MSC Use of the Risk-Based Framework (RBF) in a Fishery Assessment v3.1

FISHERY NAME:
PATAGONIAN SCALLOP (Zygochlamys patagonica) BOTTOM OTTER TRAWL FISHERY IN ARGENTINE SEA
3RD RE-ASSESSMENT

CERTIFICATION BODY:
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Table 1 – Fishery information	
1	**Fishery name**
	Patagonian scallop (*Zygochlamys patagonica*) bottom otter trawl fishery in Argentine Sea.
2	**CAB**
	Organización Internacional Agropecuaria (OIA)
3	**Date that the proposal to use the RBF is submitted to the MSC**
	04 January 2023
4	**Date stakeholder comment period closes on the proposal to use the RBF**
	03 February 2023 at 17:00 UTC.
5	**PI that the RBF is to be applied for**
	PI 1.1.1 stock status
6	**Justification for use**
	According 7.7.3 and Table 3 of FCP v2.2, during the peer review stage, it was identified that there are no available stock status reference points, derived either from analytical stock assessment or using empirical approaches for target species (Patagonian scallop - *Zygochlamys patagonica*). Therefore, the team shall undertake two RBF methologies for PI 1.1.1 as Consequence Analysis (CA) and Productivity Susceptibility Analysis (PSA). OIA welcome to any stakeholders that could review preliminar/proposal RBF analysis results available in Annex 1 of this announcement in order to agree or reject potential risk scores provided by the team. Additional information to increase or reduce scores could be provided using the 'MSC Template for Stakeholder Input into Fishery Assessments' (available here: https://www.msc.org/what-you-can-do/engage-with-a-fishery-assessment). If you need more detail about draft results, please contact OIA. The team plans to conduct an additional RBF remote workshop scheduled in February 6th, 2023 through Microsoft Team. In order to ensure the effective participation, relevant stakeholders will be contacted directly by email after the fishery announcement to invite them to the RBF meeting. OIA invite to all stakeholder interested in participate. For more information about RBF methology, please see http://www.msc.org/aboutus/standards/methodologies/fam/msc-risk-based-framework.

A key purpose of the site visit is to collect information and speak to stakeholders with an interest in the fishery. For those parts of the assessment involving the MSC's Risk-Based Framework (RBF, see msc.org), we will be using a stakeholder-driven, qualitative and semi-quantitative analysis during the site visit. To achieve a robust outcome from this consultative approach, we rely heavily on participation of a broad range of stakeholders with a balance of knowledge of the fishery. We encourage any stakeholders with experience or knowledge of the fishery to participate in these meetings

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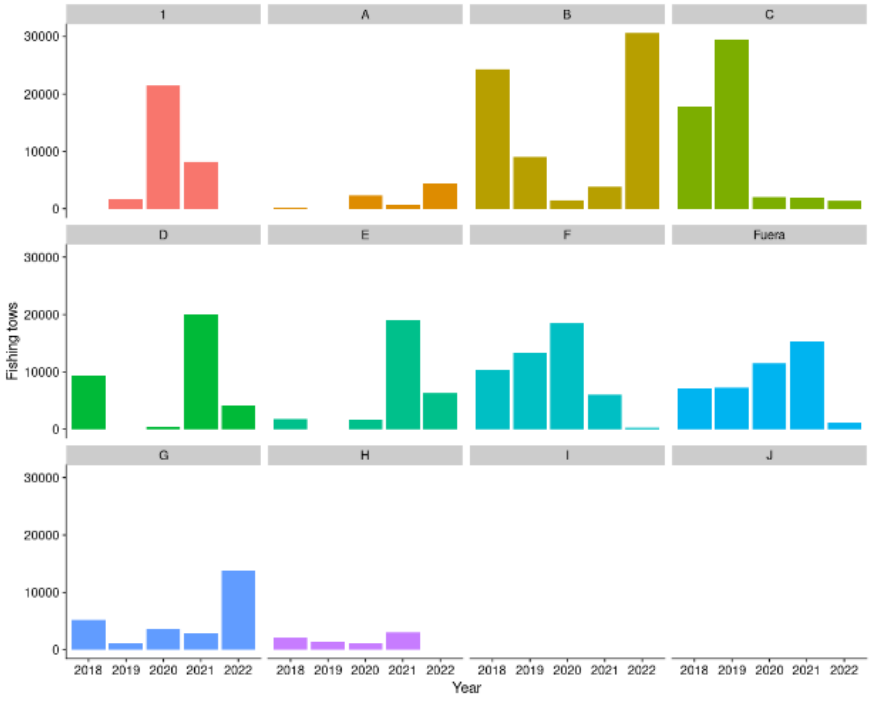
Annex 1 – RBF methologies for PI 1.1.1 (Draft results)

Table 2. Consequence analysis for PI 1.1.1

	Scoring element	Consequence subcomponents	Consequence score
Principle 1: Stock status outcome	*Zygochlamys patagonica*	Population size	60
		Reproductive capacity	
		Age/size/sex structure	
		Geographic range	
Rationale for most vulnerable subcomponent	Population size was considered the most vulnerable subcomponent based in the impact of exploitation patterns on biomass.		
Rationale for consequence score	Fishery-dependent information composed by spatial fleet activity, fishing effort, exploitation rates per MU, CPUE by vessel, indicate that the fishing intensity are variable without an evident downtrend. However, surveys in the main MUs that provide biomass estimation, distribution of commercial and pre-commercial sizes used to define the TAC and areas opened-closed to fishing, indicate that a downtrend in biomass in some MU, stable in others in a context of highly variable and patchy recruitment. Then, even when some indicators are fluctuating around a mean value considering 25 years of activity, it cannot be concluded there is no strong evidence to support that the information available can provide that the impact of the fishery on population size is minimal or its impact on population dynamics is none. The main weakness is the lack of reference points that can indicate the state of recruitment in whole stock. Indicators used are: • Fleet activity: Fishing effort alternate between the different MUs in relation with the TAC stablished in the harvest strategy.  *Fig. 1. Annual fishing effort by MU.*		

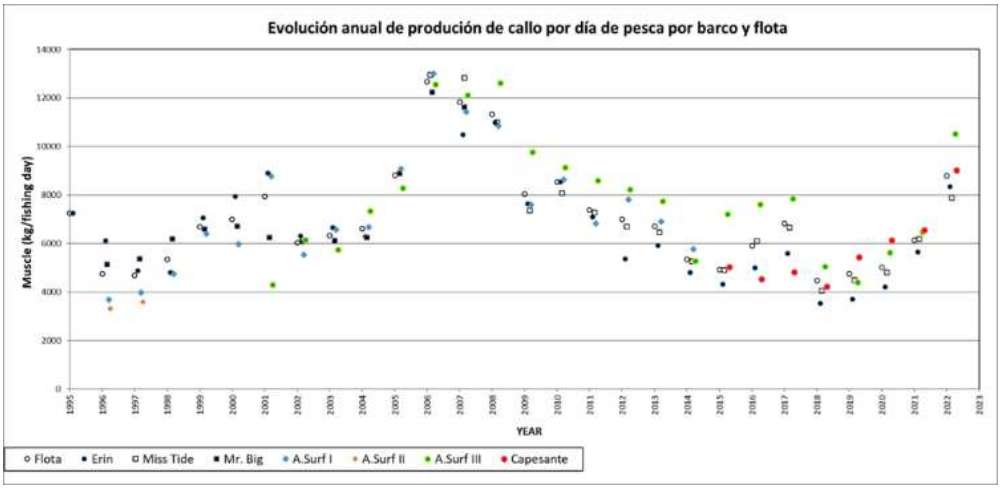
	The general picture of CPUE trend shows a peak around 2006-2009 as result of the recruitments of 1999-2000 and 2000-2001. When these cohorts reach the maximum biomass, it is followed by a downtrend when the strong cohort gradually vanish. Excluding the highly abundant years, the mean value is similar before and after such period.  *Fig. 2. Mean muscle production per day and vessel during the period 1995 – 2021.* • Exploitation rates: Management is based in the exploitation rate of 40% of lower confidence interval of commercial biomass in a survey-based information. Exploitation rates have been maintained generally at consistent levels with this management target which is considered that will not pose a risk on the productivity of the scallop population or the recruitment. However, such rate is generic, and no recruitment index is available to determine if some downtrend exists and if the PRI is reached. • Fishing areas: Each MU is managed independently, with a TAC for ad hoc designed polygon inside it. The open-close rule is defined by size composition (Z index), density and TAC. This approach was considered appropriate, but the irregularity of recruitment could produce increment in the TAC determined by the income of previously recruited cohorts to legal size without density of precommercial sized scallops. The lack of an operational model unable to determine if trends in catches indicate that biomass removed has been kept below any levels that could have an effect on population dynamics.

Table 3. Productivity Susceptibility Analysis (PSA).

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Bivalvia – Pectinidae – *Zygochlamys patagonica*	
Attribute	Rationale	Score
Average age at maturity	The average size at maturity has been determined at different latitudes, being 36 mm TL at 39° S (Campodónico *et al.,* 2008, 2009) and 45 mm in the range between 40° and 54° S (Waloszek & Waloszek 1986). Thus, the legal commercial size of the Patagonian scallop (55 mm TL) is reached between 3 and 5 years of age, depending on the latitudinal location, and allows for at least two consecutive spawnings (Campodónico *et al.,* 2008). Therefore, the age of first maturity is estimated before 5 years of age. References cited in https://ojs.inidep.edu.ar/index.php/mafis/article/view/126/173	**1**
Average maximum age	According Lomovasky *et al.* (2008, 2011) (cited in Campodónico *et al.,* 2019), the average maximum age varied between 13 and 25 years. https://ojs.inidep.edu.ar/index.php/mafis/article/view/126/173	**2**

Fecundity	Sea scallops are among the most fecund of bivalves, producing gametes starting in the first or second year and eventually producing up to 270 million eggs (Langton *et al.* 1987, cited in Hart & Chute, 2004).	**1**
Average maximum size Not scored for invertebrates	N/A	**N/A**
Average size at maturity Not scored for invertebrates	N/A	**N/A**
Reproductive strategy	Spawning generally occurs synchronously when males extrude sperm and the females release eggs in masse into the water, but it may occur over a more protracted period of time depending on environmental conditions. It has been suggested that year-class strength may correlate with the degree of spawning synchrony, rather than fecundity per se (Langton *et al.* 1987, cited in Hart & Chute, 2004).	**1**
Trophic level	According Sun *et al.* (2020), scallop has a trophic level of 2.06.	**1**
Density dependence Invertebrates only	Density-dependence in scallop meta-populations is likely to be significant only during benthic stages. Most density-dependent interactions have small operational scales, as individuals are influenced only by their neighbours (Orensanz *et al.,* 1998). The small-scale spatial structure and concentration profiles of scallop populations have implications for density-dependent processes. Density-dependence can be compensatory or depensatory. In the first case, the per capita reproductive contribution decreases at higher densities, a result of increased competition for resources, slower growth, less energy available for reproduction, and increased mortality. In depensatory density-dependence (also known as inverse density-dependence or 'Allee effects'), the reproductive contribution per capita decreases as density decreases. This is the case for fertilisation rate in broadcast spawners: the fewer neighbours around, the lower the chances of fertilisation. Claereboudt (1999) developed a spatially explicit, 3D, diffusion, and fertilisation simulation model inspired by a scallop example, showing the effects of sperm limitation; fertilisation and gamete production declined linearly with density. The dynamics of fertilisation-related Allee effects in relation to the spatial distribution of spawners were further investigated by Lundquist & Botsford (2004). Smith & Rago (2004) used Claereboudt's model to explore the potential effects of density-dependent fertilisation in sea scallop; their results suggest that egg production increased by several orders of magnitude since closed areas were established on Georges Bank (1994) and the Mid-Atlantic region (1998) (see 'Protected Areas' section). References cited in Orensanz *et al.* (2016)	**3**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	N/A	
Attribute	Rationale	Score
Areal Overlap	Alberti (2020) analyzed the spatial distribution of scallop bottom trawl (i.e. total area trawled, without considering possible overlaps between trawls) and habitat (i.e. bottom trawl, discounting overlap), also considering the return intervals for each UM, in the period 2012-2019. The maximum bottom trawl area was 21.3% in UM F, while most units, except D and E remained below 10% (See Figures 19 and 20).	**2**

	Therefore, the risk score that overlap of the fishing effort with a species concentration of the stock is 2.	
Encounterability	According the MSC Fisheries Certification Process v2.2, the risk score that the position of the stock/species within water column relative to the fishing gear, and the position of stock/species within habitat relative to the position of the gear is 3 by Default score for target species (Principle 1).	**3**
Selectivity of gear type	Escolar *et al.* (2018) analyzed the invertebrate bycatch composition in the scallop fishery. The unwanted catch represented between 23.87 and 63.71% of total catch. Schejter *et al.* (2020) estimated that the percentage of non-commercial scallop was similar to that commercial size (22.3%). Kittlein (2022) observed that the percentage of commercial scallop on the contrary registered an increase in the fishing nets from 28% to 35% between the first and the last 4 years of the history of the fishery. Although it is possible that the variation in the state of the resource affects this pattern (due to a greater availability of commercial size scallops), the record of recruitment events of magnitude in the intervening years (Campodónico *et al.* 2019), has not affected this trend. Taking into account this information, individuals < size at maturity are regularly caught and a risk score of 2 is given.	**2**
Post capture mortality	According the MSC Fisheries Certification Process v2.2, the risk score that the chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival is 3 by Default score for retained species (Principle 1).	**3**
Catch (weight) Only where the scoring element is scored cumulatively	N/A	**N/A**

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Scientific name	Family name	Common name	Species type	Fishery descriptor	Productivity								Susceptibility				MSC PSA-derived score	Consequence Score (CA)
					Average age at maturity	Average max age	Fecundity	Average max size	Average size at maturity	Reproductive strategy	Trophic level	Density dependance	Availability	Encounterability	Selectivity	Post-capture mortality		
Zygochlamys patagonica	Pectinidae	Patagonian scallop	Invertebrate	Bottom otter trawl	1	2	1	n/a	n/a	1	1	3	2	3	2	3	87	60
													Final MSC score				**74**	
													Status				**Pass with condition**	