MarinTrust Standard V2

Whole fish Fishery Assessment
Ecuador small pelagics fishery - FAO 87

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Table 1 Application details and summary of the assessment outcome

Application details and summary of the assessment outcome			
Name(s): Productos Pesqueros SA Produpes			
Country: Ecuador			
Email address: jgarcia@productospesqueros.com		**Applicant Code**	WF34
Certification Body Details			
Name of Certification Body:		Global Trust Certification/NSF	
Assessor Name	**CB Peer Reviewer**	**Assessment Days**	**Initial/Surveillance/ Re-approval**
Ana Elisa Almeida Ayres	Léa Lebechnech	7	Initial
Assessment Period	November 2022- November 2023		
Scope Details			
Management Authority (Country/State)	Vice-ministry of Aquaculture and Fisheries of Ecuador		
Main Species	*Scomber japonicus* - Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish) *Auxis* spp - frigate tuna ("*Botella*" or "*Melva*", in Spanish) *Decapterus macrosoma* - shortfin scad ("*Picudillo*" in Spanish) *Cetengraulis mysticetus* - Pacific anchoveta/bocona sardine ("*Chuhueco*", in Spanish) *Etrumeus acumminatus* - round herring ("*Sardina Redonda*", in Spanish) *Prionotus stephanophrys* - lumptail searobin ("*Gallineta*", in Spanish) *Peprilus medius* – Pacific harvestfish ("*Chazo*", in Spanish) *Prionotus albirrostris* - whitesnout searobin ("*Gallineta*", in Spanish)		
Fishery Location	FAO 87 - Ecuador		
Gear Type(s)	Purse Seine		
Outcome of Assessment			
Overall Outcome	Failed		
Clauses Failed	Frigate tuna: A.3.2, A.4 and Table Ba.		
CB Peer Review Evaluation	Agree with the assessor's determination		
Fishery Assessment Peer Review Group Evaluation	Not approved		
Recommendation	Not approved		

Table 2. Assessment Determination

Assessment Determination
The small pelagic fishery is the second most important industrial fishery in Ecuador, being behind only from tuna fishing with purse seine. In October 2018, a Fishery Improvement Project through the MarinTrust Fishery Improvement Project, began with the purpose of achieving the sustainability of stocks and the MarinTrust certification for marine ingredient production by 2023. Catch composition in Ecuador small pelagic fishery is highly variable. For this assessment, the species categorisation rationale is based on a report of Public Research Institute of Aquaculture and Fisheries - IPIAP ("*Instituto Público de Investigación de Acuicultura y Pesca*", in Spanish) published in 2022 named "Analysis of the composition of the catch associated with the fishery of small pelagics authorized for fishmeal production, during 2020-2022" ("*Análisis de la composición de la captura asociada a la pesquería de pelágicos pequeños autorizados para producción de harina de pescado, durante 2020-2022",* in Spanish). The data analysed in this report was obtained from the record of the fishing activity of the vessels of the purse-seine fleet during 2020-2022 and the study was tailored to MarinTrust standard. The IPIAP report showed that 97.38% of the catches of small pelagic fishery were composed by: - *Scomber japonicus* – Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish), - *Auxis* spp – frigate tuna ("*Botella*"or "*Melva*", in Spanish), - *Decapterus macrosoma* – shortfin scad ("*Picudillo*", in Spanish). They were considered target species and assessed as Type 1 species according to MarinTrust v2.2 Whole fish standard. The species that composed the remaining 2.62% of the catches and composed more than 0.1% each were: - *Cetengraulis mysticetus* - Pacific anchoveta/bocona sardine ("*Chuhueco*", in Spanish), - *Etrumeus acumminatus* - round herring ("*Sardina Redonda*", in Spanish), - *Prionotus stephanophrys* - lumptail searobin ("*Gallineta*", in Spanish), - *Peprilus medius* – Pacific harvestfish ("*Chazo*", in Spanish), - *Prionotus albirrostris* - whitesnout searobin ("*Gallineta*", in Spanish). They were considered non-target species and assessed as Type 2 species. None of the species of this assessment is categorised as Endangered or Critically Endangered on International Union for Conservation of Nature's Red List of Threatened Species - IUCN's Red List neither appears in the Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES appendices; therefore, the three species are eligible for approval for use as MarinTrust Whole fish raw material. The government body with responsibility for the management of fisheries in Ecuador is the Vice-Ministry of Aquaculture and Fishing ("*Viceministerio de Acuacultura y Pesca*", in Spanish), which was created by Executive Decree Nº. 636 of January 11, 2019, and belongs to Ministry of Production, Foreign Trade, Investments, and Fisheries - MPCEIP ("*Ministerio de Producción, Comercio Exterior, Inversión y Pesca*", in Spanish). The Vice-Ministry of Aquaculture and Fishing is composed by Aquaculture and Fisheries Policy Directorate, which has 3 Undersecretariats: Undersecretariat of Fisheries Resources – SRP ("*Subsecretaría de recursos pesqueros*", in Spanish) Undersecretariat of Quality and Safety ("*Subsecretaría de calidad e inocuidad*", in Spanish) and Undersecretariat of Aquaculture ("*Subsecretaría de Acuacultura*", in Spanish). The mission of the Vice-Ministry of Aquaculture and Fishing is strategic management of regulations, promotion and use of fishing and aquaculture activities, with the use of policies, strategies, standards, technical and legal instrumentation. SRP formulates and implements strategies, plans, programs and projects for the regulation, development, strengthening, promotion and control of the fishing activity in all its phases in order to guarantee the sustainable use of fishing resources. IPIAP is responsible for conducting scientific research on fisheries resources in

Ecuador.

There was an update of the National Action Plan and the Management of the Small Pelagic Fish Fisheries in 2021, which considered stakeholders positions and interactions of the fisheries with Endangered, Threatened and Protected (ETP) species, habitat, ecosystem, oceanographic conditions and bycatches.

Several updated and continuous data and reports are publicity available in IPIAP and SRP websites, such as stock assessments, results of hydroacoustic cruises, landings data, reports of interactions of the fisheries with ETP species, habitat and ecosystem, data of verified vessels, fishermen and companies involved with fisheries activities, etc. Updated values of B/Bmsy and F/Fmsy of key species of the small pelagic fishery from the 2017-2022 period were sent by e-mail by the client in October 2023, who claimed that values provided in the last stock assessment published in 2022 (Table A) by IPIAP were based in a methodology from 2017. Therefore, for this assessment the new table provided by the client was used as a reference instead of the one from the IPIAP report.

Ecuador went from being sanctioned by the European Union for not having the necessary control elements against Illegal, Unreported and Unregulated Fishing (IUU) fishing, to presiding, until 2025, over the most important and relevant binding international agreement in this fight, the United Nations Food and Agriculture Organization's (FAO) Agreement on Port State Measures (AMERP). Under request to the client, data of enforcement and combat to illegal fishing in the small pelagic fishery of MPCEIP and SRP were provided for the period between 2020- September 2023.

The management of multispecies fishery, such as of the small pelagic fishery, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species. Thus, Ecuador created a strategy based on the management of an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly of the small pelagic fishery. The current indicator species is Pacific chub mackerel.

For the small pelagic fishery in Ecuador, biomass and fishing mortality are evaluated in relation to specific biological reference points. The target reference point for small pelagic fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy~0.4 B0] and its respective fishing mortality (Fmsy~F40%). The limit reference point for this fishery is 50% of the target reference point, which is equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=F20%). Therefore, in summary for this fishery:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

The Ecuadorian government has implemented a mechanism to restrict the total fishing mortality of fish species in Ecuador based on the state of exploitation of the indicator species, which is determined by the variation of its Catch per Unit of Effort (CPUE). Stock assessments are performed annually by IPIAP, there have been peer-reviews involved in the process and the status of the target species of small pelagic fishery is predicted to be revised every two years to evaluate the need to modify the indicator species.

Commercial fishery removals are not prohibited when a specific specie of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery (reproductive and recruitment closures).

Pacific chub mackerel has a species-specific management regime in place with reference points, thus it was assessed

under Category A. Although in 2022 the biomass of Pacific chub mackerel was slight lower than the target level (B/Bmsy = 0.91) and fishing mortality has been slightly above the target in the last two years (B_{2021}/Bmsy=1.03; B_{2022}/Bmsy=1.05), over the history of the fishery these indicators were within the target levels for the species. The species passes all the clauses o of the Category A.

Although frigate tuna has a species-specific management regime in place with reference points, this species failed on clauses A3.2 and A.4, so it was assessed under Category B, table Ba. Total fishery removals of this species regularly exceed the level indicated or stated in the stock assessment, leading to a fail on clause 3.2. Frigate tuna also failed A.4.1, as the biomass of the species is currently B/Bmsy=34%, being below Blim= 50%Bmsy and fishery removals are not prohibited. Although there is well-supported research justifying that for this multispecies fishery the closure would be determined by the indicator species and frigate tuna is not one of them, the population shows evidence of both overfishing and overexploitation and the target level for the fishing mortality has not been met for decades. In 2022, fishing mortality exceeded almost four times the target fishing mortality. Considering the current level of the biomass, noting that fishing mortality has been above the limit reference point in the last five years and above the long-term average (stock is subject to overfishing), the outcome of table Ba of MarinTrust v2.2 Whole fish standard indicated "Fail".

Shortfin scad has a species-specific management regime in place, with reference points, thus it was assessed under category A. The biomass of shortfin scad is above the target reference point, while the fishing mortality is below the target reference point. Shortfin scad passes all the clauses of the Category A.

Pacific anchoveta/bocona sardine and round herring have a species-specific management regime in place, with reference points, and they have a biomass above the limit reference point, thus they were assessed under category C and pass all the clauses.

Lumptail searobin, Pacific harvestfish and whitesnout searobin have no species-specific management regime in place, neither reference points, thus they were assessed under category D and the Productivity-Susceptibility Analysis (PSA) indicated a "Pass" rating against Table D3.

ETP, habitat and ecosystems are not significantly impacted by this fishery and there are several monitoring programs and management measures to address the impacts and take them in consideration during decision making.

In conclusion, the assessor does not recommend the approval of Ecuador small pelagics fishery - FAO 87 for the production of fishmeal and/or fish oil under the current Marin Trust Whole fish Standard (v 2.1), considering that frigate tuna failed in categories A and B.

Fishery Assessment Peer Review Comments

In multispecies fisheries as this one is extremely difficult to prevent catches of species whose situation deserves a reduction of fishing mortality. The only solution to this problem comes from electronic logbooks that permit an almost real-time decision process to close areas where Frigate Tuna can be caught. The whole fishery is at risk if an action such as this one is not taken. Despite considerable efforts made in this fishery in recent years, it has not been possible to decrease F of Frigate Tuna to MSY levels. There are examples of actions that could be implemented. For instance, in Peru the industrial fishery uses electronic logbooks to report catches and fish sizes structures after every fishing set, which enables the closing of areas where they are observed over 10% of juvenile fish in number of over 5% in volume of non target species.

*Please see Appendix B for full peer review comments.

Notes for On-site Auditor

Table 3 General Results

General Clause	Outcome (Pass/Fail)
M1 - Management Framework	Pass
M2 - Surveillance, Control and Enforcement	Pass
F1 - Impacts on ETP Species	Pass
F2 - Impacts on Habitats	Pass
F3 - Ecosystem Impacts	Pass

Table 4 Species- Specific Results

List all Category A and B species. List approximate total percentage (%) of landings which are Category C and D species; these do not need to be individually named here

Category	Species	% landings	Outcome (Pass/Fail)	
Category A	*Scomber japonicus* - Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish)	80.06	A1	Pass
			A2	Pass
			A3	Pass
			A4	Pass
Category B	*Auxis spp* - frigate tuna ("*Botella" or "Melva"*, in Spanish)	14.46	Fail	
Category A	*Decapterus macrosoma* - shortfin scad ("*Picudillo*" in Spanish)	2.86	A1	Pass
			A2	Pass
			A3	Pass
			A4	Pass
Category C	*Cetengraulis mysticetus* - Pacific anchoveta/bocona sardine ("*Chuhueco*", in Spanish)	0.88	Pass	
Category C	*Etrumeus spp* - round herring ("*Sardina Redonda*", in Spanish)	0.78	Pass	
Category D	*Prionotus stephanophrys* - lumptail searobin ("*Gallineta*", in Spanish)	0.27	Pass	
Category D	*Peprilus medius* – Pacific harvestfish ("*Chazo*", in Spanish)	0.19	Pass	
Category D	*Prionotus albirrostris* - whitesnout searobin ("*Gallineta*", in Spanish)	0.13	Pass	

Table 5 Species Categorisation Table

Common name	Latin name	Stock	IUCN Redlist Category[1]	% of landings	Management	Category
Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish)	*Scomber japonicus*	Pacific chub mackerel in FAO 87 - Ecuador	LC	80.06	Vice-Ministry of Aquaculture and Fishing	A
Frigate tuna ("*Botella*" or "*Melva*", in Spanish)	*Auxis* spp	Frigate tuna in FAO 87 - Ecuador	LC	14.46	Vice-Ministry of Aquaculture and Fishing	B (Failed A)
Shortfin scad ("*Picudillo*" in Spanish)	*Decapterus macrosoma*	Shortfin scad in FAO 87 - Ecuador	LC	2.86	Vice-Ministry of Aquaculture and Fishing	A
Pacific anchoveta/Bocona sardine ("*Chuhueco*", in Spanish)	*Cetengraulis mysticetus*	Pacific anchoveta/Bocona sardine in FAO 87 - Ecuador	LC	0.88	Vice-Ministry of Aquaculture and Fishing	C
Round herring ("*Sardina Redonda*", in Spanish)	*Etrumeus* spp	Round herring in FAO 87 - Ecuador	LC	0.78	Vice-Ministry of Aquaculture and Fishing	C
Lumptail searobin ("*Gallineta*", in Spanish)	*Prionotus stephanophrys*	Lumptail searobin in FAO 87 - Ecuador	LC	0.27	Vice-Ministry of Aquaculture and Fishing	D
Pacific harvestfish ("*Chazo*", in Spanish	*Peprilus medius*	Pacific harvestfish in FAO 87 - Ecuador	LC	0.19	Vice-Ministry of Aquaculture and Fishing	D
Whitesnout searobin ("*Gallineta*", in Spanish)	*Prionotus albirrostris*	Whitesnout searobin in FAO 87 - Ecuador	LC	0.13	Vice-Ministry of Aquaculture and Fishing	D
Species categorisation rationale						

[1] https://www.iucnredlist.org/

Catch composition in Ecuador small pelagic fishery is highly variable. In October 2018, a Fishery Improvement Project through the MarinTrust Fishery Improvement Project, began with the purpose of achieving the sustainability of stocks and the MarinTrust certification for marine ingredient production by 2023.

For this assessment, the species categorisation rationale is based on Ponce et al (2023)'s report "Analysis of the composition of the catch associated with the fishery of small pelagics authorized for fishmeal production, during 2020-2022" ("*Análisis de la composición de la captura asociada a la pesquería de pelágicos pequeños autorizados para producción de harina de pescado, durante 2020-2022*", in Spanish). The data analysed in this report was obtained from the record of the fishing activity of the vessels of the purse-seine fleet during 2020-2022 and the study was tailored to MarinTrust standard.

It was observed that 97.38% of the catches were composed by *Scomber japonicus* - Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish), *Auxis* spp - frigate tuna ("*Botella"* or "*Melva*", in Spanish), *Decapterus macrosoma* - shortfin scad ("*Picudillo*" in Spanish) [Figure 1]. They were considered target species and assessed as Type 1 species according to MarinTrust v2.3 by-products standard. The species that composed the remaining 2,62% of the catches and composed more than 0,1% each were *Cetengraulis mysticetus* - Pacific anchoveta/bocona sardine ("*Chuhueco*", in Spanish) and *Etrumeus acumminatus* - round herring ("*Sardina Redonda*", in Spanish), *Prionotus stephanophrys* - Lumptail searobin ("*Gallineta*", in Spanish), *Peprilus medius* – Pacific harvestfish ("*Chazo*", in Spanish), *Prionotus albirrostris* - Whitesnout searobin ("*Gallineta*", in Spanish), which were considered non-target species and assessed as Type 2 species.

Pacific chub mackerel, frigate tuna and shortfin scad have a species-specific management regime in place with reference points, however Pacific chub mackerel frigate tuna did not pass under category A, thus Pacific chub mackerel and frigate tuna were assessed under category B, while shortfin scad was assessed under category A.

Pacific anchoveta/bocona sardine and round herring have a species-specific management regime in place with reference points, thus they were assessed under category C. Lumptail searobin, Pacific harvestfish and whitesnout searobin have no species-specific management regime in place neither reference points, thus they were assessed under category D.

Composición de la captura asociada a especies de pelágicos pequeños autorizadas para la producción de harina de pescado 2020-2022

Nº	ESPECIE	Nombre común	Composición de la captura (%)
1	*Scomber japonicus*	*Macarela, morenillo*	80.06%
2	*Auxis spp*	*Botella, melva*	14.46%
3	*Decapterus macrosoma*	*Picudillo*	2.86%
4	*Cetengraulis mysticetus*	*Chuhueco*	0.88%
5	*Etrumeus acuminatus*	*Sardina redonda*	0.78%
6	*Prionotus stephanophrys*	*Gallineta*	0.27%
7	*Peprilus medius*	*Chazo*	0.19%
8	*Prionotus albirostris*	*Gallineta*	0.13%

Figure 1. Catch composition associated with small pelagic species authorized for the production of fishmeal 2020-2022 (Ponce et al, 2023).

Reference

Ponce, G., Ayora G., and Jurado, V. 2023. Análisis de la composición de la captura asociada a la pesquería de pelágicos pequeños autorizados para producción de harina de pescado, durante 2020-2022. Instituto Público de Investigación de Acuicultura y Pesca.https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-capturas-PPP-MT_2020-2022.pdf

MANAGEMENT

The two clauses in this section (M1, M2) relate to the general management regime applied to the fishery under assessment. The clauses should be completed by providing sufficient evidence to justify awarding each of the requirements a pass or fail rating. A fishery must meet all the minimum requirements in every clause before it can be recommended for approval.

M1	Management Framework – Minimum Requirements		
	M1.1	There is an organisation responsible for managing the fishery.	Yes
	M1.2	There is an organisation responsible for collecting data and assessing the fishery.	Yes
	M1.3	Fishery management organisations are publicly committed to sustainability.	Yes
	M1.4	Fishery management organisations are legally empowered to take management actions.	Yes
	M1.5	There is a consultation process through which fishery stakeholders are engaged in decision-making.	Yes
	M1.6	The decision-making process is transparent, with processes and results publicly available.	Yes
		Clause outcome:	Pass

M1.1 There is an organisation responsible for managing the fishery.

The government body with responsibility for the management of fisheries in Ecuador is the Vice-Ministry of Aquaculture and Fishing ("*Viceministerio de Acuacultura y Pesca*", in Spanish), which was created by Executive Decree No. 636 of January 11, 2019, and belongs to Ministry of Production, Foreign Trade, Investments, and Fisheries - MPCEIP ("*Ministerio de Producción, Comercio Exterior, Inversión y Pesca"*, in Spanish). The Vice-Ministry of Aquaculture and Fishing is composed by Aquaculture and Fisheries Policy Directorate, which has 3 Undersecretariats: Undersecretariat of Fisheries Resources – SRP ("*Subsecretaría de recursos pesqueros"*, in Spanish), Undersecretariat of Quality and Safety ("*Subsecretaría de calidad e inocuidad*", in Spanish) and Undersecretariat of Aquaculture ("*Subsecretaría de acuacultura*", in Spanish). The mission of the Vice-Ministry of Aquaculture and Fishing is strategic management of regulations, promotion and use of fishing and aquaculture activities, with the use of policies, strategies, standards, technical and legal instrumentation (Gobierno del Ecuador, 2023)[1].

There is an organisation responsible for managing the fishery. M.1.1 is met.

M1.2 There is an organisation responsible for collecting data and assessing the fishery.

The Public Research Institute of Aquaculture and Fisheries - IPIAP ("*Instituto Público de Investigación de Acuicultura y Pesca*", in Spanish) is responsible for conducting scientific research on fisheries resources in Ecuador. According to Gobierno del Ecuador (2023)[2], IPIAP "is a public law entity with legal status, administrative and financial autonomy and with its own assets, attached to the National Aquaculture and Fisheries Authority. It is the entity in charge of planning, promoting, coordinating, and executing and scientific research processes related to aquaculture, fishing and related activities; and, of the generation, innovation, validation, diffusion and transfer of technologies".

There is an organisation responsible for collecting data and assessing the fishery. M.1.2 is met.

M1.3 Fishery management organisations are publicly committed to sustainability.

The actions of fisheries management are carried out within the Constitution of the Republic of Ecuador and the Organic Law for the Development of Aquaculture and Fisheries.

In Article 395 of the Constitution states: "The State shall guarantee a sustainable model of development, one that is environmentally balanced and respectful of cultural diversity, conserves biodiversity and the natural regeneration capacity of ecosystems, and ensures meeting the needs of present and future generations." (PDBA, 2011).

One of the principles of the Organic Law for the Development of Aquaculture and Fisheries is the sustainability of resources as described in Article 4. b:" Seek responsible use and sustainable exploitation of hydrobiological resources. Establish priority to implementation of measures whose purpose is to preserve or restore the populations of the species caught at a theoretical equilibrium level of maximum sustainable yield" (Gobierno del Ecuador, 2023)[3].

The "Ministerial Agreement No. 21 001 - Organic statute of organizational management by processes of the Ministry of Production, Foreign trade, Investment and Fisheries reform" enacted in 2021 is available in the government website and specify the missions and attributions of fishery management organizations. Several of them mention explicitly the concept of sustainability.

The mission of the Fisheries and Aquaculture Policy Management, whose responsible is the Aquaculture and Fisheries Policy Director, includes to guarantee the sustainable use and of resources in all phases and includes: "k) Obtain areas for the extraction and cultivation of bioaquatic species through a process of planning oriented to the productive and sustainable development of bioaquatic resources; (…) n) Develop strategies for sustainable use of fisheries and aquaculture, and diversification and productive integration;" (Gobierno del Ecuador, 2023)[4].

The mission of the SRP is stated as: "formulate and implement strategies, plans, programs and projects for the regulation, development, strengthening, promotion and control of the fishing activity in all its phases, in order to guarantee the sustainable use of fishing resources." One of the specific attributes and responsibilities of this Undersecretariat is "i) Establish strategies for the sustainable use, diversification and productive integration of the fishing activity;" (Gobierno del Ecuador, 2023)[4].

The attributions of IPIAP are stated on its website and include: "2. Investigate, try and recommend appropriate mechanisms, measures and systems for the sustainable use of hydrobiological resources; (..) 4. Propose strategies, management measures and technological innovations for the sustainable development of aquaculture and fishing activities;" (Gobierno del Ecuador, 2023)[2].

The actions of fisheries management are carried out within the Constitution of the Republic of Ecuador. In Article 395 of the Constitution states "The Constitution recognizes the following environmental principles: 1. The State shall guarantee a sustainable model of development, one that is environmentally balanced, conserves biodiversity and the natural regeneration capacity of ecosystems, and ensures meeting the needs of present and future generations".

Fishery management organisations are publicly committed to sustainability. M.1.3 is met.

M1.4 Fishery management organisations are legally empowered to take management actions.

The Organic Law for the Development of Aquaculture and Fisheries enacted in 2020 is the current National regulatory framework for the sustainable development of aquaculture and fisheries in Ecuador**.** The law establishes a number of measures, including the creation of a National Fisheries and Aquaculture System and the Public Research Institute of Aquaculture and Fisheries – IPIAP. The attributes of IPIAP are listed in this law (Gobierno del Ecuador, 2023[5]).

The Organic Statute of the Ministry of Production, Foreign trade, Investment and Fisheries enacted in 2021 stablished the structure of the ministry and described the missions, attributions and responsibilities of several fishery management organizations, such as the Vice-Ministry of Aquaculture and Fishing, Aquaculture and Fisheries Policy Directorate,

Subsecretary of Fisheries Resources, Subsecretary of Quality and Safety and Subsecretary of Aquaculture (Gobierno del Ecuador, 2023[4]).

Fishery management organisations are legally empowered to take management actions. M.1.4 is met.

M1.5 There is a consultation process through which fishery stakeholders are engaged in decision-making.

The Organic Law for the Development of Aquaculture and Fisheries enacted in 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" (Gobierno del Ecuador, 2023[5]).

Article 97 of the Organic Law for the Development of Aquaculture and Fisheries 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 Research Institute of Aquaculture and Fisheries 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 (Gobierno del Ecuador, 2023[5]).

The Ecuadorian Small Pelagic Fishery Dialogue Platform – SPFDP ("*Mesa de Diálogo para la Pesquería de Peces Pelágicos Pequeños del Ecuador*", in Spanish) 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" (CNP, 2023). This agreement is the regulatory framework of participatory governance. SPFDP has played a key role in the implementation, evaluation, adaptation, and update of the National Action Plan and the Management of the Small Pelagic Fish Fisheries.

There is a consultation process through which fishery stakeholders are engaged in decision-making. M.1.5 is met.

M1.6 The decision-making process is transparent, with processes and results publicly available.

The Organic Law for the Development of Aquaculture and Fisheries requires that the government make all fisheries-related information publicly available, including catch data, fishing effort data, and management plans.

In IPIAP website is possible to access several reports and data, such as stock assessments, results of hydroacoustic cruises, landings data, reports of interactions of the fisheries with Endangered, Threatened and Protected - ETP species, ecosystem, and habitat: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

In SRP website is possible to verify data of verified vessels, fishermen and companies involved with fisheries activities: https://srp.produccion.gob.ec/registro-nacional-de-embarcaciones/

There were several meetings with the SPFDP during the update of the National Action Plan and the Management of the Small Pelagic Fish Fisheries (SRP, 2021).

The decision-making process is transparent, with processes and results publicly available. M.1.6 is met.

References

CNP. 2023. ACUERDO Nro. MPCEIP-SRP-2020-0054-A. https://camaradepesqueria.ec/wp-content/uploads/2020/07/ACUERDO-PLATAFORMA-MPCEIP-SRP-2020-0054-A.pdf

Gobierno del Ecuador. 2023[1]. Viceministerio de Acuacultura y Pesca. https://www.produccion.gob.ec/viceministerio-de-acuacultura-y-pesca/

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Links	
MarinTrust Standard clause	1.3.1.1, 1.3.1.2
FAO CCRF	7.2, 7.3.1, 7.4.4, 12.3
GSSI	D.1.01, D.4.01, D2.01, D1.07, D1.04,

M2	**Surveillance, Control and Enforcement - Minimum Requirements**		
	M2.1	There is an organisation responsible for monitoring compliance with fishery laws and regulations.	Yes
	M2.2	There is a framework of sanctions which are applied when laws and regulations are discovered to have been broken.	Yes
	M2.3	There is no substantial evidence of widespread non-compliance in the fishery, and no substantial evidence of IUU fishing.	Yes
	M2.4	Compliance with laws and regulations is actively monitored, through a regime which may include at-sea and portside inspections, observer programmes, and VMS.	Yes
		Clause outcome:	Pass

M2.1 There is an organisation responsible for monitoring compliance with fishery laws and regulations.

According to Gobierno del Ecuador (2023)[1], the mission of the SRP is "Formulate and implement strategies, plans, programs and projects for the regulation, development, strengthening, promotion and control of the fishing activity in all its phases in order to guarantee the sustainable use of fishing resources". Some of its attributions include:

> "o) Evaluate the strategies and actions for the monitoring, control and surveillance of the fishing activity in all its phases;
> p) Establish the execution of administrative and control processes for those who fail to comply with the laws and regulations in force within the framework of its competence (…);
> r) Articulate strategies and mechanisms for the control and surveillance of the exercise of the fishing activity in function of the legal framework, technical regulations, policies and current fishing guidelines;
> s) Establish actions to prevent, discourage and eliminate illegal, unreported and unreported fishing regulated;"

Within the SRP, there is the Fisheries Control Directorate, whose mission is "Control fishing activity through the execution of monitoring, surveillance and inspection, to guarantee the protection, conservation and sustainable use of resources bioaquatic" and some of the attributions include:

> "i) Execute plans, programs and/or projects related to the control and traceability of the fishing activity (…);
> j) Carry out the monitoring, control and surveillance of the fishing activity in all phases and its related activities;
> k) Manage the information regarding the monitoring, control and surveillance of the fishing activity;
> l) Execute control actions aimed at compliance with the laws and regulations in force in the fishing field (…);
> o) Execute the control and surveillance of the exercise of the fishing activity according to the legal framework, current technical regulations, fishing policies and guidelines;
> p) Execute actions to prevent, discourage and eliminate illegal, unreported and unregulated fishing".

There is an organisation responsible for monitoring compliance with fishery laws and regulations. M2.1 is met.

M2.2 There is a framework of sanctions which are applied when laws and regulations are discovered to have been broken.

There are several sanctions predicted in Article 215 of Organic Law for the Development of Aquaculture and Fisheries (Gobierno del Ecuador, 2023[2]):

> "a) Financial penalty or fine: which may consist of fines from one to one thousand five hundred unified basic wages (SBU);
> b) Confiscation of hydrobiological species, products or goods obtained in the commission of offenses;
> c) Definitive confiscation of the gear or fishing gear and the products or inputs of prohibited use;
> d) Suspension, revocation or non-renewal of authorizations or permits;
> e) Reduction of points in accordance with current regulations;
> f) Seizure of the fishing vessel;
> g) Temporary closure of the production line or aquaculture or fishing establishment; and,
> h) Loss of incentives".

Some major enforcements of sanctions are published in the "News" section of government and "Operation Results" section of Navy website, such as seizures of fish, sanctions and fines for expired or lack of fishing licences, fishing in protected areas and others (Gobierno del Ecuador2015, 2016[1,2],2021; Armada, 2023).

Some sentences related to sharks' catches were identified in previous years (American University, 2023):
"In Ecuador in 2019, authorities sentenced 20 crew members of the Chinese ship Fu Yuan Yu Leng 999 to one to three year terms, confiscated the ship, and imposed a US$6.1 million fine after they were caught with 7,600 sharks off the Galapagos.[72]

Also in Ecuador, in 2021 the alleged exporter of 26 tons of illegal shark fins to Hong Kong, taken from more than 38,000 sharks, was fined by the government (the fine, however, was less than $4,000)[73]."

Moreover, after requesting further information to the client, data from MPCEIP was provided on 21st September 2023. On 24th October 2023, SRP sent by e-mail further updated data of actions applied for enforcement of fishery regulations for the small pelagic fishery from 2020 - September 2023 as presented in the Figure 2 below:

Activity	2020	2021	2022	2023
Inspections carried out at fishing establishments during the closed period, small-scale pelagic fisheries	94	113	623	405
Closed season controls executed during the closed period, Small Pelagic Fish purse seine fishery	256	188	823	1,164
Maritime operations carried out on small pelagic fishing vessels	235	705	547	577
Land operations aimed at controlling the transportation and commercialization of hydrobiological resources	1,834	5,902	5,102	4,324
Closed season extension executed during the closed period, Small Pelagic Fish purse seine fishery.	211	326	449	385
Landing control of the purse seine fishery for small pelagic fish	6,000	7,562	6,067	4,705
Control of Mobilization of Fishing Products of small pelagic fish	120,569	183,458	163,763	127,641
Number of fishing hauls monitored on board small pelagic fish vessels	1,741	2,752	2,391	2,372

Figure 2. Data of inspections of the monitoring, control and surveillance system in small pelagic fishery sent by SRP by e-mail on 24th October 2023. Data of 2023 is up to September.

In the e-mail SRP informed that between 2020 and 2022, an average of 170,934 monitoring, control and surveillance actions were carried out, including its permanent satellite monitoring data.

There is a framework of sanctions which are applied when laws and regulations are discovered to have been broken. M.2.2 is met.

M2.3 There is no substantial evidence of widespread non-compliance in the fishery, and no substantial evidence of IUU fishing.

Diálogo Americas (2023) summarized evolution of Ecuador fisheries regarding the issue of IUU fishing: "Ecuador went from being sanctioned by the European Union for being a non-cooperating country that did not have the necessary control elements against IUU fishing, to presiding, until 2025, over the most important and relevant binding international agreement in this fight, the United Nations Food and Agriculture Organization's (FAO) Agreement on Port State Measures (AMERP)".

Ecuador was given a yellow card by the European Commission in October 2019 for its lack of an effective enforcement and sanctioning system to address IUU fishing (EC, 2019). In response, Ecuador passed a law in 2020 introducing measures to improve the preservation of fishery resources, including heavier penalties for offenders. SRP has informed by e-mail on 24th

October 2023 “Ecuador has successfully surpassed the follow-up audits carried out by DGMARE [Directorate-General for Maritime Affairs and Fisheries] between 2020 and 2023, in which case the audit mission has verified the country's advances in updating its normative framework and improving its fisheries control and accessibility systems. […] Ecuador has expressed its interest to the European Union in having a new audit carried out to show evidence for the removal of the yellow card”.

According to Diálogo Americas (2023), Ecuador has taken several steps to combat IUU fishing, such as:

- Becoming a party to the Food and Agriculture Organization of the United Nations - FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing - IUU fishing
- Uploading an inspection report in the FAO information exchange system.
- Connecting Ecuador software to FAO software.
- Participating in multilateral forums regarding the fight against IUU fishing.
- Enacting the Organic Law for the Development of Aquaculture and Fisheries 2020, which embraces AMERP principles.
- Sanctioning IUU fishing activities such as prohibitions of interaction with unwanted species and vulnerable, protected, and globally threatened species.
- Investing more than $65 million in improving human and infrastructure capacities.
- Having its Vice Minister of Aquaculture and Fisheries Andrés Arens participate as first vice president in the Fourth Meeting of the Parties to the Agreement on Port State Measures (AMERP) in Bali, Indonesia.
- Holding the presidency of the International Board of the Fisheries Transparency Initiative (FiTI) for the 2023-2025 period.

In 2021, Ecuador made public the data from its vessel monitoring system (VMS) on the Global Fishing Watch map. This made the movements of the country's 700-strong industrial fishing fleet and 500 smaller vessels visible to the world. This comprehensive picture allows relevant authorities to see where vessels have been fishing and identify potentially suspicious activity, such as fishing in a protected area (GFW, 2023).

In 2023, 306 new civil servants were hired to strengthen monitoring and control of fishing activities, including 224 inspectors and 51 analysts for supervision and fishing observation. These measures have yielded positive results. As of August 2023, 862 maritime, land, and river operations have been carried out, as well as operations in places where fish products are sold, resulting in the confiscation of approximately 10,441 kg of fish. In addition, the government has invested in technological equipment, such as GPS and high-performance scanners, and in the implementation of the Integrated Aquaculture and Fishing System (SIAP). This system will automate and systematize 116 processes of the Vice Ministry of Aquaculture and Fishing, which will improve the efficiency of operational management and allow traceability of fish products (Gobierno del Ecuador, 2023[3]).

Under request, the client sent data in 21st of September 2023 provided by MPCEIP from a report of April 2023, quantifying some actions taken from 2020-2023 to combat illegal fishing in the small pelagic fishery (Figure 3):

Actions to combat illegal fishing in the small pelagic fishery				
Control type	Annual Number of Controls Executed			
	2020	2021	2022	2023
Closed season controls: Closed season controls executed during the PPP closed period	256	188	823	433
Closed season controls: Ban extensions executed during the PPP ban period	211	326	449	303
	467	514	1272	736

Figure 3. Translated adapted table detailing actions taken from 2020-2023 to combat illegal fishing in the small pelagic fishery provided by MPCEIP and sent by the client.

SRP has provided further information on 24th October 2023, which shows a reduction on fisheries infringements over the

years, an indication that the actions in place are being effective on reducing IUU fishing:

"As a consequence of the actions established in accordance with the Law and its regulations, between 2020 and September 2023, the following number of files with sanctions for fishing violations in the small pelagic fishery were determined [Figure 4]:

Total number of files with sanctions for small pelagic fish vessels	2020	2021	2022	2023*
Minor infringements LODAP art. 212	1	0	0	0
Serious infringements LODAP art. 213	5	7	4	1
Very serious infringements LODAP art. 214	114	113	2	5
Total sanctions	120	120	6	6

*Data up to the month of September

Figure 4. Translated adapted table detailing actions taken from 2020-2023 to combat illegal fishing in the small pelagic fishery provided by SRP and sent by the client I 24th October 2023.

The growing strengthening of monitoring, control and surveillance capabilities, with a robust regulatory framework (LODAP) allows us to conclude that the correct application of coercive measures by the Fisheries Authority has generated an evident deterrent effect regarding the commission of infractions and recidivism by the fleet in general."

The Ecuadorian government has made significant investments in monitoring and control of fishing activities. Measures taken by the government shows that the country is taking serious steps to combat IUU and the effectiveness of them have been recognized by the authorities.

There is no substantial evidence of widespread non-compliance in the fishery, and no substantial evidence of IUU fishing. M.2.3 is met.

M2.4 Compliance with laws and regulations is actively monitored, through a regime which may include at-sea and portside inspections, observer programmes, and VMS.

There are several measures predicted in Article 161 of Organic Law for the Development of Aquaculture and Fisheries for the follow-up, control and surveillance of fishing activities, (Gobierno del Ecuador, 2023[2]):

"Article 161.- Means of Control. To monitor, control and monitor the fishing activity, the governing body will use the following means:

a) Monitoring, surveillance and control system through the devices and mechanisms provided for in this Law and in the technical regulations issued for that purpose;
b) Technical reports issued by the Satellite Monitoring Center (CMS);
c) Inspections of vessels, ports and places authorized to unloading, processing plants, means of transport, collection centres or other facilities or units involved in the phases of the activity fishery;
d) Reports issued by the Regional Fisheries Management Organisms;
e) Reports of observers on board;
f) Reports from the Public Institute for Aquaculture and Fisheries Research;
g) Documentary control of certificates of monitoring and control of unloading of fishing, mobilization guides,

transhipment authorization and other documents that required by this Law and the technical regulations issued by the governing body;
h) Fishing logs, image registration system, weighing system;
i) Technical reports on the quality, safety and health of fishery products primary or processed; and,
j) Determination of authorized ports and sites for landing resources hydrobiological; and,
k) Among others established by the governing body."

Compliance with laws and regulations is actively monitored, through a regime which may include at-sea and portside inspections, observer programmes, and VMS. M.2.4 is met.

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Links	
MarinTrust Standard clause	1.3.1.3
FAO CCRF	7.7.2
GSSI	D1.09

CATEGORY A SPECIES

The four clauses in this section apply to Category A species. Clauses A1 - A4 should be completed for **each** Category A species. If there are no Category A species in the fishery under assessment, this section can be deleted. A Category A species must meet the minimum requirements of all four clauses before it can be recommended for approval. The clauses should be completed by providing sufficient evidence to justify awarding each of the requirements a pass or fail rating. The species must achieve a pass rating against all requirements to be awarded a pass overall. **If the species fails any of these clauses it should be re-assessed as a Category B species.**

Species Name	***Scomber japonicus* - Pacific chub mackerel ("*Macarela*" or "*Morenillo*", in Spanish)**	
A1	**Data Collection - Minimum Requirements**	
A1.1	Landings data are collected such that the fishery-wide removals of this species are known.	Yes
A1.2	Sufficient additional information is collected to enable an indication of stock status to be estimated.	Yes
	Clause outcome:	Pass

A1.1 Landings data are collected such that the fishery-wide removals of this species are known.

Landings data from 1981 and onwards are available in IPIAP website and have been used for stock assessments of small pelagics fishes: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

A complied graph of the landings from 1975-2022 is provided in Figure 5. For building this graph, different sources were used. For the 1980s, data were obtained from the validation and recalculation of catch data reported by Fuentes (1989), Patterson et al. (1990), and Patterson and Santos (1990). For the 1990s to 2022, data were obtained from the factory landing database, which is generated from daily fishing reports from processing companies, as well as from the monthly field sampling database. Additionally, from 2016 and onwards, data from the fishing database of the herring purse seine fleet observer program were incorporated.
Overall, from 1975-1995, landings of Pacific chub mackerel were relatively high, but have been decreasing since then.

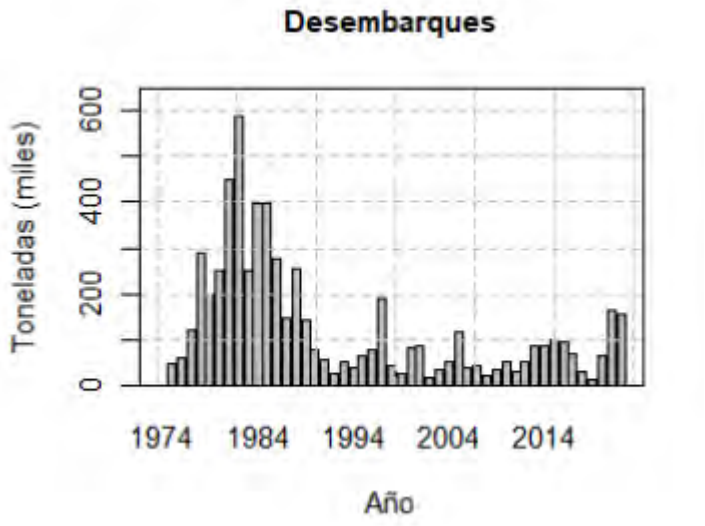

Figure 5. Landings of Pacific chub mackerel from 1975-2022 (Canales and Jurado, 2023).

The latest data of catches available in IPIAP website covers 2015-2022 (Figure 6). In 2022, 158,121.40 tons of Pacific chub mackerel were landed (IPIAP, 2023) and it is noticed a high increase of the landing in the last two years.

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS
(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.717,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	37.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 6. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

Landings data are collected such that the fishery-wide removals of this species are known. A.1 is met.

A1.2 Sufficient additional information is collected to enable an indication of stock status to be estimated.

Information is generated by the Fisheries Observer Program, which is administered by the SRP. The Program delivers data to IPIAP for analysis and the information collected allows the development of several analyses, such as stock assessment, Endangered, Threatened or Protected – ETP species interaction evaluation and habitat interactions.

The Ecuadorian government has established a mandatory program of on-board fisheries observers for vessels with purse seines that catch small pelagic fish through the Ministerial Agreement Nº MPCEIP-SRP-2020-0056-A. The program, which is administered by SRP, randomly covers 30% of the fleet.

According to FIP (2021): "The Undersecretariat of Fisheries Resources carries out permanent tasks related to the monitoring and control of the small pelagic fishery. Although this monitoring is carried out for the purpose of control, the information collected serves as support for the execution of the investigation, since it constitutes a daily information survey of the landings made by the fishery".

In addition to the monitoring and control activities, the Ecuadorian government also conducts two Hydroacoustic Evaluation Cruises per year, one in winter and one in summer. These cruises are designed to estimate the abundance, biomass and distribution of the main small pelagic species off the Ecuadorian coast. The cruises also collect data on phytoplankton, zooplankton and ichthyoplankton, as well as oceanographic parameters and relates this information to the availability of the fishing stocks.

In this sense, there are significant data and information of the Ecuadorian small pelagic fishery, and in order to provide stock assessments, a series of data is analysed: biological samplings, size compositions, abundance indices, landings, acoustic cruises and biological parameters. The analyses are performed based on estimation models and their results are discussed regarding different hypotheses and biological reference points.

Sufficient additional information is collected to enable an indication of stock status to be estimated. A1.2 is met.

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Links

MarinTrust Standard clause	1.3.2.1.1, 1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	7.3.1, 12.3
GSSI	D.4.01, D.5.01, D.6.02, D.3.14

A2	**Stock Assessment - Minimum Requirements**		
	A2.1	A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock), and considers all fishery removals and the biological characteristics of the species.	Yes
	A2.2	The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.	Yes
	A2.3	The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.	Yes
	A2.4	The assessment is subject to internal or external peer review.	Yes
	A2.5	The assessment is made publicly available.	Yes
		Clause outcome:	Pass

A2.1 A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock), and considers all fishery removals and the biological characteristics of the species.

IPIAP has performed annual stock assessments. In its website it is possible to find them from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

The stock assessment compiles a series of biological sample data, fish sizes on the catches, abundance indices, landings, data from acoustic surveys, and biological parameters. The analyses are carried out based on estimation models and their results are discussed based on different hypotheses and biological points of reference.

A stock assessment is conducted at least once every 3 years) and considers all fishery removals and the biological characteristics of the species. A.2.1 is met.

A2.2 The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.

For the small pelagic fishery in Ecuador, biomass and fishing mortality are evaluated in relation to specific biological reference points (Figure 7). The target reference point for this fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy=40%B0] and its respective fishing mortality (Fmsy=40%F). The limit reference point for this fishery is 50% of the target reference point (Flim=50%Fmsy and Blim= 50%Bmsy), which is

equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=20%F) [Canales and Jurado, 2023]. Therefore, in summary:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022, luego de la implementación de mejoras en los modelos de evaluación. Tomados a partir de los resultados de la última evaluación poblacional (Canales & Jurado, 2023).

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.78	1.10	2.02	1.74	0.90	1.06	1.27
	F/F_{RMS}	2.86	0.55	0.43	0.51	1.24	0.67	1.04
2019	B/B_{RMS}	0.63	1.12	1.80	1.29	1.32	1.15	1.22
	F/F_{RMS}	1.32	0.09	0.06	0.18	0.19	0.32	0.36
2020	B/B_{RMS}	0.52	1.16	1.89	1.35	1.42	1.17	1.25
	F/F_{RMS}	3.38	0.40	0.09	0.12	0.06	0.14	0.70
2021	B/B_{rms}	0.49	1.05	1.37	1.10	1.73	1.25	1.17
	F/F_{RMS}	2.14	1.03	0.22	0.32	0.27	0.17	0.69
2022	B/B_{RMS}	0.34	0.91	1.14	1.27	1.90	1.31	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.31	0.44	0.46	1.08

Figure 7. Comparative table of diagnostic indicators of small pelagic stocks in Ecuador 2017-2022 sent by email on 24th October 2023, after the implementation of improvements in the assessment of Canales and Jurado (2023).

According to Canales and Jurado (2023): "In the most recent period, spawning biomass [of Pacific chub mackerel] has varied around the reference value (40%B0) equivalent to 300 thousand tons, while mortality from fishing on very few occasions exceeded the Fmsy value (…). With this, the level of population reduction by 2022 is estimated to be below the target and around 36% of virgin B0 biomass." (Figure 8).

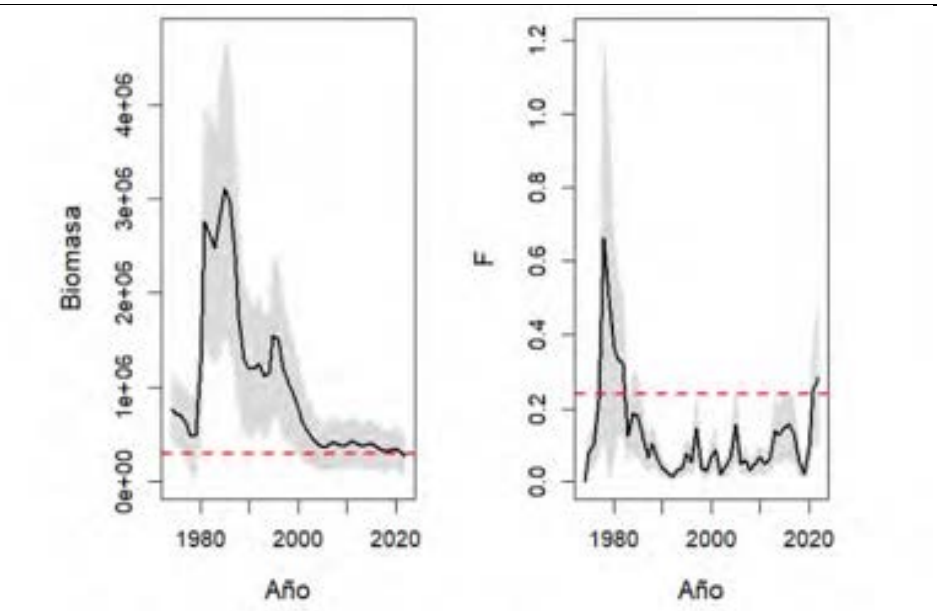

Figura M8. Biomasa y mortalidad por pesca de **MACARELA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 8. Biomass and fishing mortality of Pacific chub mackerel. Segmented thin line MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy. A.2.2 is met.

A2.3 The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.

Although in the last four years the biomass of the Pacific chub mackerel has fluctuated around the target level and in the last two years the fishing mortality has been slightly above the target, in most of the years these target levels have been respected (Figure 8). Cubillos and Cuevas (2022) pointed that "In Pacific chub mackerel, frigate tuna and shortfin scad, the models tend to underestimate spawning biomass and overestimate fishing mortality."

The analysis of population variables indicates that the population of Pacific chub mackerel has presented two periods of abundance explained mainly by recruitment. A first period 1975-1995 with five large recruitments high levels of population productivity, positive anomalies and average size of Pacific chub mackerel of 25cm and another, followed by a notable change of scale, with a period of decrease and stability of recruitment from 2000-2022, with a predominance of negative anomalies, average size of 12cm, which is about half of the historical average. Canales and Jurado (2023) believes this change might be due shifts in the productivity regime or a mix effect of this shift in productive regime with intense exploitation and stated that "the increase in recruitments towards the most recent years is uncertain due to the estimation method, which should be verified with the development of the next fishing seasons."

Pacific chub mackerel fishery is one of the most representative of the Ecuador and there is extensive series of data that allow an analysis based on an integrated stock evaluation model. Efforts have been made to improve the stock assessment, with adjustments and help of external peer reviews, proving that the fishery managers are attentive to the issues that affect the data and actively seeking for appropriate actions to solve them. Some of the peer review comments endorsing the stock assessments are provided below:

Cubillos and Cuevas (2022): "Consideration should be given to improving the fit to the CPUE and size structure of the Pacific chub mackerel. Although this influence the historical consistency of the adjustment, it is likely that it will not have an impact on the status that is based on the spawning biomass and fishing mortality of the most recent year recent. However, there is underlying serial correlation in the CPUE data and it does not necessarily include the evaluation model; aspects that need to be investigated".

Canales and Jurado (2023): "the adjustment of the analysis model to the CPUE abundance index seems appropriate and stands out for the decreasing trend that this has had despite the increase in landings in the most recent years (Figure M1), meanwhile, the temporal variability of the acoustic biomass cannot be reproduced by the model. A better goodness of fit of the model is verified in the average sizes of the landings (Figure M2)."

The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status. A.2.3 is met.

A2.4 The assessment is subject to internal or external peer review.

In the latest years, external peer reviews of the small pelagic fishery assessments have been performed. A first stock assessment was performed by an expert panel composed by Canales et al (2019) and reviewed by Minte-Vera (2019), under a consultancy contracted by the Sustainable Fisheries Partnership Foundation - SFP as part of the Sustainable Global Seafood Chains ("*Cadenas Mundiales Sostenibles de Productos del Mar*", in Spanish) project. This project is linked to the small pelagic fishery FIP to be implemented by the National Chamber of Fisheries ("*Cámara Nacional de Pesquerías*", in Spanish) in Ecuador. Besides assessing the status of various small pelagic fish stocks, the consultant and professor Cristian Canales trained researchers and technician of IPIAP in stock assessment methodologies as part of the project. In 2020, a second stock assessment was published by Canales et al (2020) and addressed the uncertainties identified in the previous assessment of Minte-Vera (2019). In 2021, a new assessment was conducted, focusing on a single, isolated stock off Ecuador's coasts and incorporating environmental variables such as sea surface temperature and chlorophyll levels as factors influencing population-level processes (Canales and Jurado 2021). In 2022, as part of the external peer review process, Cubillos and Cueva (2022) conducted a peer review of Canales and Jurado (2022) stock assessments.

Thus, the assessment is subject to internal or external peer review. A.2.4 is met.

A2.5 The assessment is made publicly available.

In IPIAP website it is possible to find stock assessments from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

The assessment is made publicly available. A.2.5 is met.

References

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Minte-Vera, C. 2019. Revisión de las evaluaciones de stocks de las principales especies de pelágicos menores de Ecuador. Cadenas Mundiales Sostenibles - Anexo de Informe Científico No. 1. Honolulu: Sustainable Fisheries Partnership Foundation & Instituto Nacional de Pesca. 38 pp. https://globalmarinecommodities.org/wp-content/uploads/2020/01/INFORME-PELA%CC%81GICO-parte-II-revisio%CC%81n.pdf

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Links

MarinTrust Standard clause	1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	12.3
GSSI	D.5.01, D.6.02, D.3.14

A3	**Harvest Strategy - Minimum Requirements**		
	A3.1	There is a mechanism in place by which total fishing mortality of this species is restricted.	Yes
	A3.2	Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.	Yes
	A3.3	Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).	Yes
		Clause outcome:	Pass

A3.1 There is a mechanism in place by which total fishing mortality of this species is restricted.

The management of multispecies fishery, such as of the small pelagic fishery, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al, 2018). Thus, Ecuador created a strategy based on the management an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly.

Control rules for the fishery was officially established in the fishery management plan (2021-2025) by Ministerial Agreement No. MPCEIP-SRP-2021-0073-A. The Ecuadorian government has implemented a mechanism to restrict the total fishing mortality of fish species in Ecuador and it was explained in FIP (2022). This mechanism is based on the state of exploitation of the indicator species, which is determined by the variation of its Catch per Unit of Effort (CPUE). For establishing the indicator species, a participatory species prioritization process was performed that evaluated the small pelagic fishes based in the criteria of inherent vulnerability of the species, population status and importance of management. The results of this studies are in Figure 9.

Tabla 7. Resultados de priorización participativa de especies de PPP.

Nombre común	Vulnerabilidad	Estado del shock	Importancia de manejo	Ranking
Macarela	4,1	2,5	4,3	3,62
Pinchagua	3,5	2,0	4,2	3,23
Picudillo	3,2	3,3	3,0	3,16
Chuhueco	2,8	3,0	3,4	3,08
Botella	3,3	1,5	4,0	2,94
Sardina redonda	3,3	2,0	1,6	2,31

Figure 9. Results of participatory prioritization of small pelagic fish species. *Nombre común* = common name; *vulnerabilidad*= vulnerability; *estado del stock:* stock status and *importancia de manejo* = importance of management. Source: SRP (2021).

Every two years, the status of the target species must be revised to evaluate the need to modify the indicator species. When the indicator species reaches or is around its target (90% Bmsy), the restrained effort will not be based in it anymore, and the species will be replaced following the ranking established in the prioritization table. Currently, the indicator species is Pacific chub mackerel.

The control of the fishery is carried out by adjusting the period of the closure fishery known as "*vedas de clara*" (can be translated as "clear closures" in English) to achieve the CPUE of the indicator species with respect to the target reference value (CPUEmsy). The estimation of the duration of *vedas de clara* is set by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP.

The CPUE is estimated annually in the regular data analysis process of fishing activities carried out by IPIAP. The mechanism works as follows:

At the beginning of each fishing season, the level of fishing effort (E) must be adjusted for the entire fishery, based on the stock status of the indicator species considering its biological reference points, with the participation of the different stakeholders of the Small Pelagic Fishery Development Program (SPFDP). The fishing effort must be adjusted annually (t) considering the variation of the CPUEmsy of the indicator species (Figure 10):

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

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

Figure 10. Formula of the fishing effort (E) adjusted annually (t). Source: Canales and Jurado (2023).

The rule considers the magnitude of the catches from previous years. This means that the effort reduction is only generated when the average catches of the last two years are greater than the MSY (stabilizer). An extension to the rule considers a buffer in which changes in fishing effort are avoided as long as the ratio between the average catches of the last two years and the MSY (φ) is less than one (Canales and Jurado, 2023) [Figure 11]:

$$\varphi_t = 0.5 \frac{(Y_{t-1} + Y_{t-2})}{RMS}$$

Figure 11. Buffer formula. Source: Canales and Jurado (2023).

The underlying objective is to reduce the effects of overfishing (~Catches>MSY) and that a condition of overexploitation should not necessarily determine the reduction of fishing effort. The conditions are detailed in Figure 12.

Condition	Action
$\rho > 1$ and $\varphi < 1$	Fishing days is increased ρ times
$\rho > 1$ and $\varphi > 1$	Fishing days remains constant
$\rho < 1$ and $\varphi < 1$	Fishing days remains constant
$\rho < 1$ and $\varphi > 1$	Fishing days is decreased ρ times

Figure 12. Adapted translated table taken from Canales and Jurado (2023) Buffer showing buffer conditions for the application of the fishing effort correction in the small pelagic fishing fleet of Ecuador.

According to the analyses of the indicator species, Pacific chub mackerel, performed in the stock assessment this year, IPIAP (2023) pointed that its average CPUE for the years 2021-2022 has been lower to the CPUEmsy reference value (ρ=0.81), the same has happened with landings with respect to the MSY (φ =0.98). According to the 2023 results and the criteria considered, Canales and Jurado (2023) stated that the fishing effort of the pelagic fleet should not be decreased.

Besides *vedas de clara*, MPCEIP-SRP-2020-0056-A established that spatial and temporal fishing closures might be implemented if the catch of juvenile specimens exceeds 40% of the catches daily reported by the Observer Program, in the fishing zones or zones of occurrence of small pelagic fish, or catch volumes that could affect the sustainability of the resource, based on a report of IPIAP. A recruitment closure from 20th May to 06th July through A.M. No. MPCEIP-SRP-2023-0140-A A.M. was set based on reports of IPIAP regarding high catches of juveniles.

In addition, a reproductive closure for small pelagic fishery was implemented from 02nd December to 10th January 2023 through MPCEIP-SRP-2022-0258-A, based in the monitoring of biological indicators (Gonadosomatic Index, monitoring of eggs and larvae), aiming to protecting their reproductive activity.

There is a mechanism in place by which total fishing mortality of this species is restricted. A.3.1 is met.

A3.2 Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.

The analysis of population variables for Pacific chub mackerel reveals two distinct periods of abundance, primarily driven by recruitment. The first period, from 1975 to 1995, saw high levels of population productivity, while the more recent period has been marked by negative anomalies. Large recruitment pulses and positive anomalies were prevalent until the mid-90s, followed by a significant shift in scale, with recruitment levels decreasing by approximately half of the historical average.

However, it's uncertain whether recent increases in recruitment are genuine due to estimation methods, which should be verified in upcoming fishing seasons. In the external peer review performed by Cubillos and Cuevas (2022), they concluded that for Pacific chub mackerel, the comparison of the time series between the estimator and the simulator showed a tendency to underestimate spawning biomass and overestimate fishing mortality.

During the lower productivity period, the spawning biomass has fluctuated around the target reference value (40% of the virgin biomass, equivalent to 300,000 tons), while fishing mortality has only occasionally exceeded the target reference value. The estimated population reduction by 2022 is close to the management target, around 36% of the virgin biomass,

corresponding to 91% of the management objective.

Although currently the biomass is slight below the target reference level and fishing mortality is above the target fishery level; biomass is above the limit reference level, and historically the biomass has not been below the target reference and fishing mortality did not regularly exceed the target management level (Figure 13).

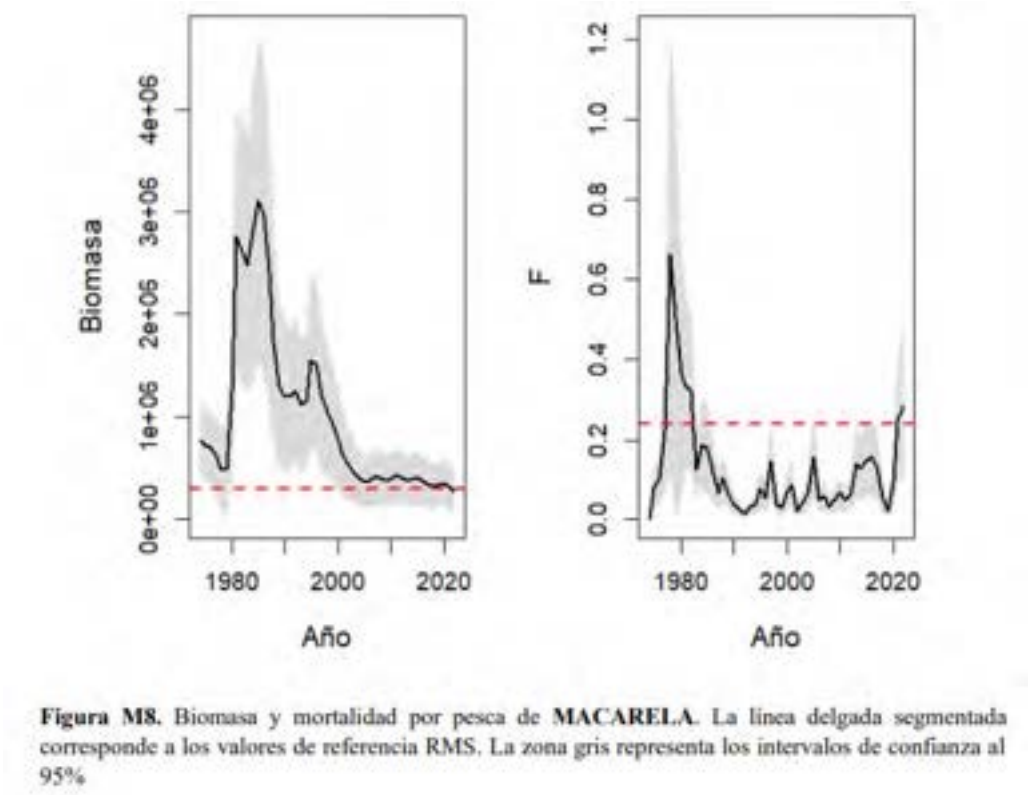

Figura M8. Biomasa y mortalidad por pesca de **MACARELA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 13. Biomass and fishing mortality of Pacific chub mackerel. Segmented thin line MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. A.3.2 is met.

A3.3 Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).

The management of multispecies fishery, such as of the small pelagic fisher, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al., 2018). Thus, Ecuador created a strategy based on the management of an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly of the small pelagic fishery.

The management strategies of this fishery are described in the National Action Plan and Management of the Small Pelagic Fishery of Ecuador (SRP, 2021). The *vedas de clara* established for the small pelagic fishery consists in the prohibition of the capture of small pelagic fish using purse seine nets during the full moon period, according to the lunar phases calendar issued by the Oceanographic Institute of the Navy – INOCAR ("*Instituto Oceanográfico de la Armada*", in Spanish). The objective labelled as BP-1.1 in SRP (2021) consists in achieving a yield in line with the target reference point of MSY (40% of B0) for the main small pelagic species by 2025 and the measure attributed for this objective maintain or extend the *veda de clara* based on the status of the indicator species. To implement this measure effectively, a control rule is established to adjust fishing

effort, measured in total fishing days for the season, according to the condition of small pelagic populations. This adjustment involves modifying the duration of the existing *veda de clara* to attain the catch per unit of effort relative to the reference point (CPUEmsy and landings with respect to MSY) of the indicator species. The duration of the closure will be determined by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP. At the start of each fishing season, the level of effort for the entire fishery is adjusted based on the condition of the indicator species, considering its biological reference points. In addition, SRP (2021) determines that the total number of active vessels in the National Registry of Industrial Fishing Vessels will not be changed unless scientific reports of IPIAP demonstrate that the fishery stock support an increase of new vessels.

Besides *vedas de clara*, there are other control on fishing removals, such as reproduction closures (based on biological indicator such as Gonadosomatic Index, monitoring of eggs and larvae) and recruitment closures (based on catches of juveniles), which consider data of several species of the small pelagic fishery.

Thus, commercial fishery removals are not prohibited when a specific species of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on target reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery. The commercial fishery removal is prohibited when the indicator species is estimated to be below the target reference value, which is more conservative than the limit reference point. This clause was adapted in this case, considering the characteristic of the fishery and its management, which does not focus on a single species, but in the group of small pelagic fishery.

Commercial fishery removals are prohibited when the indicator species of the fishery has been estimated to be below the limit reference point or proxy. A.3.3 is met.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

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Standard clause 1.3.2.1.3

Links	
MarinTrust Standard clause	1.3.2.1.3, 1.3.2.1.4
FAO CCRF	7.2.1, 7.22 (e), 7.5.3

GSSI	D3.04, D6.01

A4	Stock Status - Minimum Requirements		
	A4.1	The stock is at or above the target reference point, OR IF NOT: The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT: The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.	Yes
		Clause outcome:	Pass

A4.1 The stock is at or above the target reference point, OR IF NOT:

The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT:

The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.

The spawning biomass of Pacific chub mackerel is slightly lower than the target reference point (B/Bmsy < 91%) and higher than the limit reference point (Blim= 50%Bmsy). The fishing mortality is 17% higher than the target reference point (Figure 14).

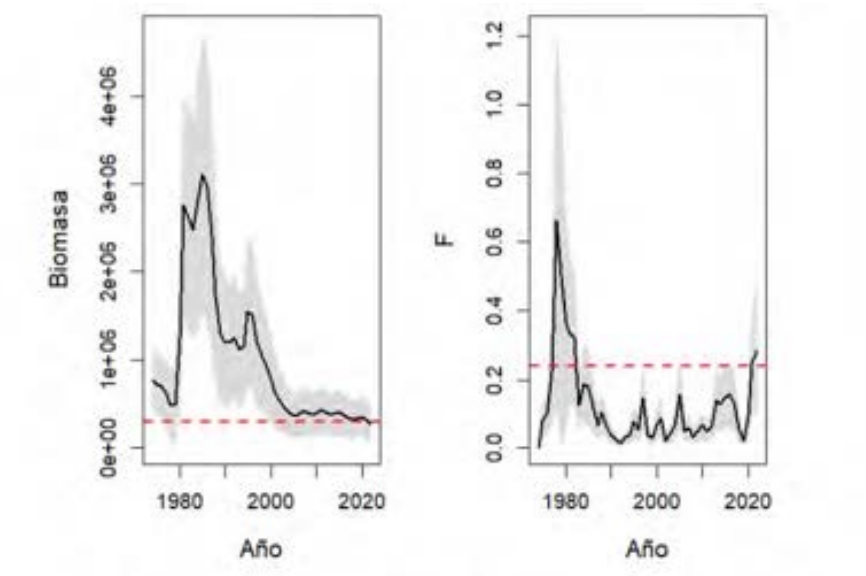

Figura M8. Biomasa y mortalidad por pesca de **MACARELA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 14. Biomass and fishing mortality of Pacific chub mackerel. Segmented thin line MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

It is estimated that the risk of overexploitation by 2022 is 59% and overfishing is 66% (Figure 15).

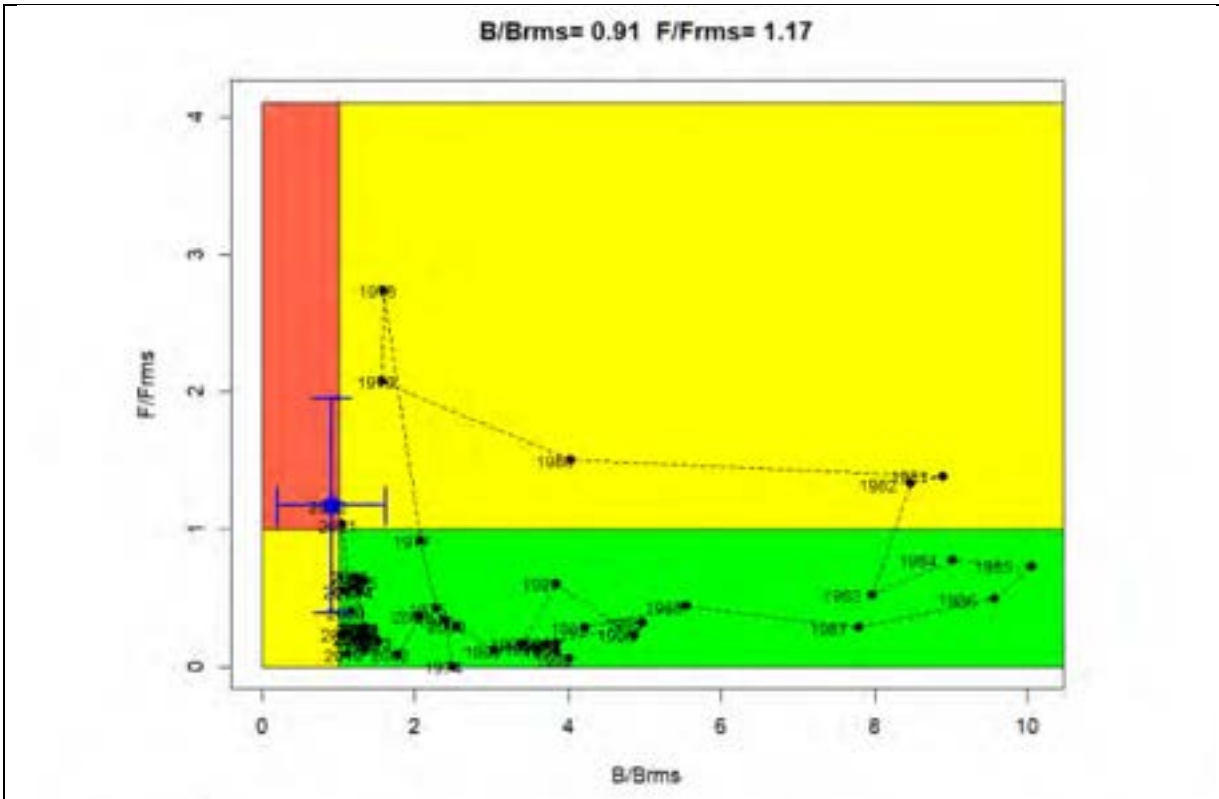

Figura M11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **MACARELA**.

Figure 15. Kobe diagram. The blue circle and error bars represent the current condition of Pacific chub mackerel (Canales and Jurado, 2023).

Pacific chub mackerel is the indicator species of the small pelagic fishery. There is a mechanism in place to determine fishery closure based on target reference values of this species, which is associated to MSY, a proxy that it is more conservative than the limit reference point.

The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure. A4.1 is met.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

Links	
MarinTrust Standard clause	**1.3.2.1.4**
FAO CCRF	**7.2.1, 7.2.2 (e)**
GSSI	**D6 01**

Species Name	***Auxis* spp - Frigate tuna ("*Botella*" or "*Melva*", in Spanish)**
A1	**Data Collection - Minimum Requirements**

	A1.1	Landings data are collected such that the fishery-wide removals of this species are known.	Yes
	A1.2	Sufficient additional information is collected to enable an indication of stock status to be estimated.	Yes
		Clause outcome:	Pass

A1.1 Landings data are collected such that the fishery-wide removals of this species are known.

Landings data from 1981 and onwards are available in IPIAP website and have been used for stock assessments of small pelagics fishes: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

A complied graph of the landings from 1975-2022 is provided in Figure 16. For building this graph, different sources were used. For the 1980s, data were obtained from the validation and recalculation of catch data reported by Fuentes (1989), Patterson et al. (1990), and Patterson and Santos (1990). For the 1990s to 2022, data were obtained from the factory landing database, which is generated from daily fishing reports from processing companies, as well as from the monthly field sampling database. Additionally, from 2016 and onwards, data from the fishing database of the herring purse seine fleet observer program were incorporated.

Landings of frigate tuna reached their maximum during 2006-2018 and it is closed related to recruitment fluctuations in this period (Canales and Jurado, 2023).

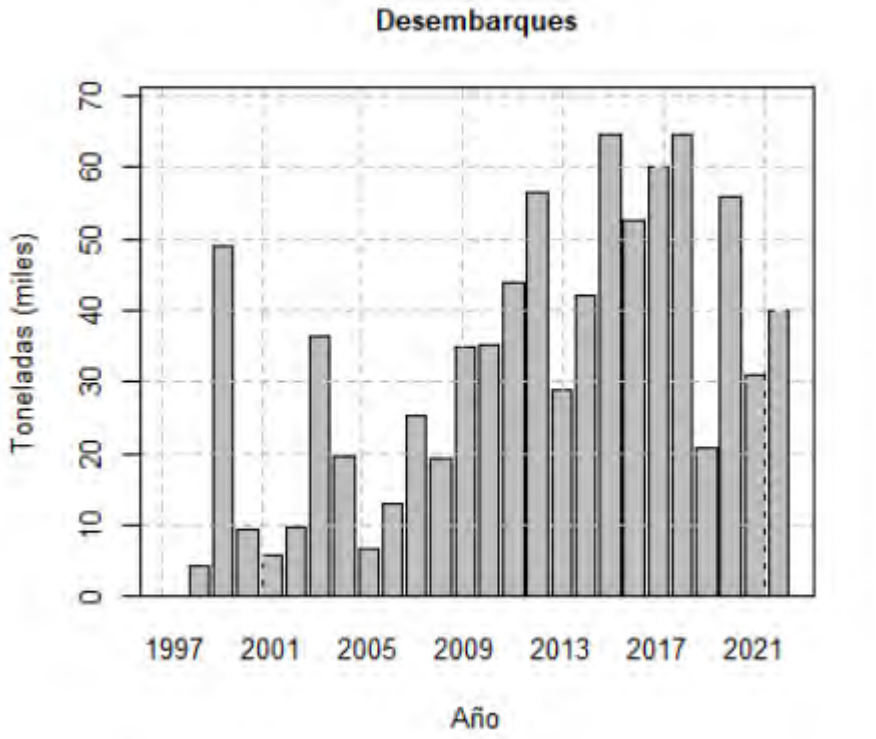

Figure 16. Landings from 1975-2022 of frigate tuna (Canales and Jurado, 2023).

The latest data of catches available in IPIAP website covers 2015-2022 (Figure 17). In 2022, 40,133.10 tons of were landed (IPIAP, 2023).

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS
(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.717,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	17.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 17. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

Landings data are collected such that the fishery-wide removals of this species are known. A.1.1 is met.

A1.2 Sufficient additional information is collected to enable an indication of stock status to be estimated.

Information is generated by the Fisheries Observer Program, which is administered by the SRP. The Program delivers data to IPIAP for analysis and the information collected allows the development of several analyses, such as stock assessment, Endangered, Threatened or Protected – ETP species interaction evaluation and habitat interactions.

The Ecuadorian government has established a mandatory program of on-board fisheries observers for vessels with purse seines that catch small pelagic fish through the Ministerial Agreement Nº MPCEIP-SRP-2020-0056-A. The program, which is administered by SRP, randomly covers 30% of the fleet.

According to FIP (2021): "The Undersecretariat of Fisheries Resources carries out permanent tasks related to the monitoring and control of the small pelagic fishery. Although this monitoring is carried out for the purpose of control, the information collected serves as support for the execution of the investigation, since it constitutes a daily information survey of the landings made by the fishery".

In addition to the monitoring and control activities, the Ecuadorian government also conducts two Hydroacoustic Evaluation Cruises per year, one in winter and one in summer. These cruises are designed to estimate the abundance, biomass and distribution of the main small pelagic species off the Ecuadorian coast. The cruises also collect data on phytoplankton, zooplankton and ichthyoplankton, as well as oceanographic parameters and relates this information to the availability of the fishing stocks.

In this sense, there are significant data and information of the Ecuadorian small pelagic fishery, and in order to provide stock assessments, a series of data is analysed: biological samplings, size compositions, abundance indices, landings, acoustic cruises and biological parameters. The analyses are performed based on estimation models and their results are discussed regarding different hypotheses and biological reference points.

Sufficient additional information is collected to enable an indication of stock status to be estimated. A1.2 is met.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

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Links

MarinTrust Standard clause	1.3.2.1.1, 1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	7.3.1, 12.3
GSSI	D.4.01, D.5.01, D.6.02, D.3.14

A2	**Stock Assessment - Minimum Requirements**		
	A2.1	A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock) and considers all fishery removals and the biological characteristics of the species.	Yes
	A2.2	The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.	Yes
	A2.3	The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.	Yes
	A2.4	The assessment is subject to internal or external peer review.	Yes
	A2.5	The assessment is made publicly available.	Yes
		Clause outcome:	Pass

A2.1 A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock) and considers all fishery removals and the biological characteristics of the species.

IPIAP has performed annual stock assessments. In its website it is possible to find them from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

The stock assessment compiles a series of biological sample data, fish sizes on the catches, abundance indices, landings, data from acoustic surveys, and biological parameters. The analyses are carried out based on estimation models and their results are discussed based on different hypotheses and biological points of reference.

A stock assessment is conducted at least once every 3 years and considers all fishery removals and the biological characteristics of the species. A.2.1 is met.

A2.2 The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.

For the small pelagic fishery in Ecuador, biomass and fishing mortality are evaluated in relation to specific biological reference points (Figure 18). The target reference point for this fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy=40%B0] and its respective fishing mortality (Fmsy=40%F). The limit reference point for this fishery is 50% of the target reference point (Flim=50%Fmsy and Blim= 50%Bmsy), which is

equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=20%F) [Canales and Jurado, 2023]. Therefore, in summary:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022, luego de la implementación de mejoras en los modelos de evaluación. Tomados a partir de los resultados de la última evaluación poblacional (Canales & Jurado, 2023).

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.78	1.10	2.02	1.74	0.90	1.06	1.27
	F/F_{RMS}	2.86	0.55	0.43	0.51	1.24	0.67	1.04
2019	B/B_{RMS}	0.63	1.12	1.80	1.29	1.32	1.15	1.22
	F/F_{RMS}	1.32	0.09	0.06	0.18	0.19	0.32	0.36
2020	B/B_{RMS}	0.52	1.16	1.89	1.35	1.42	1.17	1.25
	F/F_{RMS}	3.38	0.40	0.09	0.12	0.06	0.14	0.70
2021	B/B_{rms}	0.49	1.05	1.37	1.10	1.73	1.25	1.17
	F/F_{RMS}	2.14	1.03	0.22	0.32	0.27	0.17	0.69
2022	B/B_{RMS}	0.34	0.91	1.14	1.27	1.90	1.31	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.31	0.44	0.46	1.08

Figure 18. Comparative table of diagnostic indicators of small pelagic stocks in Ecuador 2017-2022 sent by email on 24th October 2023, after the implementation of improvements in the assessment of Canales and Jurado (2023).

According to Canales and Jurado (2023): "The stock assessment of Frigate Tuna *Auxis* spp. shows that the increase in catches in the fishery has been closely linked to fluctuations in recruitment (2-year-old individuals of age), whose positive anomalies dominated between 2006 and 2018. This increase in captures generated a similar increase in fishing mortality, which exceeded the value of reference from 2009 and reaches its peak in 2022, exceeding by more than three times the target fishing mortality value (F40%). The analyses showed that the spawning biomass would have decreased to a level close to 12 thousand tons, and equivalent to 14% of the virgin biomass B0." [Figure 19].

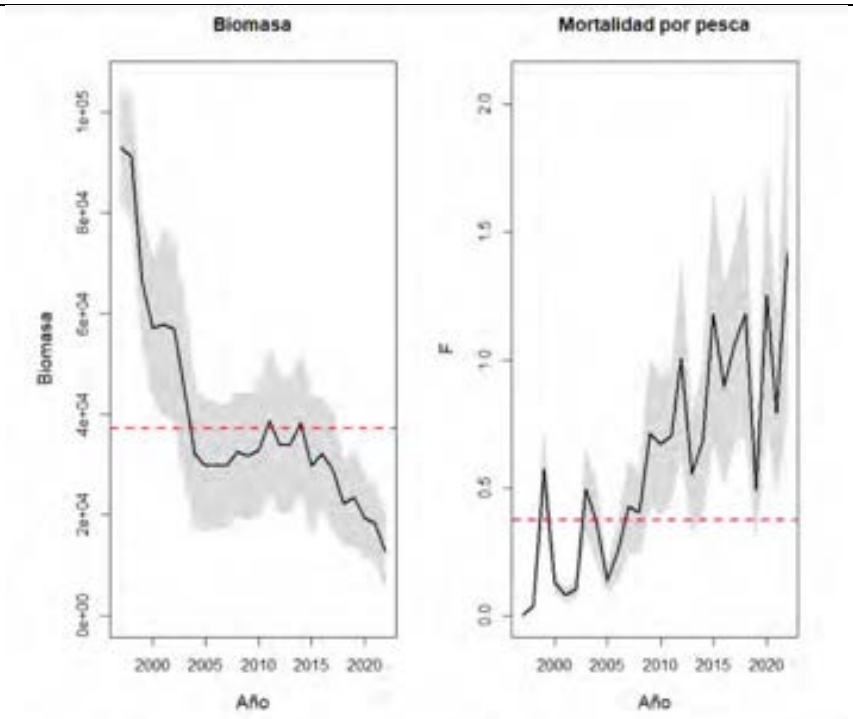

Figura B8. Biomasa y mortalidad por pesca de **BOTELLA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 19. Biomass and fishing mortality of frigate tuna. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy. A.2.2 is met.

A2.3 The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.

For the management of this multispecies fisheries, studies have been done and a model was developed simulating the dynamic of the six most (Pacific chub mackerel, frigate tuna, shortfin scad, Pacific anchoveta/bocona sardine, round herring and Pacific thread herring) important species under the assumption that the total fishing effort can be regulated based on monitoring the fishing performance of a few relevant specie. The results showed that controlling fishing effort of chosen indicator species would allow the recovery of the assemblage of small pelagic fish species. The conclusion of this study was that management based on CPUE variations was feasible, and that with moderate control and stability of the fishing effort, a sustainable and stable fishery could be achieved, even though not all species reach the biomass at maximum sustainable yield. The summary of this study was sent by the client on 24th October 2023 and it was part of the final report of the "Sustainable Global Seafood Supply Chains project."

The stock assessments of the species were considered appropriated for Canales and Jurados (2023): "The evaluation model applied to the frigate tuna fishery data shows that despite the variability of the information (observation error), the trend of the abundance indicators and data used is generally reproduced by the model." And the external review also approved: "In frigate tuna, Pacific anchovy and shortfin scad, from the point of view of the variables for diagnosis, the bias is moderate and acceptable. However, for these resources, important biases are detected in the time series, with a tendency towards underestimation of biomass and overestimation of fishing mortality over time.(…) In frigate tuna case, the estimator underestimates the spawning biomass and overestimates the fishing mortality (Fig. 22), although the differences seem not so important from the visual point of view given the overlap of SSB2021 and the not exploited spawning biomass (Fig. 23).

However, the relative error time series shows that the bias at the underestimation tends to be close to a median value of -25% in spawning biomass and a median overestimation close to +35% in fishing mortality (Fig. 24). It is also observed that the recruitment estimates do not present important biases in average" (Cubillos and Cueva, 2022).

Thus, several studies have been done for improving the stock assessment of the small pelagic fish from Ecuador and a specific study was performed for identifying the most appropriate way to deal with management decisions considering the multispecies aspect of this fishery. Adjustments to the stock assessment models have been performed with the help of external peer reviews, proving that the fishery managers are attentive to the issues that affect the data and committed to solve them. Therefore, the indication of the fishery removals for this fishery were based in scientific decisions with external validation.

The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status. A.2.3 is met.

A2.4 The assessment is subject to internal or external peer review.

In the latest years, external peer reviews of the small pelagic fishery assessments have been performed. A first stock assessment was performed by an expert panel composed by Canales et al (2019) and reviewed by Minte-Vera (2019), under a consultancy contracted by the Sustainable Fisheries Partnership Foundation – SFP as part of the Sustainable Global Seafood Chains ("*Cadenas Mundiales Sostenibles de Productos del Mar*", in Spanish) project. This project is linked to the small pelagic fishery FIP to be implemented by the National Chamber of Fisheries ("*Cámara Nacional de Pesquerías*", in Spanish) in Ecuador. Besides assessing the status of various small pelagic fish stocks, the consultant and professor Cristian Canales trained researchers and technician of IPIAP in stock assessment methodologies as part of the project. In 2020, a second stock assessment was published by Canales et al (2020) and addressed the uncertainties identified in the previous assessment of Minte-Vera (2019). In 2021, a new assessment was conducted, focusing on a single, isolated stock off Ecuador's coasts and incorporating environmental variables such as sea surface temperature and chlorophyll levels as factors influencing population-level processes (Canales and Jurado, 2021). In 2022, as part of the external peer review process, Cubillos and Cueva (2022) conducted a peer review of Canales and Jurado (2022) stock assessments.

Thus, the assessment is subject to internal or external peer review. A.2.4 is met.

A2.5 The assessment is made publicly available.

In IPIAP website it is possible to find stock assessments from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

The assessment is made publicly available. A.2.5 is met.

References

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Links

MarinTrust Standard clause	1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	12.3
GSSI	D.5.01, D.6.02, D.3.14

A3	**Harvest Strategy – Minimum Requirements**		
	A3.1	There is a mechanism in place by which total fishing mortality of this species is restricted.	Yes
	A3.2	Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.	No
	A3.3	Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).	Yes
		Clause outcome:	Fail

A3.1 There is a mechanism in place by which total fishing mortality of this species is restricted.

The management of multispecies fishery, such as of the small pelagic fisher, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al., 2018). Thus, Ecuador created a strategy based on the management an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly.

Control rules for the fishery was officially established in the fishery management plan (2021-2025) by Ministerial Agreement No. MPCEIP-SRP-2021-0073-A. The Ecuadorian government has implemented a mechanism to restrict the total fishing mortality of fish species in Ecuador and it was explained in FIP (2022). This mechanism is based on the state of exploitation of the indicator species, which is determined by the variation of its Catch per Unit of Effort (CPUE).

For establishing the indicator species, a participatory species prioritization process was performed that evaluated the small pelagic fishes based in the criteria of inherent vulnerability of the species, population status and importance of management. The results of this studies are in Figure 20.

Tabla 7. Resultados de priorización participativa de especies de PPP.

Nombre común	Vulnerabilidad	Estado del shock	Importancia de manejo	Ranking
Macarela	4,1	2,5	4,3	3,62
Pinchagua	3,5	2,0	4,2	3,23
Picudillo	3,2	3,3	3,0	3,16
Chuhueco	2,8	3,0	3,4	3,08
Botella	3,3	1,5	4,0	2,94
Sardina redonda	3,3	2,0	1,6	2,31

Figure 20. Results of participatory prioritization of small pelagic fish species. *Nombre común* = common name; *vulnerabilidad*= vulnerability; *estado del stock:* stock status and *importancia de manejo* = importance of management. Source: SRP (2021).

Every two years, the status of the target species must be revised to evaluate the need to modify the indicator species. When the indicator species reaches or is around its target (90% Bmsy), the restrained effort it will not be based in it anymore, and the species will be replace following the ranking established in the prioritization table. Currently, the indicator species is Pacific chub mackerel.

The control of the fishery is carried out by adjusting the period of the closure fishery known as "*vedas de clara*" (can be translated as "clear closures" in English) to achieve the CPUE of the indicator species with respect to the target reference value (CPUEmsy). The estimation of the duration of *vedas de clara* is set by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP.

The CPUE is estimated annually in the regular data analysis process of fishing activities carried out by IPIAP. The mechanism works as follows:

At the beginning of each fishing season, the level of fishing effort (E) must be adjusted for the entire fishery, based on the stock status of the indicator species considering its biological reference points, with the participation of the different stakeholders of the Small Pelagic Fishery Development Program (SPFDP). The fishing effort must be adjusted annually (t) considering the variation of the CPUEmsy of the indicator species (Figure 21):

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

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

Figure 21. Formula of the fishing effort (E) adjusted annually (t). Source: Canales and Jurado (2023).

The rule considers the magnitude of the catches from previous years. This means that the effort reduction is only generated when the average catches of the last two years are greater than the MSY (stabilizer). An extension to the rule considers a buffer in which changes in fishing effort are avoided as long as the ratio between the average catches of the last two years and the MSY (φ) is less than one (Canales and Jurado, 2023) [Figure 22]:

$$\varphi_t = 0.5\frac{(Y_{t-1} + Y_{t-2})}{RMS}$$

Figure 22. Buffer formula. Source: Canales and Jurado (2023).

The underlying objective is to reduce the effects of overfishing (~Catches>MSY) and that a condition of overexploitation should not necessarily determine the reduction of fishing effort. The conditions are detailed in Figure 23.

Condition	Action
ρ > 1 and φ < 1	Fishing days is increased ρ times
ρ > 1 and φ > 1	Fishing days remains constant
ρ <1 and φ < 1	Fishing days remains constant
ρ <1 and φ >1	Fishing days is decreased ρ times

Figure 23. Adapted English table taken from Canales and Jurado (2023) Buffer showing buffer conditions for the application of the fishing effort correction in the small pelagic fishing fleet of Ecuador.

According to the analyses of the indicator species, Pacific chub mackerel, performed in the stock assessment this year, Canales and Jurado (2023) pointed that its average CPUE for the years 2021-2022 has been lower to the CPUEmsy reference value (ρ=0.81), the same has happened with landings with respect to the MSY (φ =0.98). According to the 2023 results and the criteria considered, Canales and Jurado (2023) stated that the fishing effort of the pelagic fleet should not be decreased.

Besides *vedas de clara*, MPCEIP-SRP-2020-0056-A established that spatial and temporal fishing closures might be implemented if the catch of juvenile specimens exceeds 40% of the catches daily reported by the Observer Program, in the fishing zones or zones of occurrence of small pelagic fish, or catch volumes that could affect the sustainability of the resource, based on a report of IPIAP. A recruitment closure from 20th May to 06th July through A.M. No. MPCEIP-SRP-2023-0140-A A.M. was set based on reports of IPIAP regarding high catches of juveniles.
In addition, a reproductive closure for small pelagic fishery was implemented from 02nd December to 10th January 2023 through MPCEIP-SRP-2022-0258-A, based in the monitoring of biological indicators (Gonadosomatic Index, monitoring of eggs and larvae), aiming to protecting their reproductive activity.

Thus, commercial fishery removals are not prohibited when a specific specie of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery. This clause should be adapted in this case, considering the characteristic of the fishery and its management, which does not focus on a single species, but in the group of small pelagic fishery. Even though the results for the indicator species, which is based on target reference values, this year recommended that the fishing effort of the pelagic fleet should not be decreased, fishing closures were established, demonstrating that the mechanisms of commercial fishery removals are being implemented for all small pelagic fishery.

There is a mechanism in place by which total fishing mortality of this species is restricted. A.3.1 is met.

A3.2 Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.

The history of fishery removals for the frigate tuna stock shows a strong connection to recruitment fluctuations, particularly in the number of 2-year-old individuals. Positive anomalies in recruitment dominated from 2006 to 2018, leading to increased catches. This increase in catches resulted in a parallel rise in fishing mortality, surpassing the reference value starting in 2009 and reaching its peak in 2022, exceeding the target reference fishing mortality by more than three times (Figure 24). The biomass of frigate tuna decreased steadily until 2017, reaching its lowest value close to 8,700 tons and below the target reference level.

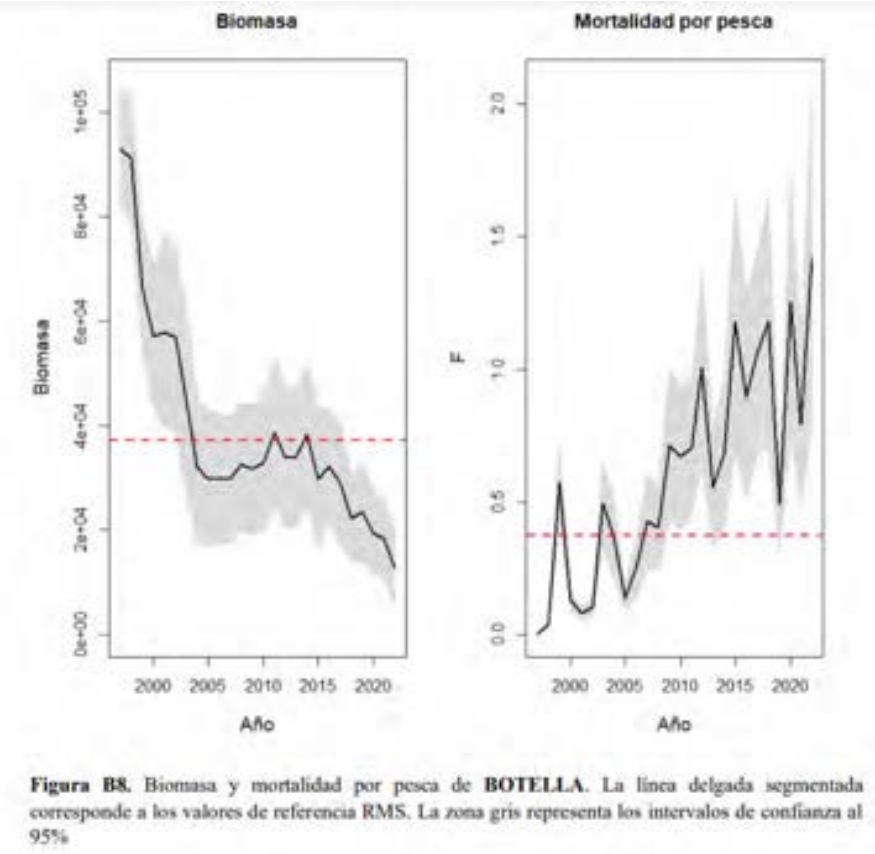

Figura B8. Biomasa y mortalidad por pesca de **BOTELLA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 24. Biomass and fishing mortality of frigate tuna. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

Analyses suggest that the spawning biomass of frigate tuna had decreased to around 12,000 tons by 2022, equivalent to just 14% of its virgin biomass (B0), being below the limit reference level. According to the Kobe diagram, this population shows clear evidence of both overfishing (F>Fmsy) and overexploitation (B/Bmsy<0.4), with a 100% estimated probability of both (Figure 25).

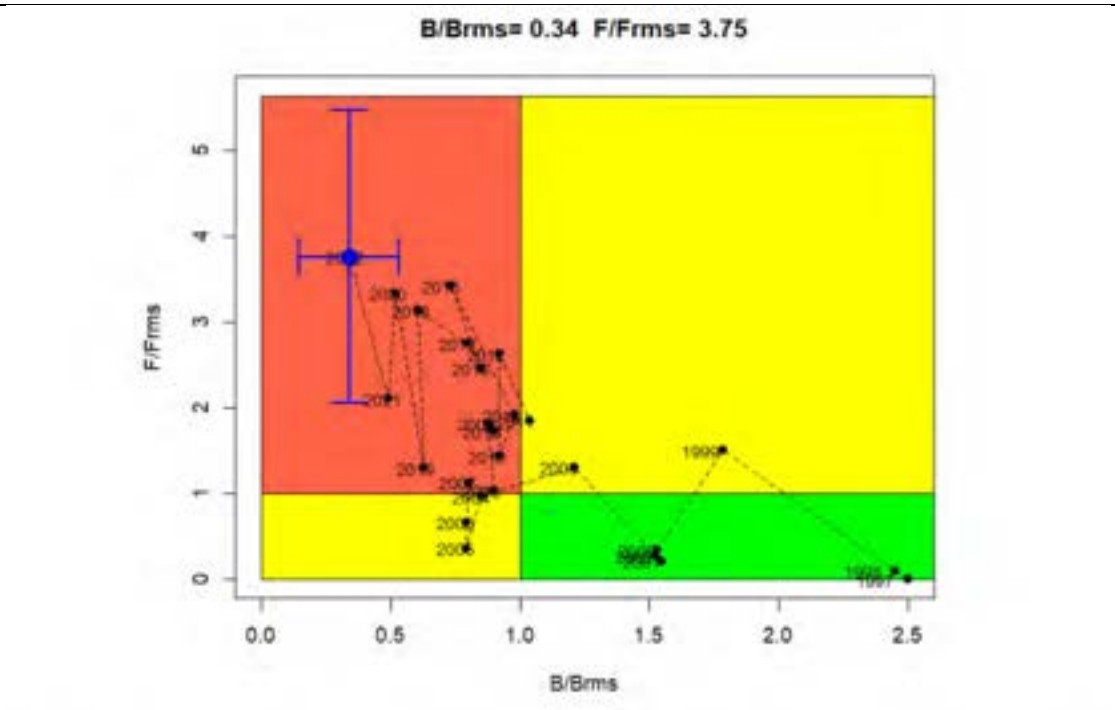

Figura B11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **BOTELLA**.

Figure 25. Kobe diagram. The blue circle and error bars represent the current condition of Pacific frigate tuna (Canales and Jurado, 2023).

It's noteworthy that, compared to information provided in the 2021 stock assessment (Figure 26), the current conditions of frigate tuna are more pessimist. There was a decline in the virgin biomass (B0) from 2021 (49%) to 2022 (34%). The significant decline in the frigate tuna population in 2022 was attributed to a combination of factors: a 33% increase in landings, a decrease in the estimated biomass value from the 2022 cruise, and the revaluation of the CPUE abundance index using higher-quality data. This confirmed a declining stock trend not previously recognized.

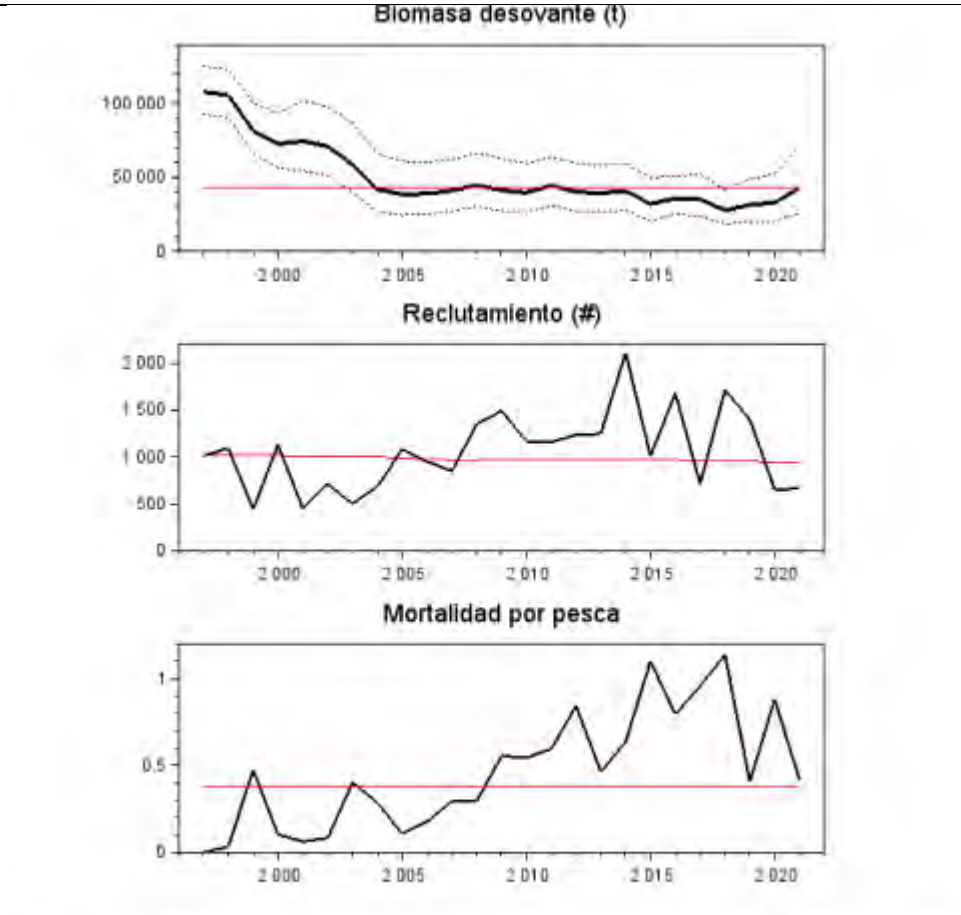

Figura B5. Biomasa desovante, reclutamientos y mortalidad por pesca de **BOTELLA**. Las líneas rojas representan valores de referencia (objetivos de manejo para BD y F) y reclutamiento esperado. La línea delgada segmentada corresponde a los intervalos de confianza al 95%.

Figure 26. Spawning biomass, recruitment and fishing mortality from frigate tuna fishing provided in 2021 stock assessment (Canales and Jurado, 2022). The red lines represent target reference values for spawning biomass and fishing mortality and expected recruitment. The thin segmented line corresponds to the 95% confidence intervals.

Therefore, total fishery removals of this species regularly exceed the level indicated or stated in the stock assessment. It fails A.3.2. Thus, the species will be classified and assessed under Category B.

A3.3 Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).

The management of multispecies fishery, such as of the small pelagic fisher, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al., 2018). Thus, Ecuador created a strategy based on the management of an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly of the small pelagic fishery.

The management strategies of this fishery are described in the National Action Plan and Management of the Small Pelagic Fishery of Ecuador (SRP, 2021). The *vedas de clara* established for the small pelagic fishery consists in the prohibition of the capture of small pelagic fish using purse seine nets during the full moon period, according to the lunar phases calendar issued by the Oceanographic Institute of the Navy – INOCAR ("*Instituto Oceanográfico de la Armada*", in Spanish). The objective

labelled as BP-1.1 in SRP (2021) consists in achieving a yield in line with the target reference point of MSY (40% of B0) for the main small pelagic species by 2025 and the measure attributed for this objective maintain or extend the *veda de clara* based on the status of the indicator species. To implement this measure effectively, a control rule is established to adjust fishing effort, measured in total fishing days for the season, according to the condition of small pelagic populations. This adjustment involves modifying the duration of the existing *veda de clara* to attain the catch per unit of effort relative to the reference point (CPUEmsy and landings with respect to MSY) of the indicator species. The duration of the closure will be determined by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP. At the start of each fishing season, the level of effort for the entire fishery is adjusted based on the condition of the indicator species, considering its biological reference points. In addition, SRP (2021) determines that the total number of active vessels in the National Registry of Industrial Fishing Vessels will not be changed unless scientific reports of IPIAP demonstrate that the fishery stock support an increase of new vessels.

Besides *vedas de clara*, there are other control on fishing removals, such as reproduction closures (based on biological indicator such as Gonadosomatic Index, monitoring of eggs and larvae) and recruitment closures (based on catches of juveniles), which consider data of several species of the small pelagic fishery.

Thus, commercial fishery removals are not prohibited when a specific specie of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on target reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery. The commercial fishery removal is prohibited when the indicator species is estimated to be below the target reference value, which is more conservative than the limit reference point. This clause was adapted in this case, considering the characteristic of the fishery and its management, which does not focus on a single species, but in the group of small pelagic fishery.

Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy. A.3.3 is met.

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Manta-Manabí-Ecuador. 54 pp. https://globalmarinecommodities.org/wp-content/uploads/2021/04/Plan-de-Accio%CC%81n-y-Manejo-Pela%CC%81gicos-Pequen%CC%83os-Ecuador_2021.pdf
Standard clause 1.3.2.1.3

Links	
MarinTrust Standard clause	1.3.2.1.3, 1.3.2.1.4
FAO CCRF	7.2.1, 7.22 (e), 7.5.3
GSSI	D3.04, D6.01

A4	**Stock Status - Minimum Requirements**		
	A4.1	The stock is at or above the target reference point, OR IF NOT: The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT: The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.	No
		Clause outcome:	Fail

A4.1 The stock is at or above the target reference point, OR IF NOT:
The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT:
The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.

The biomass of frigate tuna is below the target reference point and the fishing mortality is above the target reference point (Figure 27). According to Canales and Jurado (2023), the biomass spawning of frigate tuna would have decreased to a level close to 12,000 tons by 2022, which is equivalent to 14% of B0, being below the limit reference point (Blim = 0,20 B0).

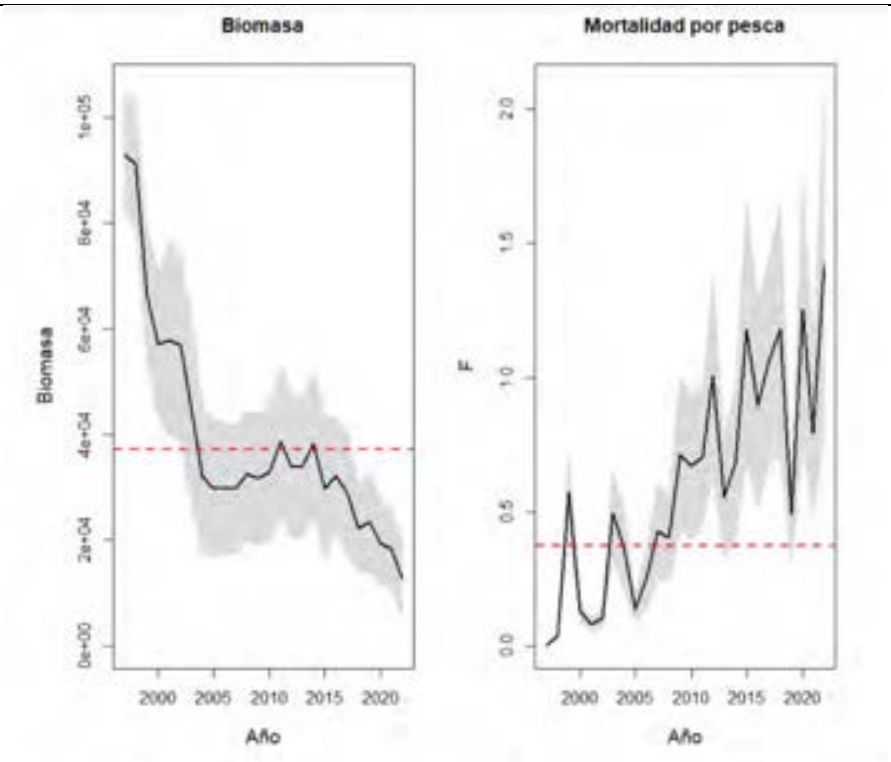

Figura B8. Biomasa y mortalidad por pesca de **BOTELLA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 27. Biomass and fishing mortality of frigate tuna. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

The population of frigate tuna shows evidence of overfishing and overexploitation. The risk of overexploitation and overfishing by 2022 is estimated to be close to 100% (Figure 28).

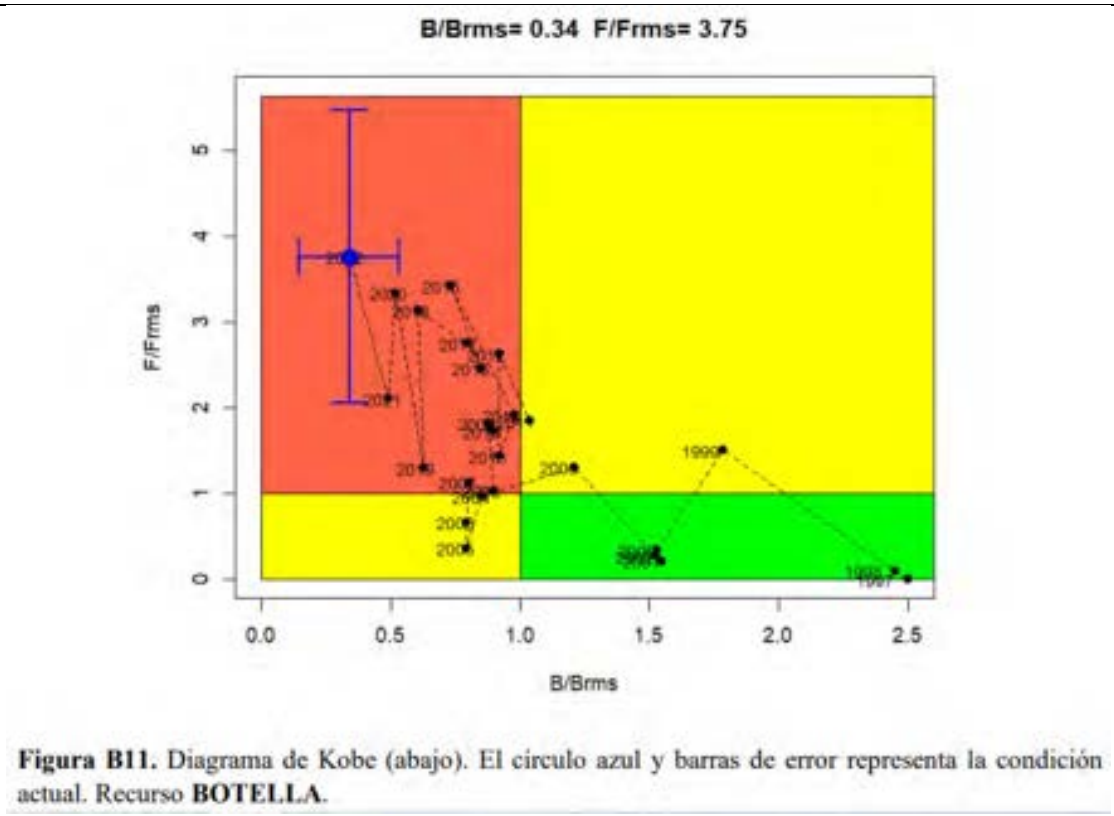

Figura B11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **BOTELLA**.

Figure 28. Kobe diagram. The blue circle and error bars represent the current condition of Pacific frigate tuna (Canales and Jurado, 2023).

Although fishery closures were established this year for specific period of times, currently, fishery removals of the Pacific frigate tuna are not prohibited neither of small pelagic fishery, as it is not the indicator species. The decision for closing the fishery based on indication species is based on well-supported research an given the multispecies trait of this fishery is not possible to make a distinguish of the species during the catch. However, even if it is accepted this reason for not closing this fishery, at least the target fishing mortality should be respected. The poor status condition of this species and the historical of fishing mortality higher than the target for years cannot be ignored for passing this clause.

The stock is estimated to be below the limit reference point or proxy, and fishery removals are not prohibited. It fails A.4.1. Thus, the species will be classified and assessed under Category B.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

Links	
MarinTrust Standard clause	**1.3.2.1.4**
FAO CCRF	**7.2.1, 7.2.2 (e)**
GSSI	**D6 01**

Species Name	***Decapterus macrosoma* - Shortfin scad ("*Picudillo*" in Spanish)**
A1	**Data Collection - Minimum Requirements**

	A1.1	Landings data are collected such that the fishery-wide removals of this species are known.	Yes
	A1.2	Sufficient additional information is collected to enable an indication of stock status to be estimated.	Yes
		Clause outcome:	Pass

A1.1 Landings data are collected such that the fishery-wide removals of this species are known.

Landings data from 1981 and onwards are available in IPIAP website and have been used for stock assessments of small pelagics fishes: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

A complied graph of the landings from 1975-2022 is provided in Figure 29. For building this graph, different sources were used. For the 1980s, data were obtained from the validation and recalculation of catch data reported by Fuentes (1989), Patterson et al. (1990), and Patterson and Santos (1990). For the 1990s to 2022, data were obtained from the factory landing database, which is generated from daily fishing reports from processing companies, as well as from the monthly field sampling database. Additionally, from 2016 and onwards, data from the fishing database of the herring purse seine fleet observer program were incorporated.

The shortfin scad fishery has presented great variability along the history, with two maximum moments in its landings since its beginnings in the 2000s. A record of 70,000 tons was reached in 2016, followed by a decrease in productivity in 2017.

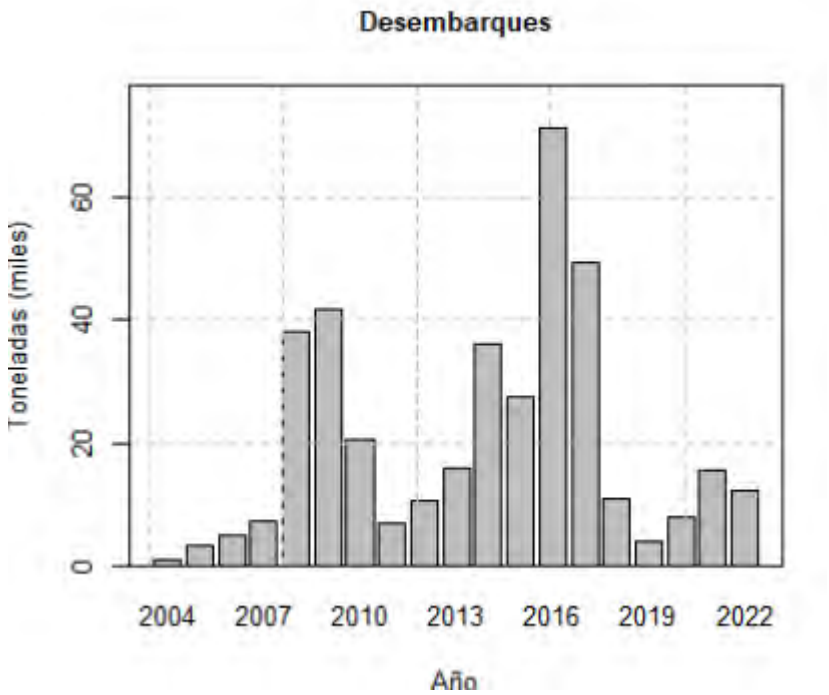

Figure 29. Landings from 1975-2022 of shortfin scad (Canales and Jurado, 2023).

The latest data of catches available in IPIAP website covers 2015-2022 (Figure 30). In 2022, 12,348.40 tons of were landed (IPIAP, 2023).

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS
(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.717,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	37.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 30. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

Landings data are collected such that the fishery-wide removals of this species are known. A.1.1 is met.

A1.2 Sufficient additional information is collected to enable an indication of stock status to be estimated.

Information is generated by the Fisheries Observer Program, which is administered by the SRP. The Program delivers data to IPIAP for analysis and the information collected allows the development of several analyses, such as stock assessment, Endangered, Threatened or Protected – ETP species interaction evaluation and habitat interactions.

The Ecuadorian government has established a mandatory program of on-board fisheries observers for vessels with purse seines that catch small pelagic fish through the Ministerial Agreement Nº MPCEIP-SRP-2020-0056-A. The program, which is administered by SRP, randomly covers 30% of the fleet.

According to FIP (2021): "The Undersecretariat of Fisheries Resources carries out permanent tasks related to the monitoring and control of the small pelagic fishery. Although this monitoring is carried out for the purpose of control, the information collected serves as support for the execution of the investigation, since it constitutes a daily information survey of the landings made by the fishery".

In addition to the monitoring and control activities, the Ecuadorian government also conducts two Hydroacoustic Evaluation Cruises per year, one in winter and one in summer. These cruises are designed to estimate the abundance, biomass and distribution of the main small pelagic species off the Ecuadorian coast. The cruises also collect data on phytoplankton, zooplankton and ichthyoplankton, as well as oceanographic parameters and relates this information to the availability of the fishing stocks.

In this sense, there are significant data and information of the Ecuadorian small pelagic fishery, and in order to provide stock assessments, a series of data is analysed: biological samplings, size compositions, abundance indices, landings, acoustic cruises and biological parameters. The analyses are performed based on estimation models and their results are discussed regarding different hypotheses and biological reference points.

Sufficient additional information is collected to enable an indication of stock status to be estimated. A1.2 is met.

References

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Links

MarinTrust Standard clause	1.3.2.1.1, 1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	7.3.1, 12.3
GSSI	D.4.01, D.5.01, D.6.02, D.3.14

A2	**Stock Assessment - Minimum Requirements**		
	A2.1	A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock), and considers all fishery removals and the biological characteristics of the species.	Yes
	A2.2	The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.	Yes
	A2.3	The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.	Yes
	A2.4	The assessment is subject to internal or external peer review.	Yes
	A2.5	The assessment is made publicly available.	Yes
		Clause outcome:	Pass

A2.1 A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock), and considers all fishery removals and the biological characteristics of the species.

IPIAP has performed annual stock assessments. In its website it is possible to find them from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

The stock assessment compiles a series of biological sample data, fish sizes on the catches, abundance indices, landings, data from acoustic surveys, and biological parameters. The analyses are carried out based on estimation models and their results are discussed based on different hypotheses and biological points of reference.

A stock assessment is conducted at least once every 3 years and considers all fishery removals and the biological characteristics of the species. A.2.1 is met.

A2.2 The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.

For the small pelagic fishery in Ecuador, biomass and fishing mortality are evaluated in relation to specific biological reference points (Figure 31). The target reference point for this fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy=40%B0] and its respective fishing mortality (Fmsy=40%F). The limit reference point for this fishery is 50% of the target reference point (Flim=50%Fmsy and Blim= 50%Bmsy), which is equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=20%F) [Canales and Jurado, 2023]. Therefore, in

summary:
Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022, luego de la implementación de mejoras en los modelos de evaluación. Tomados a partir de los resultados de la última evaluación poblacional (Canales & Jurado, 2023).

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.78	1.10	2.02	1.74	0.90	1.06	1.27
	F/F_{RMS}	2.86	0.55	0.43	0.51	1.24	0.67	1.04
2019	B/B_{RMS}	0.63	1.12	1.80	1.29	1.32	1.15	1.22
	F/F_{RMS}	1.32	0.09	0.06	0.18	0.19	0.32	0.36
2020	B/B_{RMS}	0.52	1.16	1.89	1.35	1.42	1.17	1.25
	F/F_{RMS}	3.38	0.40	0.09	0.12	0.06	0.14	0.70
2021	B/B_{rms}	0.49	1.05	1.37	1.10	1.73	1.25	1.17
	F/F_{RMS}	2.14	1.03	0.22	0.32	0.27	0.17	0.69
2022	B/B_{RMS}	0.34	0.91	1.14	1.27	1.90	1.31	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.31	0.44	0.46	1.08

Figure 31. Comparative table of diagnostic indicators of pelagic stocks (Canales and Jurado, 2023).

Although is not visible in the historical graph provided by the report (Figure 31), according to Canales and Jurado (2023), in 2022 the biomass of shortfin scad was found above the Bmsy (Figure 32), with 40% of overexploitation risk in 2022 and without a risk of overfishing.

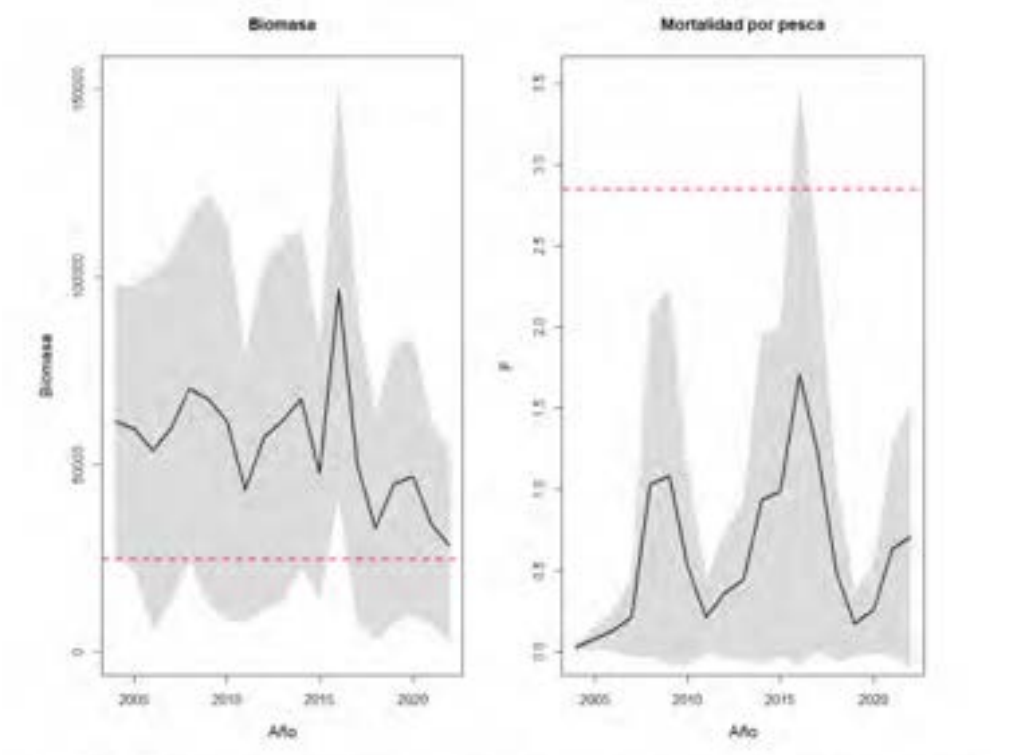

Figura PIC8. Biomasa y mortalidad por pesca de **PICUDILLO**. La linea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%.

Figure 32. Biomass and fishing mortality of shortfin scad. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy. A.2.2 is met.

A2.3 The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.

According to the external review of the stock assessment performed by Cubillos and Cueva (2022):

"The uncertainty associated with the evaluation of shortfin scad is low compared to that of the simulator, and greater uncertainty tends to be observed in the estimation of recruitment (…)
In the case of the shortfin scad, the assessment model tends to systematically overestimate spawning biomass with each year that is added to the assessment model (Figure 17D). However, like Pacific chub mackerel, this is a consequence of the loss of influence of acoustic evaluation. Likewise, the 2020 and 2021 evaluation are consistent with each other, and it is feasible that when adding the 2022 data, the estimates will continue to be consistent (…)
In the frigate tuna, Pacific anchoveta and shortfin scad, from the point of view of the variables for diagnosis, the bias is moderate
and acceptable."

Although there are some issues with stock assessment of this species, overall external peer review approved it and efforts have been made to improve it. Historically, fishing mortality has been below the target reference level and, the biomass of the shortfin scad stock has been above the target reference level. The population is at 40% risk of overexploitation and with no

risk of overfishing (Canales and Jurado, 2023), which suggests that by following the target recommendations the stock has been managed sustainably.

The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status. A.2.3 is met.

A2.4 The assessment is subject to internal or external peer review.

In the latest years, external peer reviews of the small pelagic fishery assessments have been performed. A first stock assessment was performed by an expert panel composed by Canales et al (2019) and reviewed by Minte-Vera (2019), under a consultancy contracted by the Sustainable Fisheries Partnership Foundation - SFP as part of the Sustainable Global Seafood Chains ("*Cadenas Mundiales Sostenibles de Productos del Mar*", in Spanish) project. This project is linked to the small pelagic fishery FIP to be implemented by the National Chamber of Fisheries ("*Cámara Nacional de Pesquerías*", in Spanish) in Ecuador. Besides assessing the status of various small pelagic fish stocks, the consultant and professor Cristian Canales trained researchers and technician of IPIAP in stock assessment methodologies as part of the project. In 2020, a second stock assessment was published by Canales et al (2020) and addressed the uncertainties identified in the previous assessment of Minte-Vera (2019). In 2021, a new assessment was conducted, focusing on a single, isolated stock off Ecuador's coasts and incorporating environmental variables such as sea surface temperature and chlorophyll levels as factors influencing population-level processes (Canales and Jurado 2021). In 2022, as part of the external peer review process, Cubillos and Cueva (2022) conducted a peer review of Canales and Jurado (2022) stock assessments.

Thus, the assessment is subject to internal or external peer review. A.2.4 is met.

A2.5 The assessment is made publicly available.

In IPIAP website it is possible to find stock assessments from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

The assessment is made publicly available. A.2.5 is met.

References

Canales, C. M., V. Jurado, M. Peralta, D. Chicaiza, E. Elías, M. Preciado, M. Hurtado, E. Landívar, C. Alemán, and G. Sandoval. 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. https://globalmarinecommodities.org/wp-content/uploads/2020/01/INFORME-PELA%CC%81GICO-INFORME-PPAL-.pdf

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Links

MarinTrust Standard clause	1.3.2.1.2, 1.3.2.1.4, 1.3.1.2
FAO CCRF	12.3
GSSI	D.5.01, D.6.02, D.3.14

A3	**Harvest Strategy - Minimum Requirements**		
	A3.1	There is a mechanism in place by which total fishing mortality of this species is restricted.	Yes
	A3.2	Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.	Yes
	A3.3	Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).	Yes
		Clause outcome:	Pass

A3.1 There is a mechanism in place by which total fishing mortality of this species is restricted.

The management of multispecies fishery, such as of the small pelagic fisher, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al., 2018). Thus, Ecuador created a strategy based on the management an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly.

Control rules for the fishery was officially established in the fishery management plan (2021-2025) by Ministerial Agreement No. MPCEIP-SRP-2021-0073-A. The Ecuadorian government has implemented a mechanism to restrict the total fishing mortality of fish species in Ecuador and it was explained in FIP (2022). This mechanism is based on the state of exploitation of the indicator species, which is determined by the variation of its Catch per Unit of Effort (CPUE).

For establishing the indicator species, a participatory species prioritization process was performed that evaluated the small pelagic fishes based in the criteria of inherent vulnerability of the species, population status and importance of management. The results of this studies are in Figure 33.

Tabla 7. Resultados de priorización participativa de especies de PPP.

Nombre común	Vulnerabilidad	Estado del shock	Importancia de manejo	Ranking
Macarela	4,1	2,5	4,3	3,62
Pinchagua	3,5	2,0	4,2	3,23
Picudillo	3,2	3,3	3,0	3,16
Chuhueco	2,8	3,0	3,4	3,08
Botella	3,3	1,5	4,0	2,94
Sardina redonda	3,3	2,0	1,6	2,31

Figure 33. Results of participatory prioritization of small pelagic fish species. *Nombre común* = common name; *vulnerabilidad*= vulnerability; *estado del stock:* stock status and *importancia de manejo* = importance of management. Source: SRP (2021).

Every two years, the status of the target species must be revised to evaluate the need to modify the indicator species. When the indicator species reaches or is around its target (90% Bmsy), the restrained effort it will not be based in it anymore, and the species will be replace following the ranking established in the prioritization table. Currently, the indicator species is Pacific chub mackerel.

The control of the fishery is carried out by adjusting the period of the closure fishery known as "*vedas de clara*" (can be translated as "clear closures" in English) to achieve the CPUE of the indicator species with respect to the target reference value (CPUEmsy). The estimation of the duration of *vedas de clara* is set by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP.

The CPUE is estimated annually in the regular data analysis process of fishing activities carried out by IPIAP. The mechanism works as follows:

At the beginning of each fishing season, the level of fishing effort (E) must be adjusted for the entire fishery, based on the stock status of the indicator species considering its biological reference points. The fishing effort must be adjusted annually (t) considering the variation of the CPUEmsy of the indicator species (Figure 34):

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

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

Figure 34. Formula of the fishing effort (E) adjusted annually (t). Source: Canales and Jurado (2023).

The rule considers the magnitude of the catches from previous years. This means that the effort reduction is only generated when the average catches of the last two years are greater than the MSY (stabilizer). An extension to the rule considers a buffer in which changes in fishing effort are avoided as long as the ratio between the average catches of the last two years and the MSY (φ) is less than one (Canales and Jurado, 2023) [Figure 35]:

$$\varphi_t = 0.5 \frac{(Y_{t-1} + Y_{t-2})}{RMS}$$

Figure 35. Buffer formula. Source: Canales and Jurado (2023).

The underlying objective is to reduce the effects of overfishing (~Catches>MSY) and that a condition of overexploitation should not necessarily determine the reduction of fishing effort. The conditions are detailed in Figure 36.

Condition	Action
ρ > 1 and φ < 1	Fishing days is increased ρ times
ρ > 1 and φ > 1	Fishing days remains constant
ρ <1 and φ < 1	Fishing days remains constant
ρ <1 and φ >1	Fishing days is decreased ρ times

Figure 36. Adapted English table taken from Canales and Jurado (2023) Buffer showing buffer conditions for the application of the fishing effort correction in the small pelagic fishing fleet of Ecuador.

The level of fishing effort for the whole fishery is adjusted at the beginning of each fishing season based on the condition of the population of the indicator species, with the participation of the different stakeholders of the Small Pelagic Fishery Development Program (SPFDP).

According to the analyses of the indicator species, Pacific chub mackerel, performed in the stock assessment this year, Canales and Jurado (2023) pointed that its average CPUE for the years 2021-2022 has been lower to the CPUEmsy reference value (ρ=0.81), the same has happened with landings with respect to the MSY (φ =0.98). According to the 2023 results and the criteria considered, Canales and Jurado (2023) stated that the fishing effort of the pelagic fleet should not be decreased.

Besides *vedas de clara*, MPCEIP-SRP-2020-0056-A established that spatial and temporal fishing closures might be implemented if the catch of juvenile specimens exceeds 40% of the catches daily reported by the Observer Program, in the fishing zones or zones of occurrence of small pelagic fish, or catch volumes that could affect the sustainability of the resource, based on a report of IPIAP. A recruitment closure from 20th May to 06th July through A.M. No. MPCEIP-SRP-2023-0140-A A.M. was set based on reports of IPIAP regarding high catches of juveniles.

In addition, a reproductive closure for small pelagic fishery was implemented from 02nd December to 10th January 2023 through MPCEIP-SRP-2022-0258-A, based in the monitoring of biological indicators (Gonadosomatic Index, monitoring of eggs and larvae), aiming to protecting their reproductive activity.

Thus, commercial fishery removals are not prohibited when a specific specie of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery. This clause should be adapted in this case, considering the characteristic of the fishery and its management, which does not focus on a single species, but in the group of small pelagic fishery. Even though the results for the indicator species, which is based on target reference values, this year recommended that the fishing effort of the pelagic fleet should not be decreased, fishing closures were established, demonstrating that the mechanisms of commercial fishery removals are being implemented for all small pelagic fishery.

There is a mechanism in place by which total fishing mortality of this species is restricted. A.3.1 is met.

A3.2 Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.

It is estimated that the development of the shortfin scad fishery has been associated to fluctuations in recruitment, with negative anomalies and a decline on the productivity since 2017. Biomass estimation is uncertain due to model issues, but most of this uncertainty is above the target reference value (Bmsy). Historically, fishing mortality has been below the target reference value (Fmsy) [Figure 37]. The population reduction by 2022 is estimated at 46%, surpassing the management target, but below the limit reference point. The dynamic reproductive potential is estimated at 70% of the virgin condition. The Kobe diagram and confidence intervals suggest a risk of overexploitation, but no risk of overfishing. The estimated risk of overexploitation by 2022 is 40% (Figure 38).

Therefore, historically the biomass of the stock has been above the target reference level and fishing mortality has been below the target reference level.

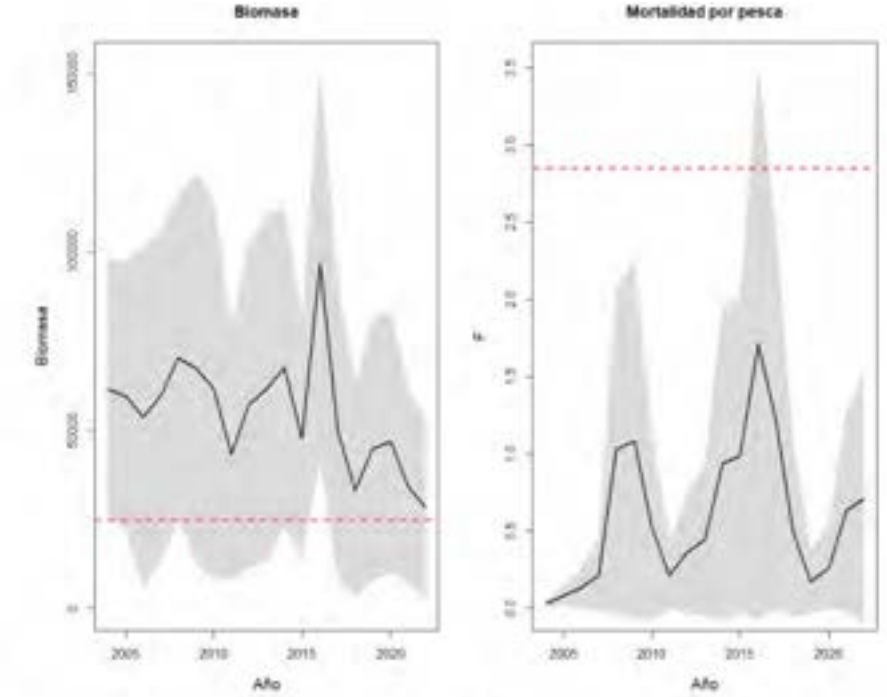

Figura PIC8. Biomasa y mortalidad por pesca de **PICUDILLO**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%.

Figure 37. Biomass and fishing mortality of shortfin scad. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado, 2023).

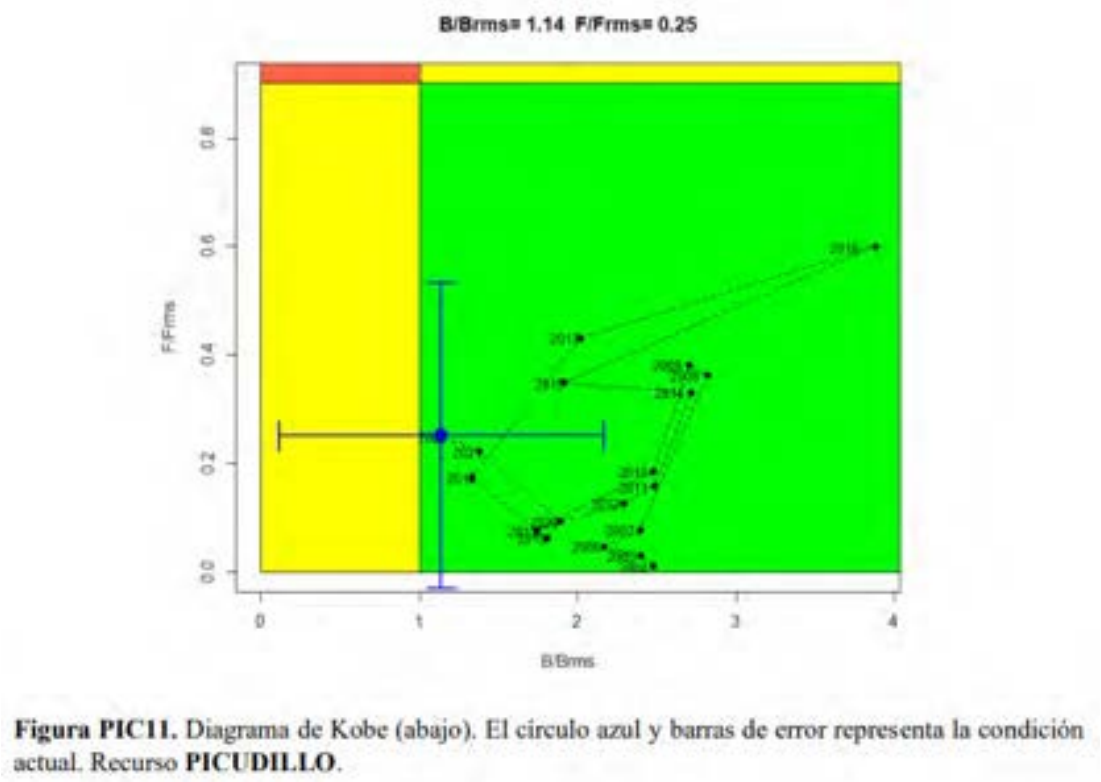

Figura PIC11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **PICUDILLO**.

Figure 38. Kobe diagram. The blue circle and error bars represent the current condition of shortfin scad (Canales and Jurado, 2023).

Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. A.3.2 is met.

A3.3 Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).

The management of multispecies fishery, such as of the small pelagic fisher, involves great complexity and it is logistically impracticable, as fishing effort is applied indiscriminately over all species (Newman et al., 2018). Thus, Ecuador created a strategy based on the management of an indicator species, considering that this will allow to achieve the objective of management for the entire species assembly of the small pelagic fishery.

The management strategies of this fishery are described in the National Action Plan and Management of the Small Pelagic Fishery of Ecuador (SRP, 2021). The *vedas de clara* established for the small pelagic fishery consists in the prohibition of the capture of small pelagic fish using purse seine nets during the full moon period, according to the lunar phases calendar issued by the Oceanographic Institute of the Navy – INOCAR ("*Instituto Oceanográfico de la Armada*", in Spanish). The objective labelled as BP-1.1 in SRP (2021) consists in achieving a yield in line with the target reference point of MSY (40% of B0) for the main small pelagic species by 2025 and the measure attributed for this objective maintain or extend the *veda de clara* based on the status of the indicator species. To implement this measure effectively, a control rule is established to adjust fishing effort, measured in total fishing days for the season, according to the condition of small pelagic populations. This adjustment involves modifying the duration of the existing *veda de clara* to attain the catch per unit of effort relative to the reference point (CPUEmsy and landings with respect to MSY) of the indicator species. The duration of the closure will be determined by the SRP through a Ministerial Agreement and should be based on estimations and recommendations provided by the IPIAP. At the start of each fishing season, the level of effort for the entire fishery is adjusted based on the condition of the indicator species, considering its biological reference points. In addition, SRP (2021) determines that the total number of active vessels

in the National Registry of Industrial Fishing Vessels will not be changed unless scientific reports of IPIAP demonstrate that the fishery stock support an increase of new vessels.

Besides *vedas de clara*, there are other control on fishing removals, such as reproduction closures (based on biological indicator such as Gonadosomatic Index, monitoring of eggs and larvae) and recruitment closures (based on catches of juveniles), which consider data of several species of the small pelagic fishery.

Thus, commercial fishery removals are not prohibited when a specific specie of the small pelagic group is estimated to be below the limit reference point as it is a multispecies fishery, and its management is based on target reference values of an indicator species (*vedas de clara*) and on combined results of reproductive indicators and juveniles catches of several species that composed the small pelagic fishery. The commercial fishery removal is prohibited when the indicator species is estimated to be below the target reference value, which is more conservative than the limit reference point. This clause was adapted in this case, considering the characteristic of the fishery and its management, which does not focus on a single species, but in the group of small pelagic fishery.

Commercial fishery removals are prohibited when the indicator species of the fishery has been estimated to be below the limit reference point or proxy. A.3.3 is met.

References

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_tIdR369V2kYYFAcigHs-XaQ-4/view?usp=sharing

FIP. 2022. Fishery Improvement Project progress report - fourth–year - October 2022. https://www.marin-trust.com/sites/marintrust/files/2022-10/SPS-FIP%20PROGRESS%20REPORT%20FOURTH%20YEAR%20%28OCT%202022%29.pdf

Newman, S. J., Brown, J. I., Fairclough, D. V., Wise, B. S., Bellchambers, L. M., Molony, B. W., … Wakefield, C. B. 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. https://www.sciencedirect.com/science/article/abs/pii/S0308597X17305596

SRP. 2021. Plan de Acción Nacional y Manejo de la Pesquería de Peces Pelágicos Pequeños del Ecuador/SRP-VAP-MPCEIP. Manta-Manabí-Ecuador. 54 pp. https://globalmarinecommodities.org/wp-content/uploads/2021/04/Plan-de-Accio%CC%81n-y-Manejo-Pela%CC%81gicos-Pequen%CC%83os-Ecuador_2021.pdf

Standard clause 1.3.2.1.3

Links	
MarinTrust Standard clause	1.3.2.1.3, 1.3.2.1.4
FAO CCRF	7.2.1, 7.22 (e), 7.5.3
GSSI	D3.04, D6.01

A4	**Stock Status - Minimum Requirements**		
	A4.1	The stock is at or above the target reference point, OR IF NOT: The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT:	Yes

		The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.	
			Clause outcome: Pass

A4.1 The stock is at or above the target reference point, OR IF NOT:
The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT:
The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.

The biomass of shortfin scad is above the target reference point in 2022, while the fishing mortality has been below the target reference point from 2017-2022 (Figure 39).

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022, luego de la implementación de mejoras en los modelos de evaluación. Tomados a partir de los resultados de la última evaluación poblacional (Canales & Jurado, 2023).

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.78	1.10	2.02	1.74	0.90	1.06	1.27
	F/F_{RMS}	2.86	0.55	0.43	0.51	1.24	0.67	1.04
2019	B/B_{RMS}	0.63	1.12	1.80	1.29	1.32	1.15	1.22
	F/F_{RMS}	1.32	0.09	0.06	0.18	0.19	0.32	0.36
2020	B/B_{RMS}	0.52	1.16	1.89	1.35	1.42	1.17	1.25
	F/F_{RMS}	3.38	0.40	0.09	0.12	0.06	0.14	0.70
2021	B/B_{rms}	0.49	1.05	1.37	1.10	1.73	1.25	1.17
	F/F_{RMS}	2.14	1.03	0.22	0.32	0.27	0.17	0.69
2022	B/B_{RMS}	0.34	0.91	1.14	1.27	1.90	1.31	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.31	0.44	0.46	1.08

Figure 39. Comparative table of diagnostic indicators of pelagic stocks (Canales and Jurado, 2023).

The population is at risk of overexploitation, but without risk of overfishing. The risk of overexploitation by 2022 is estimated at 40% (Figure 40) [Canales and Jurado, 2023].

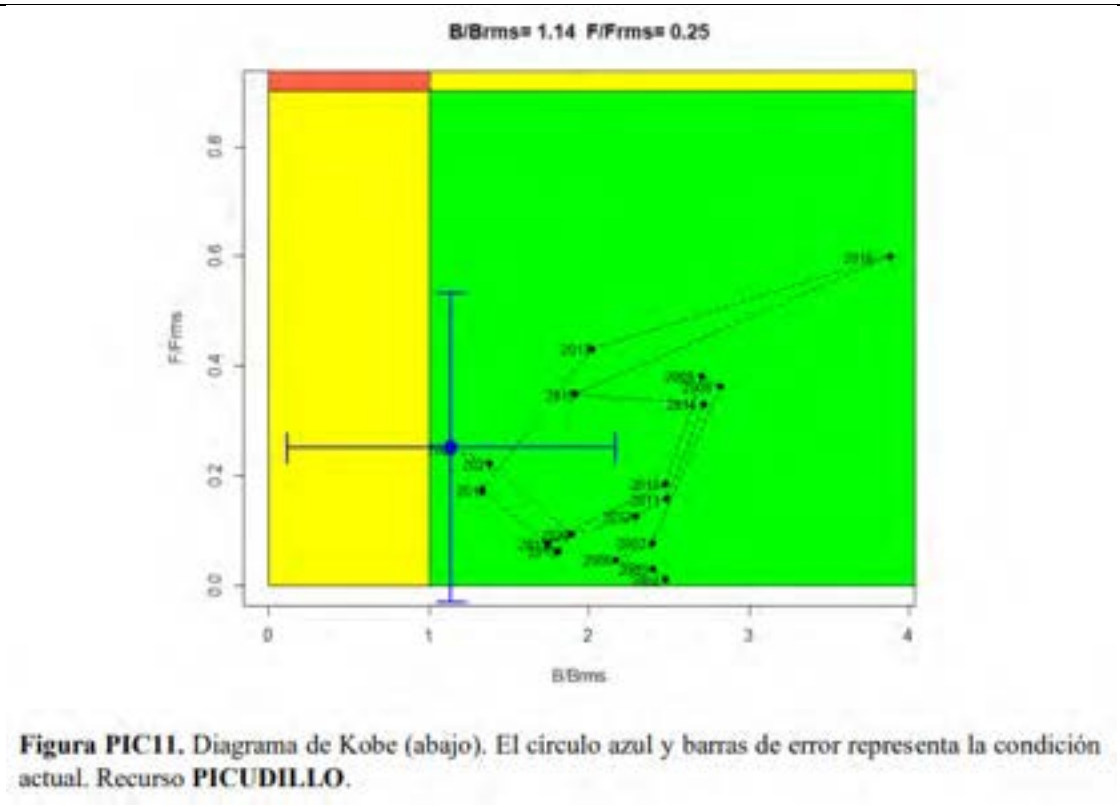

Figura PIC11. Diagrama de Kobe (abajo). El circulo azul y barras de error representa la condición actual. Recurso **PICUDILLO**.

Figure 40. Kobe diagram. The blue circle and error bars represent the current condition of shortfin scad (Canales and Jurado, 2023).

The stock is above the target reference point. A.4.1 is met.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

Links	
MarinTrust Standard clause	**1.3.2.1.4**
FAO CCRF	**7.2.1, 7.2.2 (e)**
GSSI	**D6 01**

CATEGORY B SPECIES

Category B species are those which make up greater than 5% of landings in the applicant raw material, but which are not subject to a species-specific research and management regime sufficient to pass all Category A clauses. If there are no Category B species in the fishery under assessment, this section can be deleted.

Category B species are assessed using a risk-based approach. The following process should be completed once for each Category B species.

If there are estimates of biomass (B), fishing mortality (F), and reference points

It is possible for a Category B species to have some biomass and fishing mortality data available. When sufficient information is present, the assessment team should use the following risk matrix to determine whether the species should be recommended for approval.

TABLE–B(A) - F, B AND REFERENCE POINTS ARE AVAILABLE

Biomass is above MSY / target reference point	Pass	Pass	Pass	Fail	Fail
Biomass is below MSY / target reference point, but above limit reference point	Pass, but re-assess when fishery removals resume	Pass	Fail	Fail	Fail
Biomass is below limit reference point (stock is overfished)	Pass, but re-assess when fishery removals resume	Fail	Fail	Fail	Fail
Biomass is significantly below limit reference point (Recruitment impaired)	Fail	Fail	Fail	Fail	Fail
	Fishery removals are prohibited	**Fishing mortality is below MSY or target reference point**	**Fishing mortality is around MSY or target reference point, or below the long-term average**	**Fishing mortality is above the MSY or target reference point, or around the long-term average**	**Fishing mortality is above the limit reference point or above the long-term average (Stock is subject to overfishing)**

If the biomass / fishing pressure risk assessment is not possible

Initially, the resilience of each Category B species to fishing pressure should be estimated using the American Fisheries Society procedure described in Musick, J.A. (1999). This approach is used as the resilience values for many species and stocks have been estimated by FishBase and are already available online. For details of the approach, please refer to Appendix A. Determining the resilience provides a basis for estimating the risk that fishing may pose to the long-term sustainability of the stock. Table B(b) should be used to determine whether the species should be recommended for approval.

TABLE–B(B) - NO REFERENCE POINTS AVAILABLE. B = CURRENT BIOMASS; B_{AV} = LONG-TERM AVERAGE BIOMASS; F = CURRENT FISHING MORTALITY; F_{AV} = LONG-TERM AVERAGE FISHING MORTALITY.

B > B_{av} and F < F_{av}	Pass	Pass	Pass	Fail
B > B_{av} and F or F_{av} unknown	Pass	Pass	Fail	Fail
B = B_{av} and F < F_{av}	Pass	Pass	Fail	Fail
B = B_{av} and F or F_{av} unknown	Pass	Fail	Fail	Fail
B > B_{av} and F > F_{av}	Pass	Fail	Fail	Fail
B < B_{av}	Fail	Fail	Fail	Fail
B unknown	Fail	Fail	Fail	Fail
Resilience	**High**	**Medium**	**Low**	**Very Low**

Assessment Results

Species Name		***Auxis* spp - frigate tuna ("*Botella*" or "*Melva*", in Spanish)**
B1	Species Name	*Auxis* spp - frigate tuna
	Table used (Ba, Bb)	Ba
	Outcome	Fail

Fishing mortality, biomass and reference points are available, thus the frigate tuna was assessed under Table Ba.

Biomass is below limit reference point (stock is overfished) and fishing mortality is above the limit reference point or above the long-term average (Stock is subject to overfishing), therefore the outcome is: "Fail".

IPIAP has performed annual stock assessments of frigate tuna. In its website it is possible to find them from 2020 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

In 2022, 40,133.10 tons of frigate tune were landed (IPIAP, 2023) [Figure 41].

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS

(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.717,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	37.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 41. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

For the small pelagic fishery in Ecuador, biomass and fishing mortality are evaluated in relation to specific biological reference points. The target reference point for this fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy=40%B0] and its respective fishing mortality (Fmsy=40%F). The limit reference point for this fishery is 50% of the target reference point (Flim=50%Fmsy and Blim= 50%Bmsy), which is equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=20%F) [Canales and Jurado, 2023]. Therefore, in summary:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

The biomass was found below the limit reference point of 50%Bmsy in 2022 (34%Bmsy) [Figure 42 and 43]. According to Canales and Jurado (2023), the biomass spawning of frigate tuna decreased to a level close to 12,000 tons by 2022, which is equivalent to 14% of B0.

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022, luego de la implementación de mejoras en los modelos de evaluación. Tomados a partir de los resultados de la última evaluación poblacional (Canales & Jurado, 2023).

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.78	1.10	2.02	1.74	0.90	1.06	1.27
	F/F_{RMS}	2.86	0.55	0.43	0.51	1.24	0.67	1.04
2019	B/B_{RMS}	0.63	1.12	1.80	1.29	1.32	1.15	1.22
	F/F_{RMS}	1.32	0.09	0.06	0.18	0.19	0.32	0.36
2020	B/B_{RMS}	0.52	1.16	1.89	1.35	1.42	1.17	1.25
	F/F_{RMS}	3.38	0.40	0.09	0.12	0.06	0.14	0.70
2021	B/B_{rms}	0.49	1.05	1.37	1.10	1.73	1.25	1.17
	F/F_{RMS}	2.14	1.03	0.22	0.32	0.27	0.17	0.69
2022	B/B_{RMS}	0.34	0.91	1.14	1.27	1.90	1.31	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.31	0.44	0.46	1.08

Figure 42. Comparative table of diagnostic indicators of pelagic stocks (Canales and Jurado, 2023).

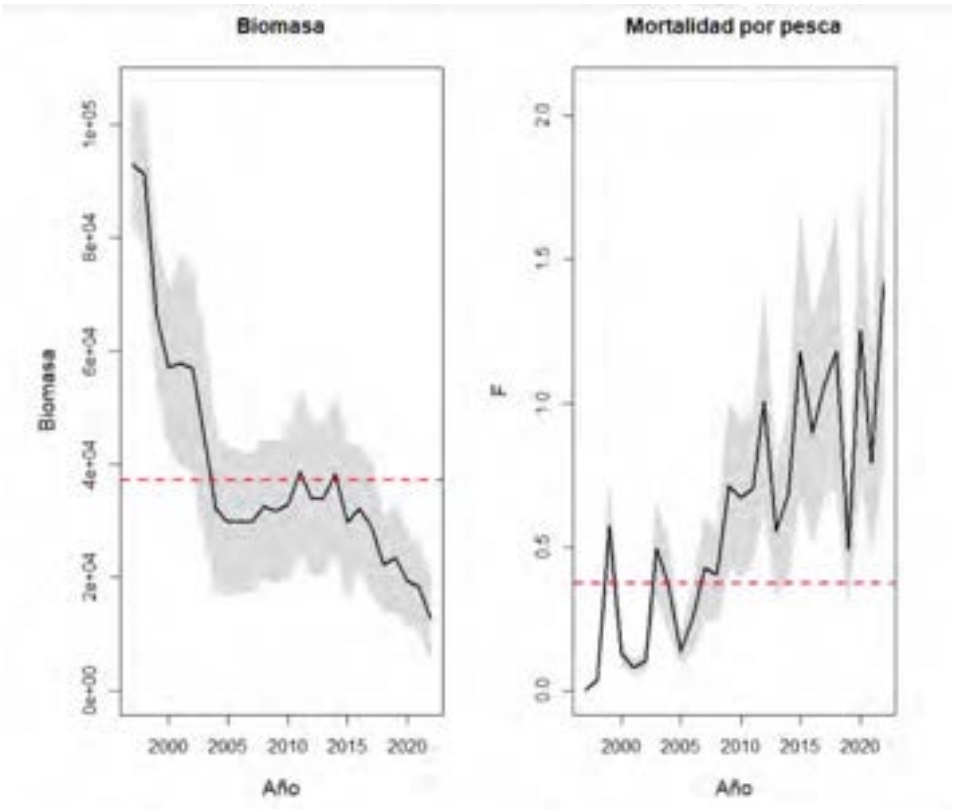

Figura B8. Biomasa y mortalidad por pesca de **BOTELLA**. La línea delgada segmentada corresponde a los valores de referencia RMS. La zona gris representa los intervalos de confianza al 95%

Figure 43. Biomass and fishing mortality of frigate tuna. Segmented thin line corresponds to the MSY reference values. The grey area represents the confidence intervals at the 95% (Canales and Jurado,

2023).

There was a decline in B0 from 2021 (49%) to 2022 (34%). The significant decline in the frigate tuna population in 2022 was attributed to a combination of factors: a 33% increase in landings, a decrease in the estimated biomass value from the 2022 cruise, and the revaluation of the CPUE abundance index using higher-quality data (Canales and Jurado, 2023). This confirmed a declining stock trend not previously recognized.

The population shows clear evidence of both overfishing and overexploitation (Figure 44).

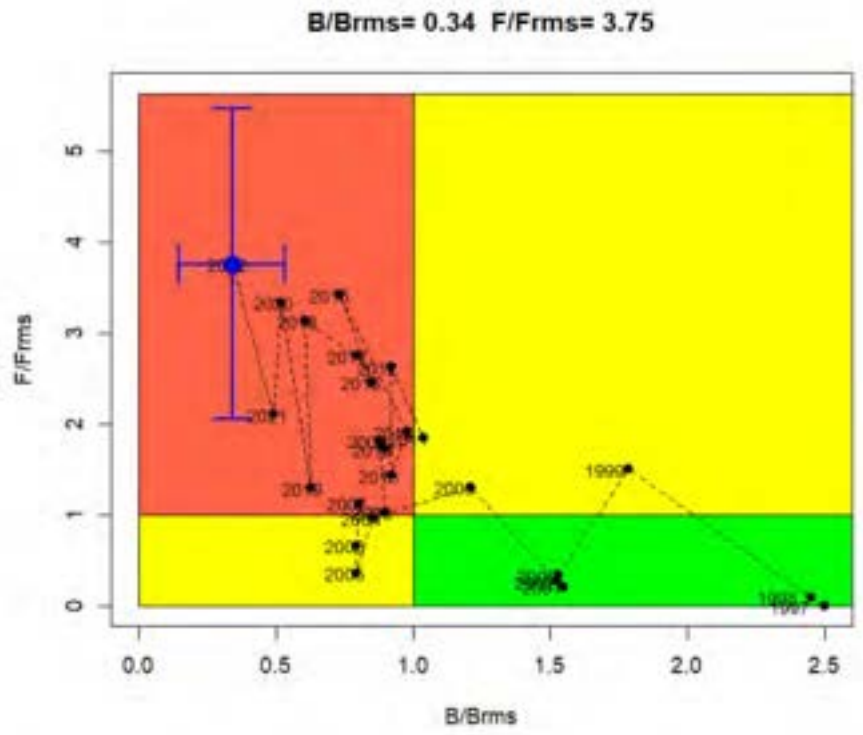

Figura B11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **BOTELLA**.

Figure 44. Kobe diagram. The blue circle and error bars represent the current condition of Pacific frigate tuna (Canales and Jurado, 2023).

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

IPIAP. 2023. Captura de Peces Pelágicos Pequeños 2015-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Capturas-pela%CC%81gicos-pequen%CC%83os-2015-2022.pdf

Links	
MarinTrust Standard clause	**1.3.2.2, 4.1.4**
FAO CCRF	**7.5.1**
GSSI	**D.5.01**

CATEGORY C SPECIES

In a whole fish assessment, Category C species are those which make up less than 5% of landings, but which are subject to a species-specific management regime. In most cases this will be because they are a commercial target in a fishery other than the one under assessment.

Clause C1 should be completed for **each** Category C species. If there are no Category C species in the fishery under assessment, this section can be deleted. Where a species fails this Clause, it may be assessed as a Category D species instead, EXCEPT if there is evidence that it is currently below the limit reference point.

Species Name		***Cetengraulis mysticetus* - Pacific anchoveta/Bocona sardine ("*Chuhueco*", in Spanish)**	
C1	**Category C Stock Status - Minimum Requirements**		
	C1.1	Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.	Yes
	C1.2	The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.	Yes
		Clause outcome:	Pass

C1.1 Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.

Landings data from 1981 and onwards are available in IPIAP website and have been used for stock assessments of small pelagics fishes: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

A complied graph of the landings from 1975-2022 is provided in Figure 45. For building this graph, different sources were used. For the 1980s, data were obtained from the validation and recalculation of catch data reported by Fuentes (1989), Patterson et al. (1990), and Patterson and Santos (1990). For the 1990s to 2022, data were obtained from the factory landing database, which is generated from daily fishing reports from processing companies, as well as from the monthly field sampling database. Additionally, from 2016 and onwards, data from the fishing database of the herring purse seine fleet observer program were incorporated.

According to Canales and Jurado (2023): "It is estimated that the development of the fishery and its maximum records have been very linked to fluctuations in recruitment, with positive anomalies dominating much part of the 80s and 90s (Figure CH7) followed by a downward trend related probably to a change in the productivity regime since 2005. The apparent recovery of recruitment towards more recent years is uncertain due to the method of estimation, and should be verified with the development of the next fishing seasons."

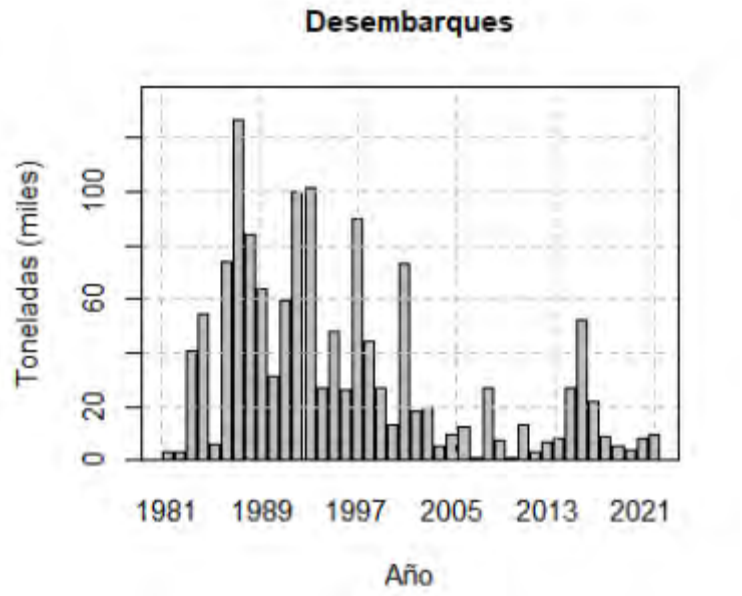

Figure 45. Landings from 1975-2022 of Pacific anchoveta/bocona sardine (Canales and Jurado, 2023).

The latest data of catches available in IPIAP website covers 2015-2022 (Figure 46). In 2022, 9,249.85 tons of Pacific anchoveta/bocona sardine were landed (IPIAP, 2023).

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS
(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.717,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	37.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 46. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

Fishery removals of the species in the fishery under assessment are included in the stock assessment process. C.1.1 is met.

C1.2 The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.

The target reference point for this fishery is represented by a proxy of MSY, which is set as 40% of the virgin spawning biomass (B0) (Bmsy~0.4 B0] and its respective fishing mortality (Fmsy~F40%). The limit reference point for this fishery is 50% of the target reference point, which is equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=F20%) [Canales and Jurado, 2023]. Therefore, in summary:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F

Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

Considering 2017-2022 period, Pacific anchoveta/bocona has presented a biomass above the limit reference point of 50%Bmsy from 2020 and onwards, while the fishing mortality has been below the target reference point, except for 2020 year (Figure 47).

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022.

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.28	0.58	0.15	0.43	0.08	0.80	0.38
	F/F_{RMS}	4.25	1.84	0.20	0.56	0.07	1.57	1.42
2019	B/B_{RMS}	1.15	0.73	0.35	0.35	0.68	1.03	0.71
	F/F_{RMS}	0.69	0.24	0.76	0.95	0.67	0.38	0.62
2020	B/B_{RMS}	0.95	0.78	0.23	1.38	0.58	1.10	0.83
	F/F_{RMS}	2.04	1.03	2.45	0.14	0.27	0.16	1.02
2021	B/B_{0}	0.99	0.91	0.88	1.28	0.98	0.98	1.00
	F/F_{RMS}	1.10	1.22	0.45	0.31	0.27	0.35	0.62
2022	B/B_{RMS}	0.34	0.91	1.14	1.31	1.90	1.27	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.46	0.44	0.31	1.08

Figure 47. Comparative table of diagnostic indicators of pelagic stocks (Canales and Jurado, 2023).

The population is away from overfishing, with slight risks of overexploitation. The risk of overexploitation by 2022 is estimated to be close to 23% (Canales and Jurado, 2023) [Figure 48].

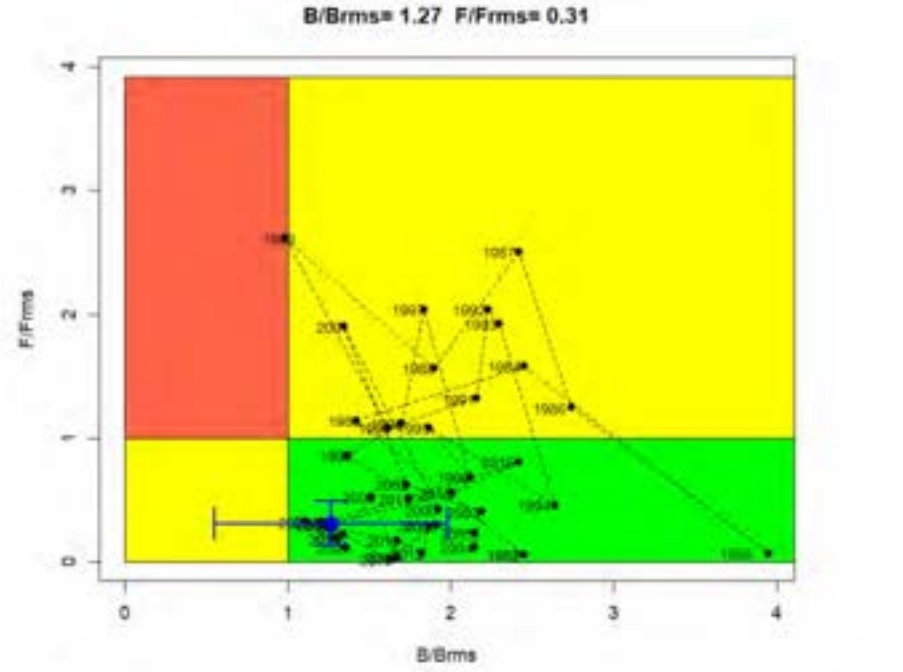

Figura CHI1. Diagrama de Kobe (abajo). El circulo azul y barras de error repeesenta la condición actual. Recurso **CHUHUECO**.

Figure 48. Kobe diagram. The blue circle and error bars represent the current condition of Pacific anchoveta/ bocona sardine (Canales and Jurado, 2023).

The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy). C.1.2 is met.

References

Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf

IPIAP. 2023. Captura de Peces Pelágicos Pequeños 2015-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Capturas-pela%CC%81gicos-pequen%CC%83os-2015-2022.pdf

Links

MarinTrust Standard clause	1.3.2.2
FAO CCRF	7.5.3
GSSI	D.3.04, D5.01

CATEGORY C SPECIES

In a whole fish assessment, Category C species are those which make up less than 5% of landings, but which are subject to a species-specific management regime. In most cases this will be because they are a commercial target in a fishery other than the one under assessment.

Clause C1 should be completed for **each** Category C species. If there are no Category C species in the fishery under assessment, this section can be deleted. Where a species fails this Clause, it may be assessed as a Category D species instead, EXCEPT if there is evidence that it is currently below the limit reference point.

Species Name		***Etrumeus* spp - round herring ("*Sardina Redonda*", in Spanish)**	
C1	**Category C Stock Status - Minimum Requirements**		
	C1.1	Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.	Yes
	C1.2	The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.	Yes
		Clause outcome:	Pass

C1.1 Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.

Landings data from 1981 and onwards are available in IPIAP website and have been used for stock assessments of small pelagics fishes: https://institutopesca.gob.ec/peces-pelagicos-pequenos/

A complied graph of the landings from 1975-2022 is provided in Figure 49. For building this graph, different sources were used. For the 1980s, data were obtained from the validation and recalculation of catch data reported by Fuentes (1989), Patterson et al. (1990), and Patterson and Santos (1990). For the 1990s to 2022, data were obtained from the factory landing database, which is generated from daily fishing reports from processing companies, as well as from the monthly field sampling database. Additionally, from 2016 and onwards, data from the fishing database of the herring purse seine fleet observer program were incorporated.

According to Canales and Jurado (2023): "It is estimated that the development of the fishery and its maximum records have been very linked to fluctuations in recruitment, with positive anomalies dominating much part of the 80s and 90s (Figure SR7) followed by a downward trend related probably due to a change in the productivity regime since 1997. The apparent recovery of recruitment towards more recent years is uncertain due to the method of estimation, and should be verified with the development of the next fishing seasons."

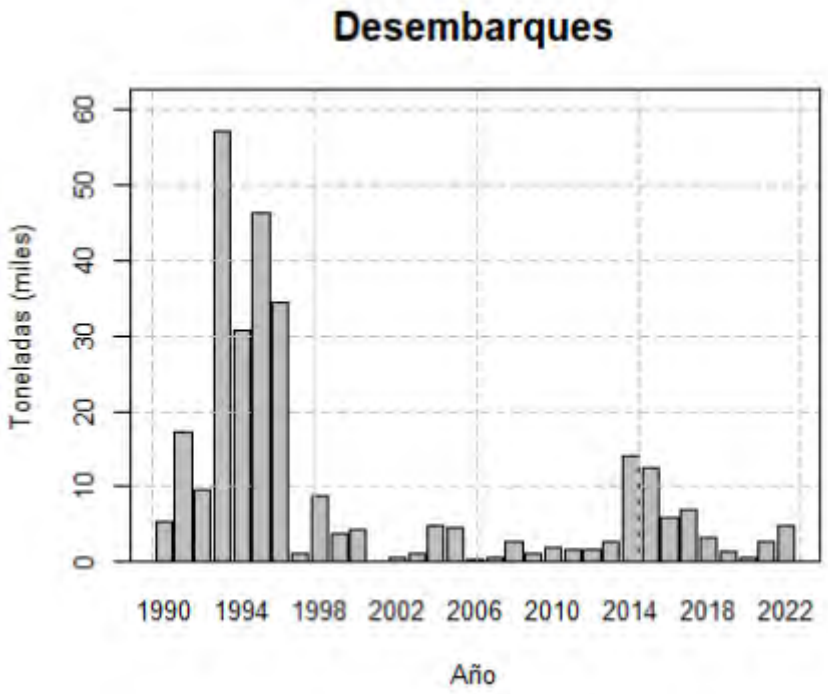

Figure 49. Landings from 1975-2022 of round herring (Canales and Jurado, 2023).

The latest data of catches available in IPIAP website covers 2015-2022 (Figure 50). In 2022, 4,906.11 tons of round herring were landed (IPIAP, 2023).

FLOTA CERQUERA COSTERA
CAPTURA DE PELÁGICOS PEQUEÑOS
(Toneladas)

Especie	2015	2016	2017	2018	2019	2020	2021	2022
MACARELA	103.602,17	96.737,80	69.013,29	31.932,54	30.952,67	65.461,70	164.706,63	158.121,40
BOTELLA	65.006,70	54.601,37	58.457,70	64.096,93	63.896,56	56.693,60	30.972,26	40.133,10
PICUDILLO	21.551,55	60.960,97	45.804,51	13.375,25	9.041,50	8.612,59	15.587,28	12.348,40
PINCHAGUA	37.865,55	13.392,47	16.654,30	17.382,67	23.370,83	10.444,62	7.127,05	22.064,42
CHUHUECO	18.058,52	45.836,16	33.371,33	9.170,05	12.196,72	3.195,60	6.184,04	9.249,85
SARDINA REDONDA	12.559,98	5.315,65	5.637,97	3.737,89	5.968,09	508,54	2.678,95	4.906,11
ROLLIZO	12,47	87,15	19,74	193,86	312,63	50,22	163,55	66,45
JUREL	301,05	24,32	76,85	51,70	2,36	13,91	0,63	27,00
ANCHOVETA						187,05	13,26	54,91
SARDINA DEL SUR	1,54							119,16
ANCHOA					12,49	1,73	2,60	4,84
Total	**258.959,53**	**276.935,89**	**229.035,69**	**139.940,89**	**145.753,86**	**145.169,58**	**227.436,25**	**247.095,63**

Figure 50. Catches in tons of small pelagic fishes from the coastal purse-seine fleet during 2015-2019 (IPIAP, 2023).

Fishery removals of the species in the fishery under assessment are included in the stock assessment process. C.1.1 is met.

C1.2 The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.

The target reference point for this fishery is represented by a proxy of Maximum Sustainable Yield (MSY), which is set as 40% of the virgin spawning biomass (B0) (Bmsy~0.4 B0] and its respective fishing mortality (Fmsy~F40%). The limit reference point for

this fishery is 50% of the target reference point, which is equivalent to 20% of B0 (Blim=20%B0) and its fishing mortality (Flim=F20%) [Canales and Jurado, 2023]. Therefore, in summary:

Btarget = Bmsy = 40%B0
Ftarget= Fmsy = 40%F
Blim= 50%Bmsy = 20%B0
Flim= 50%Fmsy = 20%F

Considering the 2017-2022 period, round herring has presented a biomass above the limit reference point of 50%Bmsy from 2019 and onwards, while the fishing mortality has been below the target reference point (Figure 51).

Tabla A. Cuadro comparativo de los indicadores de diagnóstico de los stocks de pelágicos pequeños del Ecuador 2017-2022.

Año		Botella	Macarela	Picudillo	Chuhueco	Sardina	Pinchagua	Promedio
2017	B/B_{RMS}	0.28	0.58	0.15	0.43	0.08	0.80	0.38
	F/F_{RMS}	4.25	1.84	0.20	0.56	0.07	1.57	1.42
2019	B/B_{RMS}	1.15	0.73	0.35	0.35	0.68	1.03	0.71
	F/F_{RMS}	0.69	0.24	0.76	0.95	0.67	0.38	0.62
2020	B/B_{RMS}	0.95	0.78	0.23	1.38	0.58	1.10	0.83
	F/F_{RMS}	2.04	1.03	2.45	0.14	0.27	0.16	1.02
2021	B/B_{RMS}	0.99	0.91	0.88	1.28	0.98	0.98	1.00
	F/F_{RMS}	1.10	1.22	0.45	0.31	0.27	0.35	0.62
2022	B/B_{RMS}	0.34	0.91	1.14	1.31	1.90	1.27	1.15
	F/F_{RMS}	3.82	1.17	0.25	0.46	0.44	0.31	1.08

Figure 51. Comparative table of diagnostic indicators of pelagic stocks (Canales and Jurado, 2023).

The risk of overfishing is low and the risk of overexploitation is zero (Canales and Jurado, 2023) [Figure 52].

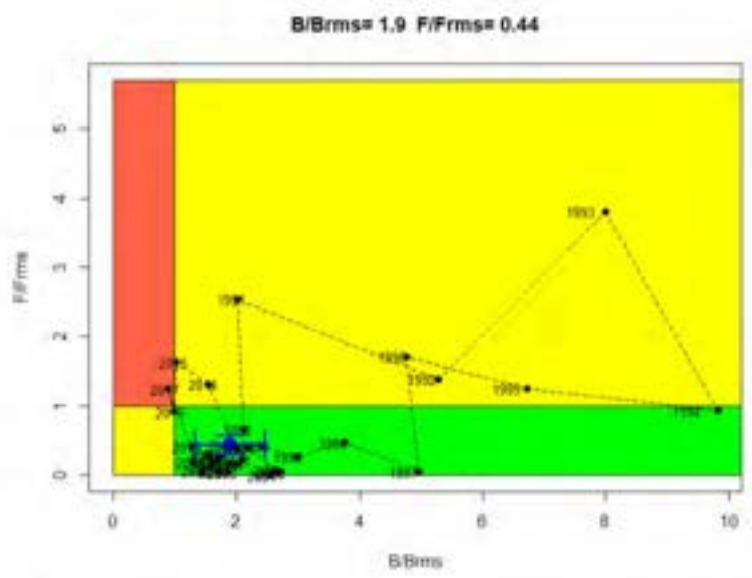

Figura SR11. Diagrama de Kobe (abajo). El círculo azul y barras de error representa la condición actual. Recurso **SARDINA REDONDA**.

Figure 52. Kobe diagram. The blue circle and error bars represent the current condition of round herring (Canales and Jurado, 2023). **The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy). C.1.2 is met.**
References Canales C. M., V. Jurado, 2023. Evaluación del stock de recursos pelágicos pequeños del Ecuador 2022. Informe Técnico IPIAP. Guayaquil, marzo 2023. 154p. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-Evaluacio%CC%81n-2023final.pdf IPIAP. 2023. Captura de Peces Pelágicos Pequeños 2015-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Capturas-pela%CC%81gicos-pequen%CC%83os-2015-2022.pdf

Links	
MarinTrust Standard clause	1.3.2.2
FAO CCRF	7.5.3
GSSI	D.3.04, D5.01

CATEGORY D SPECIES

Category D species are those which make up less than 5% of landings and are not subject to a species-specific management regime. In the case of mixed trawl fisheries, Category D species may make up the majority of landings. The comparative lack of scientific information on the status of the population of the species means that a risk-assessment style approach must be taken.

D1	**Species Name**	***Prionotus stephanophrys* - Lumptail searobin ("*Gallineta*", in Spanish)**	
	Productivity Attribute	**Value**	**Score**
	Average age at maturity (years)	4.1[1]	1
	Average maximum age (years)	16.7[1]	2
	Fecundity (eggs/spawning)	>20,000[3]	1
	Average maximum size (cm)	40.3[1]	1
	Average size at maturity (cm)	23.1[1]	1
	Reproductive strategy	Broadcast spawner[1]	1
	Mean trophic level	3.5[1]	3
		Average Productivity Score	**1.42**
	Susceptibility Attribute	**Value**	**Score**
	Availability (area overlap)	< 10%[4]	1
	Encounterability (the position of the stock/species within the water column relative to the fishing gear)	Medium[5]	2
	Selectivity of gear type	Individuals < half the size at maturity can escape or avoid gear[5]	2
	Post-capture mortality	Evidence of some released post-capture and survival[5]	2
		Average Susceptibility Score	**1.75**
		PSA Risk Rating (From Table D3)	**Pass**
		Compliance rating	**Pass**
	Further justification for susceptibility scoring (where relevant) *For susceptibility attributes, please provide a brief rationale for scoring of parameters where there may be uncertainty affecting your decision* Lumptail searobin is found in eastern Pacific: Columbia River in Washington, USA to Chile, but rare north of Baja California, Mexico[1] (Figure 53).		

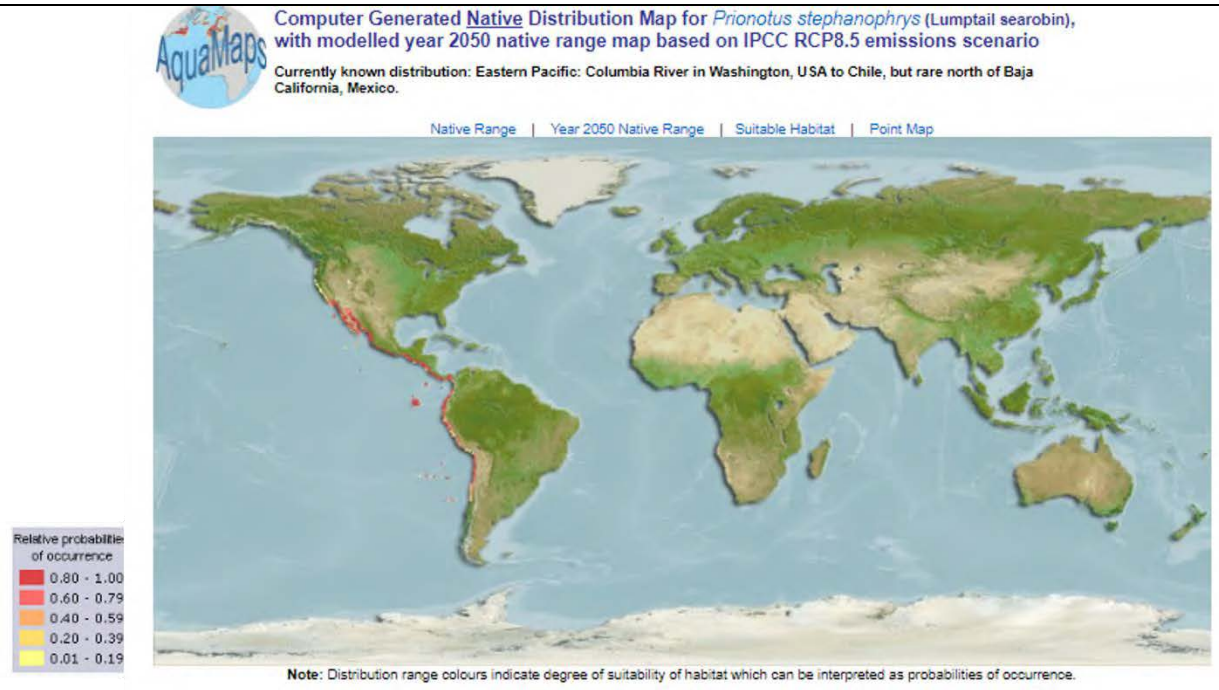

Figure 53. Distribution of lumptail searobin[4].

In the lack of fecundity data for *Prionotus stephanophrys*, the estimate of the fecundity was made based on data from *Prionotus evolans*, which is a related species that lives in the western Atlantic Ocean, ad it was reported to produce between 90 000 to 218 000 eggs/spawning.[3]

Susceptibility values were based mainly in data from acoustic cruises and interview of fishermen in a study of IPIAP within FIP.[5]

Productivity-Susceptibility Analysis (PSA) pointed that the stock has an average productivity score of 1.42 and an average susceptibility score of 1.75, leading to a "Pass" rating against Table D3.

References

[1]Froese, R. and D. Pauly. Editors. 2023. FishBase. World Wide Web electronic publication. https://www.fishbase.se/summary/Prionotus-stephanophrys

[2] Schmitter-Soto, J. J. & Castro-Aguirre, J. L. (1991). Edad y crecimiento de *Prionotus stephanophrys* (*Osteichthyes: Triglidae*) en la costa occidental de Baja California Sur, Mexico. ´ Revista de Biologia Tropical 39, 23–29. https://revistas.ucr.ac.cr/index.php/rbt/article/view/24565

[3]Yuschak, P. 1985. Fecundity, Eggs, Larvae and Osteological Development of the Striped Searobin, (*Prionotus evolans*) (Pisces, Triglidae). J. Northw. Atl. Fish. Sci. 6(1): 65-85. https://doi.org/10.2960/J.v6.a7

[4] AquaMaps. 2019. Computer generated distribution maps for *Prionotus stephanophrys* (Lumptail searobin), with modelled year 2050 native range map based on IPCC RCP8.5 emissions scenario. https://www.aquamaps.org/receive.php?type_of_map=regular&map=cached

[5]Jurado, V. and Ayora, G. 2023. Análisis de productividad y susceptibilidad al 5% de las capturas de la fauna acompañante de las especies pelágicas pequeñas autorizadas para harina de pescado durante periodo 2020-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-PSA-Especies-menor-al-5.pdf

Standard clauses 1.3.2.2

D1	Species Name	*Peprilus medius* – Pacific harvestfish ("*Chazo*", in Spanish)

Productivity Attribute	Value	Score
Average age at maturity (years)	0.8[1]	1
Average maximum age (years)	3[1]	1
Fecundity (eggs/spawning)	-	-
Average maximum size (cm)	33.1[1]	1
Average size at maturity (cm)	19.4[1]	1
Reproductive strategy	Broadcast spawner[2]	1
Mean trophic level	4.0[2]	3
	Average Productivity Score	**1.33**

Susceptibility Attribute	Value	Score
Availability (area overlap)	<10%[3]	1
Encounterability (the position of the stock/species within the water column relative to the fishing gear)	Medium overlap with fishing gear[2] (benthopelagic, depth range 10-60m))	2
Selectivity of gear type	Individuals < half the size at maturity can escape or avoid gear[2]	2
Post-capture mortality	Evidence of some released post-capture and survival[2]	2
	Average Susceptibility Score	**1.75**
	PSA Risk Rating (From Table D3)	**Pass**
	Compliance rating	**Pass**

Further justification for susceptibility scoring (where relevant)

For susceptibility attributes, please provide a brief rationale for scoring of parameters where there may be uncertainty affecting your decision

The species is found in Eastern Pacific: Mexico to Peru, including the Galapagos Islands[1] (Figure 54).

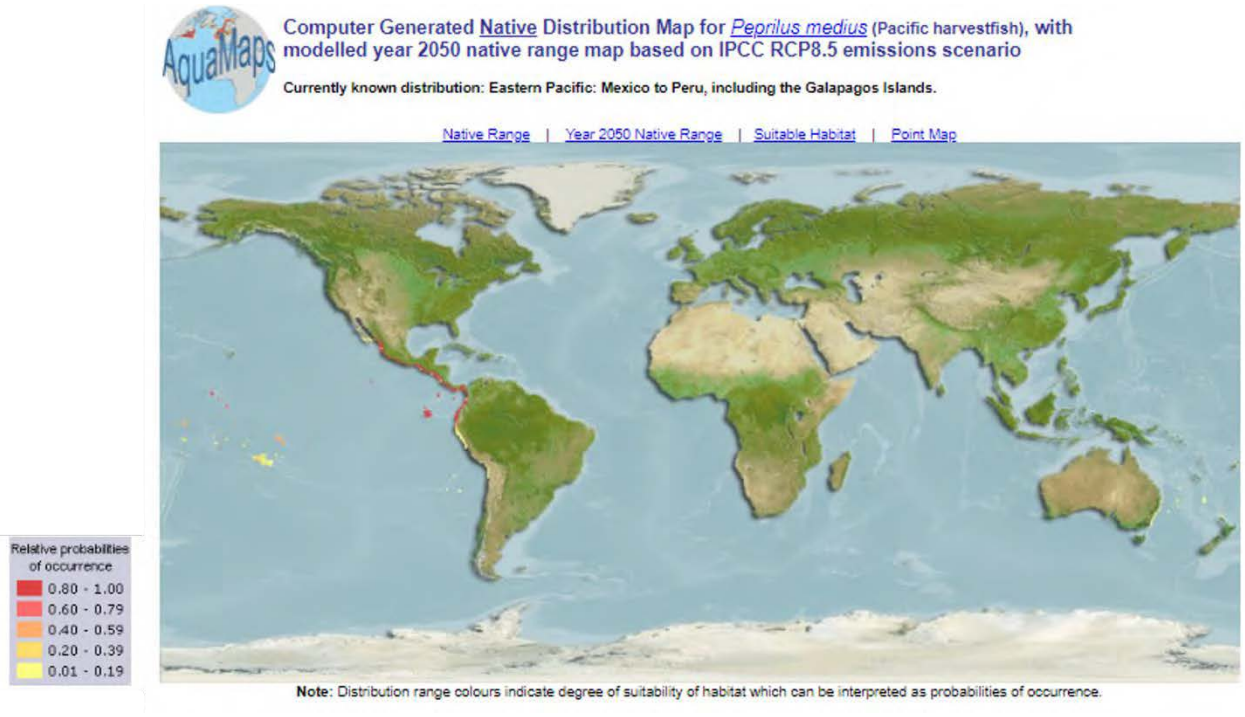

	Figure 54. Distribution of Pacific harvestfish[3]. In the lack of fecundity data for the species, this attribute has not been scored. Susceptibility values were based in data from acoustic cruises and interview of fishermen in a study of IPIAP within FIP[1]. **Productivity-Susceptibility Analysis (PSA) pointed that the stock has an average productivity score of 1.33 and an average susceptibility score of 1.75, leading to a "Pass" rating against Table D3.**
References [1]Froese, R. and D. Pauly. Editors. 2023. FishBase. World Wide Web electronic publication. https://www.fishbase.se/summary/Peprilus-medius.html [2]Jurado, V. and Ayora,G. 2023. Análisis de productividad y susceptibilidad al 5% de las capturas de la fauna acompañante de las especies pelágicas pesqueñas autorizadas para harina de pescado durante periodo 2020-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-PSA-Especies-menor-al-5.pdf [3]AquaMaps (2019). Computer generated distribution maps for *Peprilus medius* (Pacific harvestfish), with modelled year 2050 native range map based on IPCC RCP8.5 emissions scenario. https://www.aquamaps.org/receive.php?type_of_map=regular&map=cached	
Standard clauses 1.3.2.2	

D1	Species Name	*Prionotus albirrostris* - Whitesnout searobin ("*Gallineta*", in Spanish)

Productivity Attribute	Value	Score
Average age at maturity (years)	2.2[1]	1
Average maximum age (years)	8.1[1]	1
Fecundity (eggs/spawning)	>20,000[2]	1
Average maximum size (cm)	21.6[1]	1
Average size at maturity (cm)	13.2[1]	1
Reproductive strategy	Broadcast spawner[2]	1
Mean trophic level	3.6[1]	3
	Average Productivity Score	**1.28**

Susceptibility Attribute	Value	Score
Availability (area overlap)	<10%[4]	1
Encounterability (the position of the stock/species within the water column relative to the fishing gear)	Medium overlap with fishing gear[3]	2
Selectivity of gear type	Individuals < half the size at maturity can escape or avoid gear[3]	2
Post-capture mortality	Evidence of some released post-capture and survival[3]	2
	Average Susceptibility Score	**1.75**
	PSA Risk Rating (From Table D3)	**Pass**
	Compliance rating	**Pass**

Further justification for susceptibility scoring (where relevant)

For susceptibility attributes, please provide a brief rationale for scoring of parameters where there may be uncertainty affecting your decision

The species is found in Eastern Pacific: Gulf of California to Isla San Lorenzo, Callao, Peru and the Galapagos Islands[1] (Figure 55).

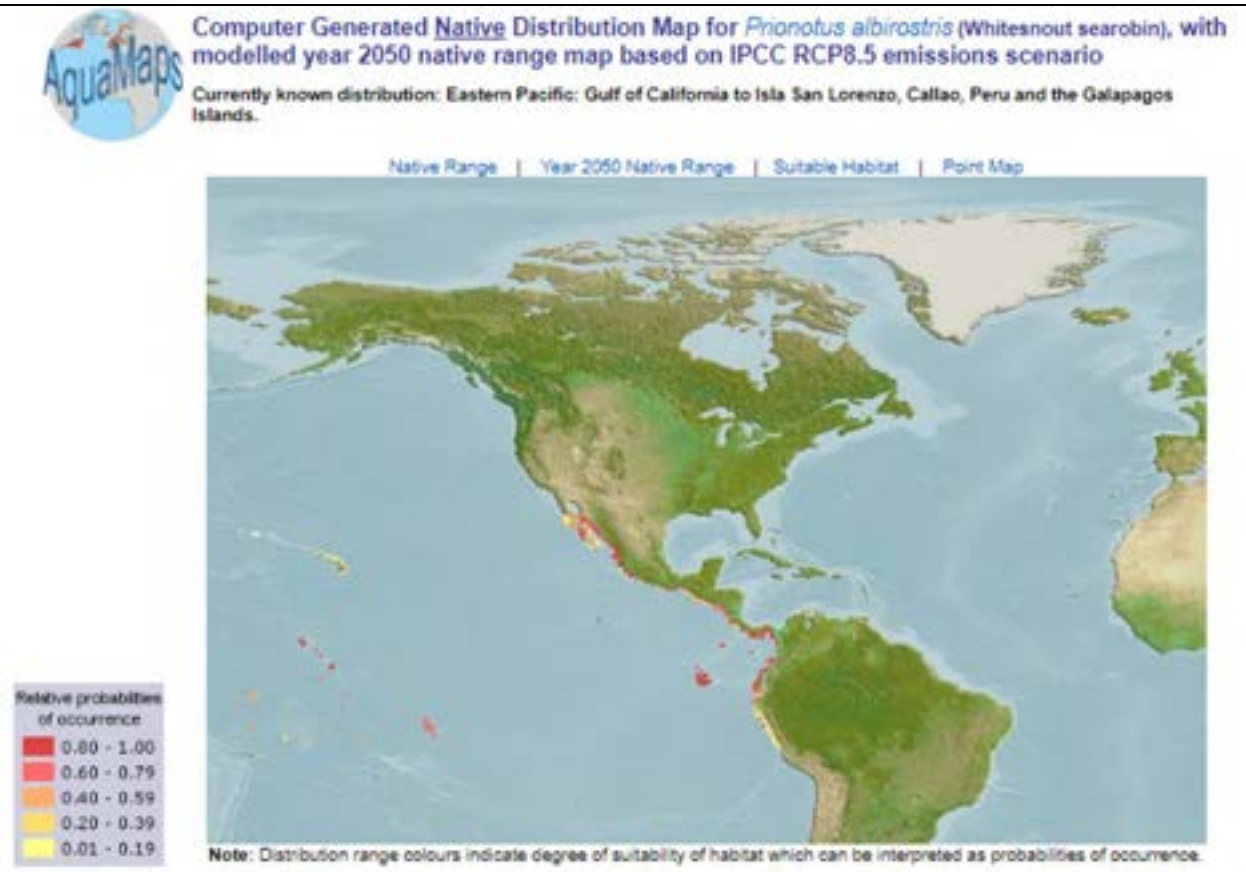

Figure 55. Distribution of whitesnout searobin[4].

In the lack of fecundity data for *Prionotus albirrostris*, the estimate of the fecundity was made based on data from *Prionotus evolans*, which is a related species that lives in the western Atlantic Ocean, ad it was reported to produce between 90 000 to 218 000 eggs/spawning.[2]

Susceptibility values were based in data from acoustic cruises and interview of fishermen in a study of IPIAP within FIP.[3]

Productivity-Susceptibility Analysis (PSA) pointed that the stock has an average productivity score of 1.28 and an average susceptibility score of 1.75, leading to a "Pass" rating against Table D3.

References

[1]Froese, R. and D. Pauly. Editors. 2023. FishBase. World Wide Web electronic publication https://www.fishbase.se/summary/14256

[2]Yuschak, P. 1985. Fecundity, Eggs, Larvae and Osteological Development of the Striped Searobin, (Prionotus evolans) (Pisces, Triglidae). J. Northw. Atl. Fish. Sci. 6(1): 65-85. https://doi.org/10.2960/J.v6.a7

[3]Jurado, V. and Ayora, G. 2023. Análisis de productividad y susceptibilidad al 5% de las capturas de la fauna acompañante de las especies pelágicas pequeñas autorizadas para harina de pescado durante periodo 2020-2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Informe-PSA-Especies-menor-al-5.pdf

[4]AquaMaps. 2019. Computer generated distribution maps for *Prionotus albirostris* (Whitesnout searobin), with modelled year 2050 native range map based on IPCC RCP8.5 emissions scenario. https://www.aquamaps.org/receive.php?type_of_map=regular&map=cached

Standard clauses 1.3.2.2

Table D2 - Productivity / Susceptibility attributes and scores.

Productivity attributes	High productivity (Low risk, score = 1)	Medium productivity (medium risk, score = 2)	Low productivity (high risk, score = 3)
Average age at maturity	<5 years	5-15 years	>15 years
Average maximum age	<10 years	10-25 years	>25 years
Fecundity	>20,000 eggs per year	100-20,000 eggs per year	<100 eggs per year
Average maximum size	<100 cm	100-300 cm	>300 cm
Average size at maturity	<40 cm	40-200 cm	>200 cm
Reproductive strategy	Broadcast spawner	Demersal egg layer	Live bearer
Mean Trophic Level	<2.75	2.75-3.25	>3.25

Susceptibility attributes	Low susceptibility (Low risk, score = 1)	Medium susceptibility (medium risk, score = 2)	High susceptibility (high risk, score = 3)
Areal overlap (availability) Overlap of the fishing effort with the species range	<10% overlap	10-30% overlap	>30% overlap
Encounterability The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear	Low overlap with fishing gear (low encounterability).	Medium overlap with fishing gear.	High overlap with fishing gear (high encounterability). Default score for target species
Selectivity of gear type Potential of the gear to retain species	a Individuals < size at maturity are rarely caught b Individuals < size at maturity can escape or avoid gear.	a Individuals < size at maturity are regularly caught. b Individuals < half the size at maturity can escape or avoid gear.	a Individuals < size at maturity are frequently caught b Individuals < half the size at maturity are retained by gear.
Post-capture mortality (PCM) The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival	Evidence of majority released post-capture and survival.	Evidence of some released post-capture and survival.	Retained species or majority dead when released.

D3		Average Susceptibility Score		
		1 - 1.75	1.76 - 2.24	2.25 - 3
Average Productivity Score	1 - 1.75	PASS	PASS	PASS
	1.76 - 2.24	PASS	PASS	TABLE D4
	2.25 - 3	PASS	TABLE D4	TABLE D4

FURTHER IMPACTS

The three clauses in this section relate to impacts the fishery may have in other areas. A fishery must meet the minimum requirements of all three clauses before it can be recommended for approval.

F1	Impacts on ETP Species - Minimum Requirements		
	F1.1	Interactions with ETP species are recorded.	Yes
	F1.2	There is no substantial evidence that the fishery has a significant negative effect on ETP species.	Yes
	F1.3	If the fishery is known to interact with ETP species, measures are in place to minimise mortality.	Yes
		Clause outcome:	Pass

F1.1 Interactions with ETP species are recorded.

According to FIP (2022):
"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. This form 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.
(…)
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."

In IPIAP website it is possible to find annual reports regarding interactions of the small pelagic fishery with Endangered, Threatened and Protected Species (ETP Species) form 2019 and onwards: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

Interactions with ETP species are recorded. F.1.1 is met.

F1.2 There is no substantial evidence that the fishery has a significant negative effect on ETP species.

According to Ponce et al (2022):
"A total of 2 391 sets were analyzed corresponding to 874 trips made by 148 vessels belonging to the purse-seine fishing fleet in continental Ecuador during 2022, 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 23 different species were sighted, of which 21 registered interactions, with 7 of these species categorized as ETP: *Aetobatus laticeps*, Chelonia mydas, Rhincodon typus, Eretmochelys imbricata, *Sphyrna zygaena, Caretta caretta y Lepidochelys olivacea*. Although there were interactions, the

data analyzed showed that their interaction rate was less than 0.1 and mortality reports were minimal (<0.01% of all interactions). Other species not categorized as ETP such as *Fregata magnificens, Pelecanus occidentalis* and *Otaria flasvescens* showed the highest interaction rates (8.23, 7.01 and 6.52, respectively). Therefore, it is recommended to keep monitoring within observer Program, and in turn, carry out this type of analysis periodically. (…)

Finally, within the interaction records with the purse seine for this analysis period, it was reported that 99.88% of the individuals were unharmed. Indeed, according to FAO (2010), this fishery records low incidental mortality of species of birds, turtles and sea mammals. (…)

In summary, the interaction rates recorded for ETP species during 2022 were less than 0.1, which indicates that there was no impact of the fleet on these species."

The list of species seen in 2022 associated to the small pelagic fishery is summarized in the Figure (56):

Tabla 2. Lista de especies avistadas, su estado en la lista roja de la UICN y número de avistamientos durante 2022. *Especies que no se han registrado anteriormente desde 2019 a 2021 (Jurado et al., 2019), (Ponce et al., 2020), (Ponce et al., 2021).

ID	Grupo faunístico	Nombre científico	Nombre común	Estado lista roja UICN	Avistamientos
1	Aves marinas	*Fregata magnificens*	Fragata común o fragata real	LC	13296
2		*Pelecanus occidentalis*	Pelicano pardo	LC	5657
3		*Pelecanus thagus*	Pelicano peruano	NT	1694
4		*Sula nebouxii*	Piquero patas azules	LC	364
5		*Oceanites gracilis*	Golondrina de mar chica	DD	38
6		**Phaethon aethereus*	Ave del trópico de pico rojo	LC	30
7		*Chroicocephalus ribundus*	Gaviota encapuchada	LC	10
8		*Sula variegata*	Piquero peruano	LC	10
9		*Larosterna inca*	Charrán inca	NT	1
10	Mamíferos marinos	*Otaria flavescens*	Lobo marino sudamericano	LC	5257
11		*Delphinus delphis*	Delfín común	LC	104
12		*Stenella attenuata*	Delfín manchado pantropical	LC	84
13		*Tursiops truncatus*	Delfín nariz de botella común	LC	22
14		*Megaptera novaeangliae*	Ballena jorobada	LC	2
15	Elasmobranquios	*Rhinoptera steindachneri*	Raya dorada	NT	54
16		**Sphyrna zygaena*	Tiburón martillo liso	VU	15
17		*Aetobatus laticeps*	Raya águila	VU	5
18		*Rhincodon typus*	Tiburón ballena	EN	2
19		**Mustelus lunulatus*	Musola media luna	LC	1
20	Tortugas marinas	*Chelonia mydas*	Tortuga verde	EN	67
21		*Lepidochelys olivacea*	Tortuga delfina/tortuga olivácea	VU	13
22		*Eretmochelys imbricata*	Tortuga carey	CR	2
23		**Caretta caretta*	Tortuga boba	VU	1

Figure 56. List of sighted species, their status on the IUCN red list and number of sightings during 2022 (Ponce et all, 2022).

There is no substantial evidence that the fishery has a significant negative effect on ETP species. F.1.2 is met.

F1.3 If the fishery is known to interact with ETP species, measures are in place to minimise mortality.

According to FIP (2022):

"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 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."

Even if the interaction rates recorded for ETP species during 2022 were less than 0.1, which is considered very low, Ponce et al (2022) pointed that in order to continue reducing the levels of interaction with the purse seine fishery, the SPS-FIP project through the Responsible Fishing Program (Small Pelagics, 2021) is conducting training for crew members on release techniques and manipulation of marine fauna species.

So even if the fishery is known for almost not interacting with ETP species, governmental measures exist and are implemented along with a continuous improvement process within the fishery.

If the fishery is known to interact with ETP species, measures are in place to minimise mortality. F.1.3 is met.

References

FIP. 2022. Fishery Improvement Project progress report - fourth year - October 2022. https://www.marin-trust.com/sites/marintrust/files/2022-10/SPS-FIP%20PROGRESS%20REPORT%20FOURTH%20YEAR%20%28OCT%202022%29.pdf

Ponce, G., Ayora, G., Daniela S. and 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 2022. https://institutopesca.gob.ec/wp-content/uploads/2023/05/Interaccio%CC%81n-especies-ETP-y-Pesqueri%CC%81a-Peces-Pela%CC%81gicos-Pequen%CC%83os-2022.pdf

Links	
MarinTrust Standard clause	1.3.3.1

FAO CCRF	7.2.2 (d)
GSSI	D4.04, D.3.08

F2	**Impacts on Habitats - Minimum Requirements**		
	F2.1	Potential habitat interactions are considered in the management decision-making process.	Yes
	F2.2	There is no substantial evidence that the fishery has a significant negative impact on physical habitats.	Yes
	F2.3	If the fishery is known to interact with physical habitats, there are measures in place to minimise and mitigate negative impacts.	Yes
		Clause outcome:	Pass

F2.1 Potential habitat interactions are considered in the management decision-making process.

According to FIP (2022):

"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 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.

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 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)."

Potential habitat interactions are considered in the management decision-making process. F.2.1 is met.

F2.2 There is no substantial evidence that the fishery has a significant negative impact on physical habitats.

The consequences of fishing activities on habitats are linked to physical disruptions that occur when bottom gear comes into contact with the seafloor (ICES 2006). According to the provided definition, fishing gear utilized in pelagic fishing, like purse seines, do not have a direct impact on the seabed. Therefore, it is believed that these gear types do not exert any influence on the habitat (ICES 2006) (Grieve et al, 2014).

According to Ponce et al (2021,2022) and Jurado et al (2019, 2020), no sets of the small pelagic purse seine fleet were reported on fragile seabeds such as coral reefs (part of the Machalilla National Park Reserve) from 2018-2021 and the fishery operations are performed mainly on mixed bottoms composed of sand and silt on the Ecuadorian coast.

The latest report regarding interaction of the fishery with habitat (Ponce et al, 2021) used fishing zone data from the spreadsheet implemented by IPIAP through the Fishing Observer Program of SRP, which is considered a representative sample of the activities or the small pelagic purse seine fleet for 2021. In general, 17% of the total fishing sets sampled were carried out at a depth of less than 25m, 29% between 25 and 64 m and the remaining 54% corresponded to sets made in areas with depths greater than 64 m (Ponce et al, 2020). It is important to notice that the majority of the sets were in water with more than 25m, which reduced the probability of the contact of the net with the bottom and consequently, less negative impact in the physical habitat.

Among the areas included on Ponce et al (2021) study (Esmeraldas, Manabí, Santa Elena and the Gulf of Guayaquil), greatest interaction was given by class I vessels (vessels with nets with lengths between 329 and 732 m and height between 27 and 82 m), especially in the Gulf of Guayaquil (17.2%) [Ponce et al 2021]. The Gulf of Guayaquil is shallow and its bottom is made up of sandy shallows (Jurado et al, 2018).

There is no substantial evidence that the fishery has a significant negative impact on physical habitats. F.2.2 is met.

F2.3 If the fishery is known to interact with physical habitats, there are measures in place to minimise and mitigate negative impacts.

Interaction with benthic habitats is limited, as the purse seine fishery is typically an epipelagic fishery occurring in the water column, so there is no evidence of negative impact with physical habitats. Nevertheless, IPIAP has been monitoring the interactions of the fishery with the habitat and reports have been published on the website almost annually since 2018: https://institutopesca.gob.ec/peces-pelagicos-pequenos/.

There are several measures in place to mitigate the negative impacts, as exposed by FIP (2022):
"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 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.

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 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)."

Although the interaction of the fishery with physical habitats be low, there are measures in place to minimise and

mitigate negative impacts. F.2.3 is met.

References

FIP. 2022. Fishery Improvement Project progress report - fourth year - October 2022. https://www.marin-trust.com/sites/marintrust/files/2022-10/SPS-FIP%20PROGRESS%20REPORT%20FOURTH%20YEAR%20%28OCT%202022%29.pdf

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ICES 2006. Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO), 5 12 April 2006, ICES Headquarters, Copenhagen. ACE:05. 174 pp. https://www.ices.dk/sites/pub/CM%20Doccuments/2006/ACE/WGECO06.pdf

Links	
MarinTrust Standard clause	1.3.3.2
FAO CCRF	6.8
GSSI	D.2.07, D.6.07, D3.09

F3	Ecosystem Impacts - Minimum Requirements		
	F3.1	The broader ecosystem within which the fishery occurs is considered during the management decision-making process.	Yes
	F3.2	There is no substantial evidence that the fishery has a significant negative impact on the marine ecosystem.	Yes
	F3.3	If one or more of the species identified during species categorisation plays a key role in the marine ecosystem, additional precaution is included in recommendations relating to the total permissible fishery removals.	Yes
		Clause outcome:	Pass

F3.1 The broader ecosystem within which the fishery occurs is considered during the management decision-making process.

In IPIAP website it is possible to see that there are studies being performed about interactions of the fishery with the habitat, ETP species, bycatch and oceanographic conditions, such as El Niño and La Niña events, which demonstrates that the ecosystem has been considered to ensure that the fishery is managed in a sustainable way.

According to FIP (2022), the broader ecosystem is considered in several management measures of the small pelagic fishery and, for instance, a study was performed to understand the main tropic interactions involving the small pelagic fish species and a project is in place that monitors distribution and abundance of small pelagic ichthyoplankton to help on evaluation of fish stock status and take management decisions:

“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.
(…)
The main conclusions of the analysis are:
(…)
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.
(…)
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. 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.

(…)

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:

(…)

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."

The broader ecosystem within which the fishery occurs is considered during the management decision-making process. F3.1 is met.

F3.2 There is no substantial evidence that the fishery has a significant negative impact on the marine ecosystem.

The fishery has no impact on the habitat and a relatively low impact on ETP species.

The ecotrophic model built using the Ecopath with Ecosim (EwE) software in Neira et al (2022) study that aimed to quantify main trophic interactions involving the species that support the small pelagic fishery in Ecuador showed that, in general, no significant effects on the ecosystem derived from the individual exploitation of small pelagics were observed.

It seems that not all species of the small pelagic fishery belong to low trophic level species (their trophic levels varied between 2 and 4) [Figure 57]

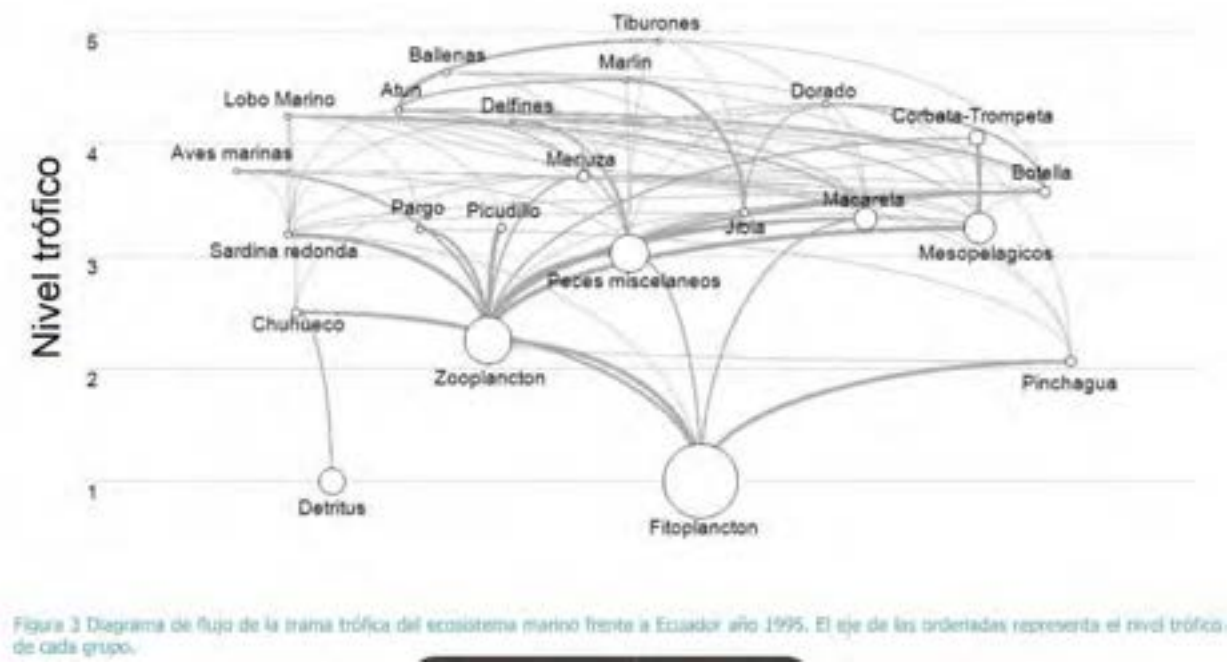

Figura 3 Diagrama de flujo de la trama trófica del ecosistema marino frente a Ecuador año 1995. El eje de las ordenadas representa el nivel trófico de cada grupo.

Figure 57. Flow diagram of the trophic web of the marine ecosystem off Ecuador in 1995. The ordinate axis represents the trophic level of each group. The year 1995 was selected as the base year because most biomass estimates in small pelagic stock assessments and environmental variables begin in that year (Neira et al, 2022).

It was also revealed that predators would depend more on other prey groups such as "other miscellaneous small fishes" and "mesopelagics" than on small pelagic fish. The major system fluxes of mass/energy of the ecosystem, apart the plankton, were through these groups and the Pacific chub mackerel (Figures 58, 59, 60 and 61).

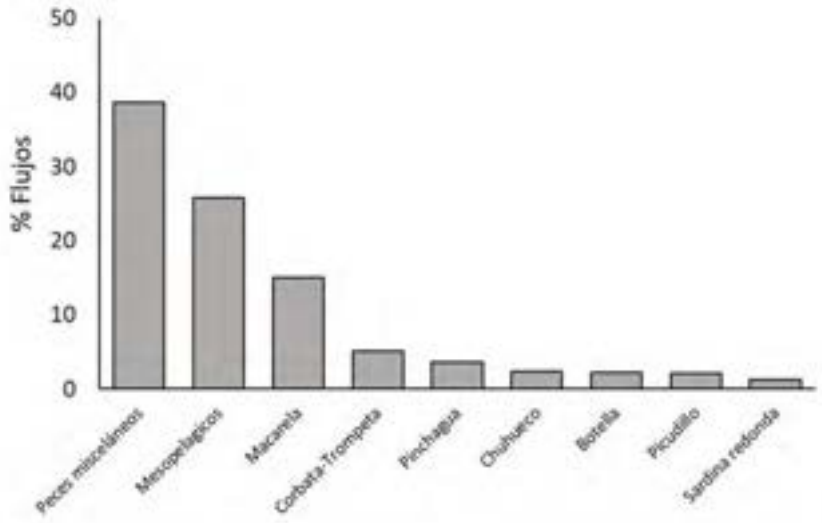

Figura 4 Porcentaje de flujos de materia/energía asociados a peces ubicados en niveles tróficos intermedios respecto de los flujos totales en el modelo que representa la trama trófica del ecosistema marino frente a Ecuador. No se considera los flujos que ocurren en el plancton.

Figure 58. Percentage of matter/energy flows associated with fish located in intermediate trophic levels with respect to the total flows in the model that represents the tropic web of the marine ecosystem of Ecuador. The

flows that occur are not considered (Neira et al, 2022).

Neira et al (2022) pointed that changes in the biomass of small pelagic species would be explained by fishing mortality, 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 target fishing mortality in each small pelagic fish, both individually and collectively, did not negatively affect (decrease > 25%) the biomass of the predators of small pelagic fish.

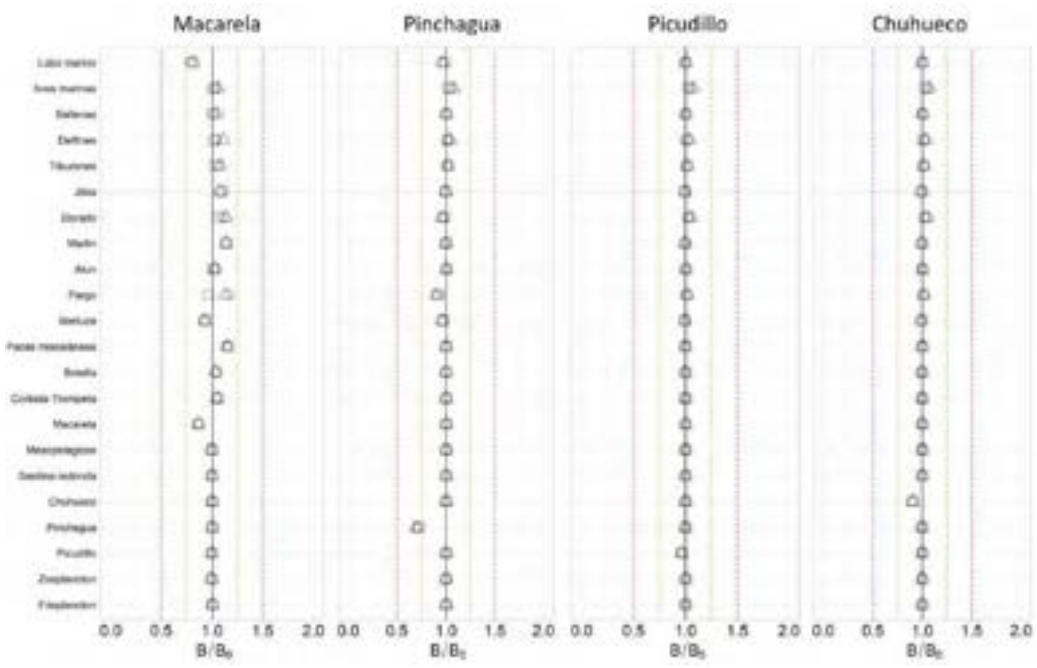

Figure 59. Changes in biomass of functional groups when applying target fishing mortality individually to each pelagic fish stock. Square, circle and triangle indicate, respectively, 5, 10 and 25 years of simulation; Yellow lines = ±25% change; Red lines = ±50% change; B0=unexploited biomass (Neira et al, 2022).

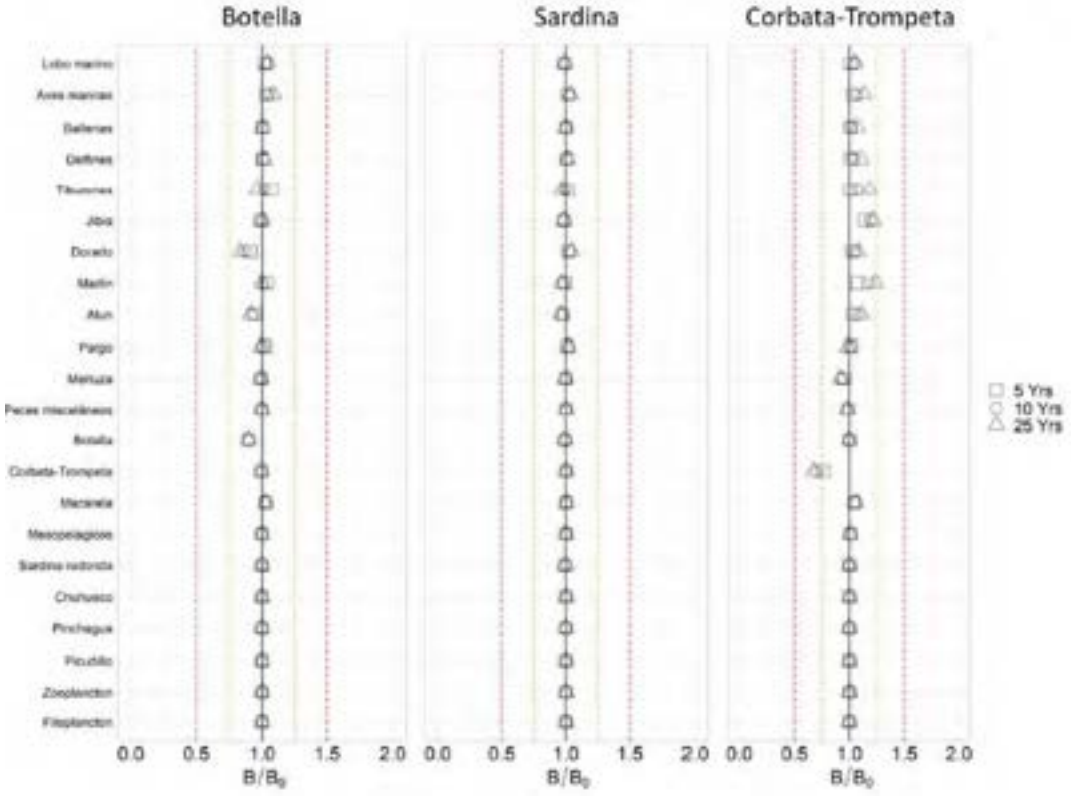

Figure 60. Changes in biomass of functional groups when applying target fishing mortality individually to each pelagic fish stock. Square, circle and triangle indicate, respectively, 5, 10 and 25 years of simulation; Yellow lines = ±25% change; Red lines = ±50% change; B0=unexploited biomass (Neira et al, 2022).

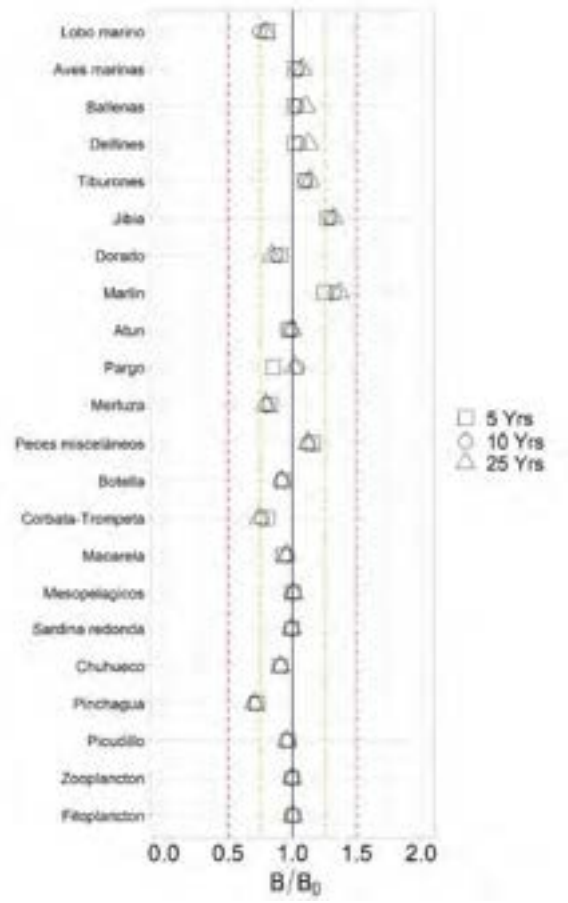

Figure 61. Relative changes in biomass of functional groups when simulating target fishing mortality in all small pelagic stocks simultaneously using Ecosim. Square, circle and triangle indicate, respectively, 5, 10 and 25 years of simulation; Yellow lines = ±25% change; Red lines = ±50% change; B0=unexploited biomass (Neira et al, 2022).

There is no substantial evidence that the fishery has a significant negative impact on the marine ecosystem. F.3.2 is met.

F3.3 If one or more of the species identified during species categorisation plays a key role in the marine ecosystem, additional precaution is included in recommendations relating to the total permissible fishery removals.

Neira et al (2022) revealed that the major system fluxes of mass/energy of the ecosystem, apart the plankton, were through "other miscellaneous small fishes" and "mesopelagics" and the Pacific chub mackerel. Pacific chub mackerel is currently the indicator species of the small pelagic fishery, meaning that the level of fishing effort is adjusted for the entire small pelagic fishery, based on the stock status of the indicator and biological reference points of Pacific chub mackerel.

There are several fishery closures established for small pelagic fishery (*vedas de clara*, reproduction closure, recruitment closure) to ensure the sustainability of the activity.

Although the fishery has no major negative impact on ETP species, habitat and ecosystem, FIP (2022) pointed pointes several measures in place related to their protection, as well to bycatch of small pelagic fishery:

"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 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."

(…)

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 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.

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 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).

(…)

In relation with bycatch the FMP and NPOA recommended:

• 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". **If one or more of the species identified during species categorisation plays a key role in the marine ecosystem, additional precaution is included in recommendations relating to the total permissible fishery removals. F3.3 is met.**
References FIP. 2022. Fishery Improvement Project progress report - fourth year - October 2022. https://www.marin-trust.com/sites/marintrust/files/2022-10/SPS-FIP%20PROGRESS%20REPORT%20FOURTH%20YEAR%20%28OCT%202022%29.pdf Neira, S., Arriaga, A., Olea, G. and Espíndola, M. 2022. Informe final. Evaluación del impacto de la pesquería de Pelágicos pequeños con red de cerco en el ecosistema marino de Ecuador. https://drive.google.com/file/d/1E4vbBv6FZPM7zM89FXaLMkPAOStsghVV/view

Links	
MarinTrust Standard clause	1.3.3.3
FAO CCRF	7.2.2 (d)
GSSI	D.2.09, D3.10, D.6.09

SOCIAL CRITERION

In addition to the scored criteria listed above, applicants must commit to ensuring that vessels operating in the fishery adhere to internationally recognised guidance on human rights. They must also commit to ensuring there is no use of enforced or unpaid labour in the fleet(s) operating upon the resource.

Appendix A - Determining Resilience Ratings

The assessment of Category B species described in this assessment report template utilises a resilience rating system suggested by the American Fisheries Society. This approach was chosen because it is also used by FishBase, and so the resilience ratings for many thousands of species are freely available online. As described by FishBase, the following is the process used to arrive at the resilience ratings:

"*The American Fisheries Society (AFS) has suggested values for several biological parameters that allow classification of a fish population or species into categories of high, medium, low and very low resilience or productivity (Musick 1999). If no reliable estimate of r_m (see below) is available, the assignment is to the lowest category for which any of the available parameters fits. For each of these categories, AFS has suggested thresholds for decline over the longer of 10 years or three generations. If an observed decline measured in biomass or numbers of mature individuals exceeds the indicated threshold value, the population or species is considered vulnerable to extinction unless explicitly shown otherwise. If one sex strongly limits the reproductive capacity of the species or population, then only the decline in the limiting sex should be considered. We decided to restrict the automatic assignment of resilience categories in the Key Facts page to values of K, t_m and t_{max} and those records of fecundity estimates that referred to minimum number of eggs or pups per female per year, assuming that these were equivalent to average fecundity at first maturity (Musick 1999). Note that many small fishes may spawn several times per year (we exclude these for the time being) and large live bearers such as the coelacanth may have gestation periods of more than one year (we corrected fecundity estimates for those cases reported in the literature). Also, we excluded resilience estimates based on r_m (see below) as we are not yet confident with the reliability of the current method for estimating rm. If users have independent r_m or fecundity estimates, they can refer to Table 1 for using this information*."

Parameter	High	Medium	Low	Very low
Threshold	0.99	0.95	0.85	0.70
r_{max} (1/year)	> 0.5	0.16 - 0.50	0.05 - 0.15	< 0.05
K (1/year)	> 0.3	0.16 - 0.30	0.05 - 0.15	< 0.05
Fecundity (1/year)	> 10,000	100 - 1000	10 - 100	< 10
t_m (years)	< 1	2 - 4	5 - 10	> 10
t_{max} (years)	1 - 3	4 - 10	11 - 30	> 30

[Taken from the FishBase manual, "Estimation of Life-History Key Facts", http://www.fishbase.us/manual/English/key%20facts.htm#resilience]