan

FAP activities 7.1 -7.9 Identify and establish biological reference points (target and limit) as well as related Harvest Control Rules

Progress against milestones

The milestone was already achieved. This report includes an update of new supporting data.

Control rules for the fishery was officially established in the fishery management plan (2021-2025) by Ministerial Agreement No. MPCEIP-SRP-2021-0073-A (March 2021). As previous reported, 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 CPUERMS 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.

Control rules are 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 (Pacific chub mackerel and Thread herring), considering its Biological Reference Points.





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 (CPUERMS):

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

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

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).

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

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

However, every two years the status of the fishery must be reviewed, to generate changes or maintain the key species that generates the entry into effect of the control rules (actually Pacific chub mackerel and Thread herring) *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 and discussed in the SPFDP.

At the beginning of each fishing season, the level of fishing effort for the whole fishery is adjusted based on the condition of the population of the indicator species, thus complying with the dialogue table in October 2021, with the participation of the different stakeholders of the SPFDP. The effort control rule was applied for the first time to define the duration of the closed season for reproduction and recruitment of small pelagic resources.

Average CPUE, resulting from the average of the last two years obtained from stock assessments (MSY) and fishery monitoring (CPUE) carried out by IPIAP and Observer Program were analyzed.

The results of the CPUE monitoring for pacific chub mackerel were CPUEprom= 0.27 lower than CPUERMS=0.42, while average catch was lower than MSY catches.

For pinchagua, the CPUEprom= 0.46 was lower than the CPUERMS=0.70, while average catch was lower than MSY catches.





With the results obtained from the assessment, the fishing effort maintained in the same number of days that the fleet operated in 2020 and also the duration of the closure seasons as agreed in that same year, proceeding to set the new period of closures corresponding to 2022. According to this evaluation explained in SPFDP carried out in October 2022, the fishing authority established closure season by Ministerial Agreement MPCEIP-SRP-2021-0241-A:

- From December 8, 2021 to January 24, 2022, for vessels provided with a purse seine net with the following capacities: 36 TRN to 70 TRN, 71 TRN to 104 TRN, and vessels greater than 105 TRN. From February 9 to March 26, 2022, for vessels equipped with a purse seine net with a capacity of 00 TRN to 35 TRN and fishing gear called "beach dinghies"
- RECRUITMENT BAN aimed at protection of juveniles, spawning biomass and recruits, important for the renewal of the stocks that make up the small pelagic fishery; from June 15 to July 15, 2022 applied to ALL vessels equipped with a purse seine, also including beach seine fishing gear

Outstanding actions and rationale

Evidence

Resume of SPFDP meeting (October 2022) http://smallpelagics.org/content/uploads/documents/laws/ACTA-DE-SESIÓN-PLATAFORMA-DE-DIÁLOGO-PECES-PELÁGICOS-PEQUEÑOS-JUEVES-28-10-2021.pdf

Ministerial Agreement Nro. MPCEIP-SRP-2021-0241-A (Fishing closure 2022) http://smallpelagics.org/content/uploads/documents/laws/MPCEIP-SRP-2021-0241-A.pdf

Fishery management plan, Ministerial Agreement No. MPCEIP-SRP-2021-0073-A.: <u>https://drive.google.com/file/d/1LguOBILr5wvxsN7sZdgtIsc5WpotezZZ/view</u>

 Status of action
 Completed. Evidence Updated.

B – Category B Stock Status

Not applicable actions were identified according to first pre-assessment.





C – Category C Stock Status

MT clause (if relevant)	С			
Action in plan				
FAP activity 18. Provide e	vidence from INP showing that catches are negligible (jack mackerel)			
Progress against milestor	nes			
The milestone was alread	ly achieved.			
Outstanding actions and	rationale			
No outstanding actions				
Evidence				
Jurado, V. (2019). ASPEC7	TOS BIOLÓGICO PESQUEROS DE JUREL (Trachurus murphyi) EN AGUAS			
ECUATORIANAS. Guayaqı	uil: Instituto Nacional de Pesca.			
https://drive.google.com	/file/d/1JUDuLwx7uL3tY3uUA4k-NQLa36JlRhjs/view?usp=sharing			
Landings 2004-2019				
https://www.institutopes	ca.gob.ec/wp-content/uploads/2021/02/DesembPPP-2004-			
2019 Desglose-Otros.pdf				
Landings 2020				
https://www.institutopesca.gob.ec/wp-content/uploads/2021/02/DesembPPP-2004-				
2019 Desglose-Otros pdf				
Status of action	Completed.			
	Evidence Updated.			





D – Impacts On Species Categorised as Vulnerable by D1-D3

Longnose anchovy and Pacific harvestfish were classified as Category D species by the fishery preassessment. Not applicable actions were identified according to pre-assessment because PASS condition determined.

In additional information section of this report, an analysis of catch composition is presented.

F – Impacts on ETP Species, Impacts on Habitats and Ecosystem Impacts

MT clause (if relevant)	F1.1
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Action in plan

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 pelagic fish, including interaction with ETPs.

Progress against milestones

The milestone was already achieved. This report includes an update of new evidence.

ETP species interaction are registered by on-board observer program and by electronic logbook of the Ecuadorian government and implemented on board SPS-FIP fleet. The observer program started to collect ETP data because 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, as result 3 studies about ETP interactions in the fisheries have been done.

Also, as part of the new "Responsible Fishing Programme" launched by CNP in 2021, vessels of firms participating in the SPS-FIP are now recording the interaction and release of marine fauna after a training. <u>This form</u> was done together with the IPIAP and is part of a model for collecting data by the industry to improve the knowledge and decision-making process of the fishery. As part of this fleet-based program, crew are also collecting data and documenting evidence of the releases of megafauna species that interact with the fishery.

Until September 2022, SFP-FIP fleet recorded 658 releases of species of megafauna, as detailed as follow:





In 2022, it was possible to train a total of 122 crew members on board SPS-FIP fleet, 74% of the proposed goal. A total of eight trainings were carried out, adding a total of 32 pedagogical hours. It was expected to have a larger number of participants; however, due to the development of a nationwide strike as of June 13, the objective was not achieved. The knowledge increase was 24%, which is very similar to the learning increase during the 2021 training, which responded to 29.8%. The crew associates the concept of responsible fishing, mainly, with releasing species of marine fauna, caring for the environment, respecting closed seasons and small or juvenile sizes. In all the crew members, mastery and knowledge about the steps for the correct handling and release of marine fauna in the different groups of taxa were observed.

Also, increased interest from the crew in developing the correct steps for sampling their catch composition on board was evident. As well, a greater interest was observed on the part of the crew in improving the identification of the target fish species, as well as knowing how to determine their size correctly.

Outstanding actions and rationale





Evidence

SPS-FIP Crew training report 2022 https://drive.google.com/file/d/1gP86jVk3KFuS5nPZn3mMUc8OnEWv9iOn/view?usp=sharing

Data Collection Protocol of the Observer Program of the small pelagic fish industrial fleet <u>https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/PROTOCOLO-DE-</u> <u>OBTENCI%c3%93N-DE-DATOS-DEL-PROGRAMA-DE-OBSERVADORES-DE-LA-FLOTA-INDUSTRIAL-DE-</u> <u>PECES-PEL%c3%81GICOS-PEQUE%c3%91OS.pdf</u>

Electronic logbook (Government of Ecuador): http://bitacora.produccion.gob.ec/bitacora/ http://smallpelagics.org/bitacora-electronica/ http://smallpelagics.org/content/uploads/2021/06/triptico-bitacora-electronica-depesca_Brochure-Inside-2048x1447.jpg

Logbook generated by BEP system https://drive.google.com/file/d/10SvC_w7yUGZCba5OEpnzv8lR9irwc5q9/view?usp=sharing

Logbook generated by new ACIIS-SIAP system https://drive.google.com/file/d/1EjAVbyK9jiLSy0JvvBdjsrAUrvP4ZzfW/view?usp=sharing

CNP Record form for the release of marine fauna for the Ecuadorian small pelagic fishery. https://drive.google.com/file/d/18kwwIh6I06KQLQTGzScIsaNcoPrU7AHU/view?usp=sharing

- Ponce, G. Ayora, G., Camacho, G., Jurado, V. & (2022). Interacción de aves marinas, tortugas, mamíferos marinos y elasmobranquios con la pesquería de peces pelágicos pequeños en la costa continental de Ecuador durante 2021. Guayaquil: IPIAP. <u>https://institutopesca.gob.ec/wp-content/uploads/2018/01/Interaccion-especies-ETP-y-</u> Pesqueria-Peces-Pelagicos-Pequenos-2021-1.pdf
- Ponce, G. Ayora, G., Jurado, V. & (2021). Interacción de aves marinas, tortugas, mamíferos marinos y elasmobranquios con la pesquería de peces pelágicos pequeños en la costa continental de Ecuador durante 2020. Guayaquil: IPIAP. <u>https://www.institutopesca.gob.ec/wp-</u> <u>content/uploads/2018/01/Interaccciones-flota-PPP-con-especies-de-tortugas-aves-</u> <u>mamiferos-elasmobranquios-ETP-2020.pdf</u>
- 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. <u>https://www.institutopesca.gob.ec/wpcontent/uploads/2018/01/Interaccciones-flota-PPP-con-especies-de-tortugas-avesmamiferos-ETP-2019.pdf</u>

completed.
Evidence Updated.





MT clause (if relevant) | F1.2

Action in plan

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

Progress against milestones

The milestone was already achieved. This report includes an update of new available research.

A new report about ETP interactions in the fishery was published by IPIAP in 2022. Ponce, Ayora, Camacho & Jurado (2022) concludes: "A total of 2 752 sets were analysed corresponding to 1 347 trips made by 142 vessels belonging to the purse-seine fishing fleet in continental Ecuador during 2021, obtained from the Observer's Program of the Undersecretariat of Fisheries Resources (SRP). The sightings and interactions that existed during the fishing activity were identified and spatially distributed.

The interaction rate for each species (seabirds, turtles, marine mammals and elasmobranchs) was obtained considering the fishing trips and the number of registered species. A total of 24 different species were sighted, of which 21 registered interactions, with 5 of these species categorized as ETP: *Aetobatus laticeps, Chelonia mydas, Rhincodon typus, Dermochelys coriacea and Lepidochelys olivacea*. Although there were interactions, the data analyzed showed that their interaction rate was less than 0.1 and mortality reports were minimal (0.06% of all interactions). Other species not categorized as ETP such as *Pelecanus occidentalis, Fregata magnificens and Otaria flasvescens* showed the highest interaction rates (8.41, 8.27 and 3.56, respectively). Therefore, it is recommended to keep monitoring within observer Program, and in turn, carry out this type of analysis periodically."

Tabla 4. Tabla general de especies con interacciones, tasa de interacción por viaje, y estado de la lista roja

ID	Nombre científico	Nombre común	Estado lista roja UICN	Interacciones	Tasa de interacciór por viaje
1	Fregata magnificens	Fragata común o fragata real	LC	11330	8.41
2	Pelecanus occidentalis	Pelícano pardo	LC	11143	8.27
3	Otaria flavescens	Lobo marino sudamericano	LC	4797	3.56
4	Chroicocephalus ridibundus	Gaviota encapuchada	LC	418	0.31
5	Sula variegata	Piquero peruano	LC	370	0.27
6	Sula nebouxii	Piquero patas azules	LC	339	0.25
7	Chelonia mydas	Tortuga verde	EN	82	0.06
8	Fregata minor	Fragata grande	LC	70	0.05
9	Pelecanus thagus	Pelícano peruano	NT	42	0.03
10	Tursiops truncatus	Delfín nariz de botella común	LC	25	0.02
11	Aetobatus laticeps	Raya águila	VU	22	0.02
12	Lepidochelys olivacea	Tortuga golfina/tortuga olivácea	VU	38	0.03
13	Rhinoptera steindachneri	Raya dorada	NT	20	0.01
14	Leucophaeus atricilla	Gaviota reidora americana	LC	20	0.01
15	Oceanodroma tethys	Paíño danzarín o golondrina de tormenta de Galápagos	LC	15	0.01
16	Ardenna grisea	Pardela oscura o fardela negra	NT	6	< 0.01
17	Creagrus furcatus	Gaviota tijereta o gaviota de cola bifurcada	LC	6	< 0.01
18	Pelecanus occidentalis californicus	Pelícano pardo de California	LC	6	< 0.01
19	Thalasseus maximus	Charrán real	LC	3	< 0.01
20	Dermochelys coriacea	Tortuga laúd	VU	3	< 0.01
21	Rhincodon typus	Tiburón ballena	EN	1	< 0.01

The next table resume the findings by Ponce, Ayora, Camacho & Jurado (2022)

UICN I

Cámara Nacional de Pesquería



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Evidence

- Ponce, G. Ayora, G., Camacho, G., Jurado, V. & (2022). Interacción de aves marinas, tortugas, mamíferos marinos y elasmobranquios con la pesquería de peces pelágicos pequeños en la costa continental de Ecuador durante 2021. Guayaquil: IPIAP.
 <u>https://institutopesca.gob.ec/wp-content/uploads/2018/01/Interaccion-especies-ETP-y-Pesqueria-Peces-Pelagicos-Pequenos-2021-1.pdf</u>
 Ponce, G. Ayora, G., Jurado, V. & (2021). Interacción de aves marinas, tortugas, mamíferos marinos
- Ponce, G. Ayora, G., Jurado, V. & (2021). Interacción de aves marinas, tortugas, mamiferos marinos y elasmobranquios con la pesquería de peces pelágicos pequeños en la costa continental de Ecuador durante 2020. Guayaquil: IPIAP. <u>https://www.institutopesca.gob.ec/wp-</u> <u>content/uploads/2018/01/Interaccciones-flota-PPP-con-especies-de-tortugas-aves-</u> <u>mamiferos-elasmobranquios-ETP-2020.pdf</u>
- 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. <u>https://www.institutopesca.gob.ec/wpcontent/uploads/2018/01/Interaccciones-flota-PPP-con-especies-de-tortugas-avesmamiferos-ETP-2019.pdf</u>
 Status of action
 Completed. Evidence Updated.

MT clause (if relevant)	F1.3	
Action in plan		
FAD Activity 14.2 CAMAs related to FTD based on existing accessment adapted by management		
FAP ACTIVITY. 14.2 CIVINIS related to ETP based on existing assessment daopted by managers		
Progress against milestones		
The milestone was already achieved.		

As previously reported, fishing of all turtle and whale species are permanently prohibited in Ecuadorian waters. Also it is prohibited to capture 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*). There is an extensive National Plan of Action on the Conservation of Marine Turtles, updated for the period 2020-2030, which includes measures intended to reduce the impact of fisheries on the five turtle species present in Ecuadorian waters. There is also a National Plan for Sharks updated in 2020.

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.
 - 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, transhipment and internment of whole sharks or shark fins in any



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state of conservation or processing, even when they have been caught in international waters.

- National Plan for marine turtles' conservation 2020-2030, MAAE-SPN-2021-001.
- Protection of whales: Ministerial Agreement 196 Official Registry 458 of June 14, 1990.
- National plan of action for the conservation, sustainable management, and recovery of the populations of sharks, rays, and chimeras found in the Ecuadorian maritime territory. Also, Executive Decree # 486 prohibits target fishing of sharks, in force since 2007.
- Species around the Galapagos Islands are protected by the 133 thousand square kilometres Galapagos Marine reserve, established in 1998 as an area completely closed to industrial fishing, 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 zones. It's important to mention that small pelagic industrial fleet and catches do not take place in Insular ZEE of Ecuador.

Outstanding actions and rationale

Evidence

Organic Law for the Development of Aquaculture and Fisheries of Ecuador: https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf

Fishery management plan, Ministerial Agreement No. MPCEIP-SRP-2021-0073-A.: https://drive.google.com/file/d/1LguOBlLr5wvxsN7sZdgtIsc5WpotezZZ/view

National Plan for marine turtles' conservation 2020-2030, MAAE-SPN-2021-001. https://www.ambiente.gob.ec/wp-content/uploads/downloads/2021/01/resolucion_plan-deaccion-tortugas-marinas.pdf

Protection of whales: Ministerial Agreement 196 Official Registry 458 of June 14, 1990. https://www.ambiente.gob.ec/11699/

National plan of action for the conservation, sustainable management and recovery of the populations of sharks, rays, and chimeras found in the Ecuadorian maritime territory https://www.wwf.org.ec/bibliotecavirtual/publicacionesec/?uNewsID=364191

Report of the implementation of a responsible fishery management model in the small pelagic fishery of Ecuador. Training plan implementation:

https://docs.google.com/document/d/1tVIfqD07-TvImzjY-

GmWERP59 OfqZ98/edit?usp=sharing&ouid=112572111827130877547&rtpof=true&sd=true

Executive Decree # 486. Regulation of incidental fishing of shark, its commercialization and exportation in continental Ecuador

https://camaradepesqueria.ec/wp-content/uploads/2016/03/DE-486.pdf

Guide to the handling and release of marine fauna in the small pelagic fish fishery in Ecuador. <u>http://smallpelagics.org/content/uploads/documents/EDICIO%CC%81N_Guia_Liberacion_Depreda_dores_Grandes-1_compressed.pdf</u>

Poster of main marine fauna in Ecuadorian sea. http://smallpelagics.org/content/uploads/documents/FAUNA_MARINA-scaled.jpg

Identification guide for marine fauna of Ecuador.





http://smallpelagics.org/content/uploads/documents/guia_identtificacion_fauna_marina_ecuador _compressed.pdf

Correct handling and release techniques for marine mammals <u>https://youtu.be/gqNagg4km4U</u>

Correct handling and release techniques for marine turtles https://youtu.be/DOwhJkauZtM

Correct handling and release techniques for sharks <u>https://youtu.be/DI0HdIWI09k</u>

Correct handling and release techniques for rays https://youtu.be/6lTtpQBDMSY

Correct handling and release techniques for seabirds https://youtu.be/pq-j8Wg3TR4

Status of action	Completed.
	Evidence Updated.

MT clause (if relevant)	F2	
Action in plan		
FAP Activity. 19. Provide evidence that habitat interactions are minimal		
Progress against milestones		
The milestone was already achieved. This report includes an update of new available research, actions, and regulations.		
Outstanding actions and rationale		
Although habitat interactions are not an issue in the fishery, it is considered in the management decision-making process, as part of the ecological dimension of the fishery management plan (2021-2025) established by Ministerial Agreement No. MPCEIP-SRP-2021-0073-A (March 2021).		

The FMP establishes the following objective *"EC-2. Minimize impacts on the habitat in which the fishery operates"*

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

- 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.

In addition to FMP strategy other measures are in force, established in the Ministerial Agreement MPCEIP-SRP-2020-0056-A (<u>https://camaradepesqueria.ec/wp-</u>





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 fish.
- 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.)

Currently there are four studies on the impact of the small pelagic purse seine fishing on habitats (Jurado, Gilbert, Ponce, & Solis, 2019) (Jurado, Ponce, & Gilbert, 2020) (Ponce, Ayora & Jurado, 2021) (Ponce, Camacho, Ayora, & Jurado, 2022).

The main conclusions of the last available study (Ponce , Camacho, Ayora, & Jurado, 2022) are: The greatest interaction was given by class I vessels, especially in the Gulf of Guayaquil (17.2%). The percentage of interaction in areas with a depth range between 25 and 64 m was 2.7% for fishing sets made in the shallow areas outside 8 nm in the Gulf of Guayaquil by class III and IV vessels. Eight types of seabed were identified in the areas where the largest number of sets were made during 2021, predominantly sandy, silty, mixed and sandy bottoms with freshwater influence.

Ponce, *et al* (2022) also concludes, no sets were reported on fragile seabeds such as coral reefs (part of the Machalilla National Park Reserve). Within the periods analyzed, it has been shown that the activities of the fleet take place mainly on mixed bottoms composed of sand and silt on the Ecuadorian coast.

Evidence

- Ponce , G., Camacho, G., Ayora, G., & Jurado, V. (2022). Análisis de la interacción de la pesquería con red de cerco con jareta para peces pelágicos pequeños y el hábitat físico, durante 2021. Guayaquil: IPIAP. <u>https://institutopesca.gob.ec/wp-</u> <u>content/uploads/2018/01/Interaccion-Habitat-Pesqueria-de-Pelagicos-Pequenos-durante-2021.pdf</u>
- Ponce, G., Ayora, G., & Jurado, V. (2021). *Análisis de la interacción de la pesquería de red de cerco con jareta de peces pelágicos pequeños y el hábitat físico, durante 2020*. Guayaquil: IPIAP. <u>https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/Informe-Impactos-HABITAT-2020.pdf</u>
- 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. <u>https://www.institutopesca.gob.ec/wp-</u> content/uploads/2018/01/Informe-Impactos-HABITAT-2019-2.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. <u>https://www.institutopesca.gob.ec/wp-content/uploads/2018/01/5-INTERACCI0%cc%81N-DE-LA-PESQUERI%cc%81A-DE-RED-DE-CERCO-DE-PECES-PELA%cc%81GICOS-PEQUEN%cc%83OS-CON-EL-HA%cc%81BITAT.pdf</u>

Organic Law for the Development of Aquaculture and Fisheries of Ecuador: https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf





Fishery management plan, Ministerial Agreement No. MPCEIP-SRP-2021-0073-A.: https://drive.google.com/file/d/1LguOBILr5wvxsN7sZdgtIsc5WpotezZZ/view

Ministerial Agreement MPCEIP-SRP-2020-0056-A (<u>https://camaradepesqueria.ec/wp-</u> content/uploads/2020/08/REGULACION-PELAGICOS-PEQUENOS-MPCEIP-SRP-2020-0056-A.pdf),

 Status of action
 Completed.

 Evidence Updated.
 Evidence Updated.

F3

MT clause (if relevant)

Action in plan

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

Progress against milestones

The main trophic interactions involving the species that support the small pelagic fishery (PPP) in Ecuador were quantified. For this, an ecotrophic model was built using the Ecopath with Ecosim (EwE) software. The parameters of the model were obtained by compiling biological, ecological, physiological and fishing information of the main functional groups that make up the food web that develops in the study area. Once the model data matrix was populated, its assumptions were verified and the main characteristics of the studied system were quantitatively analyzed using interaction network routines and indicators ("network analysis") contained in EwE. Then, using the EwE Ecosim module, scenarios were simulated in which the ecological impacts resulting from the PPP fishing exploitation were evaluated. The simulated scenarios corresponded to applying the target fishing mortality (Ftarget) of each PPP individually and collectively, and the impacts were measured as changes in the biomass of each functional group in the face of these disturbances.

Preliminary results indicated that there is a need to generate information on the functional groups of the ecosystem (pedigree index=0.29). It was observed that not all PPPs would be low trophic level species (their trophic levels varied between 2 and 4) and predators would depend more on other prey groups such as "other miscellaneous small fishes" and "mesopelagics" than on PPP. For its part, the dynamic model presented a good fit to biomass series and PPP capture. In this sense, it was observed that the changes in the biomass of these species would be explained by fishing mortality (F), but also by trophic interactions through vulnerability to predation, and potential changes in the primary productivity of the system in the last 25 years. It was observed that applying Fobjetivo in each PPP, both individually and collectively, did not negatively affect (decrease > 25%) the biomass of PPP predators.

In general, no significant effects on the ecosystem derived from the individual exploitation of small pelagics were observed. As can be seen in Figure 7, none of the simulations with a monospecific exploitation strategy generated functional groups in biomass changes beyond the 50% change threshold (Figure 7). The greatest effects on the rest of the groups in the ecosystem resulted from the exploitation of pacific chub mackerel, frigate tuna and the largedhead hairtail - pacific cornetfishgroup, although no group decreased its biomass by more than 25%, except thread herring and largedhead hairtail - pacific cornetfish due to their own exploitation. On the other hand, greater effects were observed when simulating an exploitation strategy where Fobj was applied simultaneously to all small pelagic stocks. In this case, the groups whose biomass was reduced, in





addition to the stocks themselves, were sea lion, dorado, snapper and hake, while the biomass of marlin, cuttlefish and other small pelagics increased (Figure 8). However, none of the changes in biomass exceeded the 50% threshold.



Source: Neira, Arriaga, Olea & Espíndola (2022). Figure 7. Changes in the biomass of the functional groups when applying the target fishing mortality (Fobj) individually in each stock of pelagic fish. Key: Square, circle and triangle indicate 5, 10 and 25 years of simulation; Yellow lines = $\pm 25\%$ change; Red lines = $\pm 50\%$ change; B0=unexploited biomass.







Source: Neira, Arriaga, Olea & Espíndola (2022). Figure 8. Relative changes in the biomass of the functional groups when simulating through Ecosim the target fishing mortality (Fobj) in all the small pelagic stocks simultaneously. Key: Square, circle and triangle indicate 5, 10 and 25 years of simulation; Yellow lines = $\pm 25\%$ change; Red lines = $\pm 50\%$ change; B0=unexploited biomass.

The main conclusions of the analysis are:

I. The target species that make up the small pelagic purse-seine fishery in the Ecuadorian marine ecosystem would not all be of low trophic level and would not be the main prey of top predators.





II. The application of the objective fishing mortality in the species that make up the small pelagic fishery with purse seine in the marine ecosystem of Ecuador would not have important negative ecological effects on its food web, especially on the biomass of predators of intermediate and high trophic levels.

III. The target species that make up the small pelagic purse-seine fishery in the marine ecosystem of Ecuador would not play an ecological role of key species of low trophic level.

Outstanding actions and rationale

The results will be presented to other researchers in IPIAP and to FIP stakeholders during October 2022.

Evidence

Neira, Arriaga, Olea & Espíndola (2022). Evaluación del impacto de la pesquería de pelágicos pequeños con red de cerco en el ecosistema marino de Ecuador. Pesca Sustentable. https://drive.google.com/file/d/1E4vbBv6FZPM7zM89FXaLMkPAOStsghVV/view?usp=sharing

Status of action

Completed. Evidence Updated.

MT clause (if relevant) F3

Action in plan

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

Progress against milestones

As previously reported, 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 sustainable development 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:

1. Biological-fishing dimension:

1.1. Achieve a yield according to the Maximum Sustainable Yield (MSY) of the main species of the Small Pelagic Fishery by 2025.

1.2. Achieve a sustainable level of spawning biomass of the Small Pelagic fishery stocks by 2025. 2. Ecological dimension:





2. 1. Reduce the capture of by-catch fauna species by 2025.

2. 2. Reduce severe impact interactions with ETP species by 2025.

- 2. 3. Reduce the interaction of the fishery with the seabed by 2025.
- 3. Socio-economic dimension:
 - 3. 1. Maintain or increase the net benefits from the PPP fishery by 2025.
 - 3. 2. Maintain livelihoods associated with authorized beach hammock fishing by 2025.

In relation with bycatch the FMP and NPOA stablish:

- Establish as companion fauna species that are not considered as species target of the fishery, with a maximum of 20%.
- Strengthen control of current restrictions of fishing areas, specifically the one established in the Organic Law for the Development of Aquaculture and Fisheries (art 104) and in Ministerial Agreement No. 080 of 1990, referring to the exclusive reserve for the artisanal fishing of the first 8 nautical miles.
- Strengthen the control of fishing gear restrictions, specifically what is stipulated in Ministerial Agreement No. MPCEIPSRP-2020-056-A, which prohibits the use of the "double bottom line, skirt or antifango".

Outstanding actions and rationale

Evidence

Organic Law for the Development of Aquaculture and Fisheries of Ecuador: https://camaradepesqueria.ec/wp-content/uploads/2020/04/Ley-de-Acuicultura-y-Pesca-2019.pdf Fishery management plan, Ministerial Agreement No. MPCEIP-SRP-2021-0073-A.: https://drive.google.com/file/d/1LguOBILr5wvxsN7sZdgtIsc5WpotezZZ/view

Status of action

Completed. Evidence Updated.

Additional Information

Catch composition

As part of the research of catch composition, an analysis was carried out by Ponce, Ayora & Jurado (2022). The purpose of the analysis was to elucidate the dynamics of fishing hauls on the different resources that are part of the small pelagic fishery and thus identify the possible associations between them and obtain answers on the level of incidence of multispecies catches in the small pelagic fishery and the percentage of association of the small pelagic species observed in the fishing hauls of the coastal-purse seine fleet, in order to have a better understanding about the dynamics of the fishery and the definition of the assessment unit under the MarinTrust standard.

The records of effective fishing sets were obtained by the Observer's program of the Undersecretariat of Fisheries Resources (SRP, in spanish) through the spreadsheets implemented by the IPIAP, during the period 2017 – 2021, and estimating the volume of catch leveled up to the active effort of the fleet.

he main conclusions are:





- Within the analysis it was categorized four types of fishing sets: PPP sets (monospecific), PPP + PPP (more than 1 small pelagic species in the set), PPP + OTROS (PPP species and other species in the sets) and OTROS (sets without record of small pelagic species).
- In terms of catch volume, it was found that 70% of the total catch corresponded to one or more species of small pelagics and barely 4% to fishing sets with joint catches of small pelagics with other species. While the remaining 26% was made up of catches of species not considered as small pelagic (Table 3).
- When analyzing only the sets with small pelagic catches, it was observed that 81% of the composition of the fishing sets were monospecific. Meaning that, only a single species of small pelagics were caught, corresponding to 91% of the volume of species caught. On the other hand, the percentage of remaining sets corresponded to 4% of PPP+PPP and 15% to sets of small pelagic with other species, with an equivalent in terms of catches of 4% and 5% respectively.
- Based on the results mentioned above, the associations between species in the categories PPP+PPP and PPP+OTROS were identified, and their respective percentage in the catch volume. This was done around the six main small pelagic species of study, resulting in sets of *Scomber japonicus*, *Decapterus macrosoma*, *Auxis* spp and *Etrumeus acuminatus*, that showed a similarity of presence and volume of species of ≥ 50%.
- In October 2018, the fishery started a fisheries improvement project within the framework of the MarinTrust Improver Programme in order to certify the sustainability of the production of fishmeal made with whole fish. The project was based on a pre-assessment that determined that 95% of the fishery's catches were composed of the species: *Opisthonema* spp, *Scomber japonicus, Cetengraulis mysticetus, Etrumeus acuminatus, Decapterus macrosoma, Trichiurus lepturus, Haemulopsis axillaris, Fistularia corneta,* while the remaining 5% greater than 0.1% of the total landing was composed of *Anchoa nasus, Peprilus medius, Larimus spp and Trachurus murphyi* belonging to both the pelagic and benthopelagic group, based on public information of the estimated landings for the entire fleet.
- However, the findings of the analysis carried out in this document opened the discussion on the need to redefine the assessment unit of the fishery under the MarinTrust standard. Considering that predominantly the incidence of catches of the set of benthopellagic species classified as "others", is not associated with the sets of small pelagic used as raw material for the production of fishmeal.
- In the case of *Opisthonema* spp., it was observed that the fishing effort on the species is different, where approximately 15% of its catch is associated with other types of species not considered as small pelagic. Mainly because its spatial distribution is closer to the coast. However, this species is not allowed for fishmeal processing, and therefore cannot enter a MarinTrust assessment process as a whole fish.
- The estimation methodology was incorporated based on the active effort of the fleet, which allowed to segregate the catches by species, vessel type, monthly and annual temporality. The results obtained describe a behavior similar to the results obtained with the raw catches recorded in the observer's databases.





- It is ratified that the composition of the catch disaggregated by species may vary annually, therefore this type of analysis must be replicated annually to list the species that are part of the approval process of MarinTrust.
- Based on the same analysis of similarity, using the estimates of the active effort of the fleet, it was observed that 94.8% of the associated composition in 2021 is directed mostly towards two species: *Scomber japonicus* and *Auxis* spp. In a smaller proportion other small pelagic species were found (*Decapterus macrosoma, Cetengraulis mysticetus , Etrumeus acuminatus*) and benthopelagic species such as *Prionotus* spp., *Chloroscombrus orqueta, Selene peruviana* and *Stellifer* spp.

	Especie	Aporte por especie en función de captura elevada a barcos activos (%)
1	Scomber japonicus	88,05%
2	Auxis spp.	6,73%
3	Decapterus mysticetus	1,77%
4	Cetengraulis mysticetus	1,30%
5	Prionotus spp.	0,82%
6	Etrumeus acuminatus	0,29%
7	Chloroscombrus orqueta	0,20%
8	Selene peruviana	0,16%
9	Stellifer spp.	0,10%

Source: Ponce, Ayora, Jurado (2022). Table 7. Composition of fishing effort on associations of small pelagic species with greater similarity, leveled up to the active effort of the fleet, during 2021.

Project "Monitoring of fish eggs and larvae on board the SPS-FIP FLEET" RESULTS REPORT SEPTEMBER 2021 TO MAY 2022

Within the project "Monitoring of fish eggs and larvae on board the SPS-FIP fleet" that is carried out together with the Public Institute of Aquaculture and Fisheries Research (IPIAP) and the National Chamber of Fisheries (CNP), which has the main objective is to carry out monthly monitoring in certain areas of the Ecuadorian coast, evaluating the distribution and abundance of small pelagic ichthyoplankton, and thus obtain independent and complementary data that help estimate the abundance of adults and the status of the stocks of these species, in order to contribute to the maintenance or taking of measures related to the management of the species of interest of study.

The preliminary results obtained during the study period show:

1. The analysis of the accumulated monthly variation of fish eggs showed that approximately 75% of the adult individuals of small pelagics actually spawned in January, February and March.

2. It is considered that, of the sampled stations, the most important ones where small pelagic species probably attended to spawn were off Pto. Hualtacao, Engabao, Pto. López and Salango; While, to feed and develop, the fish larvae would congregate in Bajo Cope, Puntilla de Santa Elena, Anconcito and Engabao.





3. An approximate average capture of 7 billion larvae was obtained in the entire sampled area, mainly chuhueco, bottle and mackerel, which, considering the existing natural mortality and predation, would be recruited to the fishery in the following years.

4. The environmental conditions recorded during the study period show a positive relationship between the SST and effective spawning (fish eggs) and the concentration of Cl-a and Zooplankton (VZ) with the pre-recruits, which would ensure optimal development and survival, reflected in successful recruitment.

Full results in http://smallpelagics.org/analisis-de-huevos-y-larvas/

