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CONSEQUENCE SPATIAL ANALYSIS (CSA)

FOR THE PATAGONIAN SHRIMP (*Pleoticus muelleri*) ONSHORE BOTTOM-TRAWLING FISHERY THAT TAKES PLACE IN WATERS OF THE PROVINCE OF CHUBUT

Contents

CONDUCTING A CONSEQUENCE SPATIAL ANALYSIS (CSA)

INTRODUCTION

In light of the MSC requirements for the certification of the Patagonian shrimp on-shore fishery, as pertaining to Principle 2 about environmental impacts of the fishery, it is necessary to perform a risk analysis of the interactions of the fishery with the habitat. In this case, the method described in chapter PF of the MSC Certification Requirements v2.0 will be used (Conducting a consequence spatial analysis (CSA) – pag. 89).

The analysis includes four steps and implies the allocation of scores to those attributes established by the standard, which are specified in each one of the tables that will appear throughout the document. The steps are the following:

- **Step 1: Defining the habitat:** The habitat is described including features such as type of substratum, geomorphology and biota characteristics.
- **Step 2. Scoring of Consequence Atributtes:** The productivity of the habitat and the interaction of the fishing gear with the habitat are taken into account.
- **Step 3. Scoring of Spatial Atributtes:** The fishing gear's footprint, spatial overlap and the likelihood of the fishing gear encountering the habitat are considered here.
- **Step 4. Final Score:** Once steps 1-3 have been performed, the scores of each atributte are included in the Excel spreadsheet approved by the MSC in order to obtain the final score – **PI 2.4.1 CS.**

1. HABITAT DEFINITION

1.1 Define habitat according to type of substratum, geomorphology and biota characteristics.

The Patagonian shrimp (*Pleoticus muelleri*) onshore fishery in waters of the province of Chubut is linked to sea bottoms with substratum composed of fine sediments, such as sand or mud. The geomorphology of these seabeds is flat, with a surface of simple structure and low-encrusting invertebrate communities (Bastida , Roux, & Martinez, 1992).

Table 1. PF9: SGB habitat nomenclature. Pg. 90. (MSC, 2014)

Substratum	Geomorphology	Biota
Fine (mud, sand) • Mud (0.1 mm) • Fine sediments(0.1-1 mm) • Coarse sediments (1-4 mm)	Flat • Simple surface structure • Unrippled/flat • Current rippled/directed scour • Wave rippled	Large erect Dominated by: • Large and/or erect sponges • Solitary large sponges • Solitary sedentary/sessile epifauna (e.g., ascidians/ bryozoans) • Crinoids • Corals • Mixed large or erect communities
Medium • Gravel/pebble (4-60 mm)	Low relief • Irregular topography with mounds and depressions • Rough surface structure • Debris flow/rubble banks	Small erect/ encrusting/burrowing Dominated by: • Small, low-encrusting sponges • Small, low-standing sponges • Consolidated (e.g., mussels) and unconsolidated bivalve beds (e.g., scallops) • Mixed small/low-encrusting invertebrate communities • Infaunal bioturbators
Large • Cobble/boulders (60 mm - 3 m) • Igneous, metamorphic, or sedimentary bedrock (>3 m)	Outcrop • Subcrop (rock protrusions from surrounding sediment <1 m) • Low-relief outcrop (<1 m)	No fauna or flora • No apparent epifauna, infauna, or flora
Solid reef of biogenic origin • Biogenic (substratum of biogenic calcium carbonate) • Depositions of skeletal material forming coral reef base	High relief • High outcrop (protrusion of consolidated substrate >1 m) • Rugged surface structure	Flora Dominated by: • Seagrass species

1.2. Classification of Biome, Sub-biome and their features

The Biome types suggested by the standard are determined by the depth at which the catch of the target species occurs. The Patagonian shrimp onshore fishery in Rawson interacts with two different biomes: a) **coast** (0-25m) and b) **shelf** (25-200m). The Sub-biome is more specific, the fishery is linked to two sub-biomes: a) **coastal margin** that includes the first 25 m depth (<25m) and b) **inner-shelf** (25-100m). The features of these biomes and sub-biomes are of the sediment plains type.

According to the last report from the FIP's Onboard Observers Program for the 2015-2016 fishing season, the depth of catch was between 20.8 and 62.5m in the period December 2015 -- April 2016 (CeDePesca & FCN - UNPSJB, 2016), and between 25 and 78m from October - December 2016. (CeDePesca, 2016)

Table 2.PF10: List of example biomes, sub-biomes, and features. Pg. 91. (MSC, 2014)

Biome	Sub-biome	Feature
Coast (0-25 m)	Coastal margin (<25 m)	Seamounts
Shelf (25-200 m)	Inner shelf (25-100 m)	Canyons
Slope (200-2,000 m)	Outer shelf (100-200 m)	Abyss
Abyss (>2,000 m)	Upper slope (200-700 m)	Shelf break (~150-300 m)
	Mid-slope (700-1,500 m)	Sediment plains
		Sediment terraces
		Escarpments
		Plains of scattered reef
		Large rocky banks

2. CONSEQUENCE ATTRIBUTES

The consequence attributes are divided into two groups: Habitat-productivity attributes and gear-habitat interaction attributes. Each group contains, in turn, several attributes that will receive a specific score.

Table 3. PF11: Consequence attributes. Pg. 91. (MSC, 2014)

Habitat-productivity attributes	Gear-habitat interaction attributes
1. Regeneration of biota	1. Removability of biota
2. Natural disturbance	2. Removability of substratum
	3. Substratum hardness
	4. Substratum ruggedness
	5. Seabed slope

2.1 Habitat Productivity

2.1.1. Regeneration of Biota

This attribute receives a score according to the recovery rate of the biota associated with the habitat using available data about age, growth and recolonization. In the case of absence of specific data, as in this case, scores are assigned using proxies as suggested by the standard.

Studies have been performed to identify the invertebrate fauna related to the sea bottoms where the Patagonian shrimp catch takes place. In 1997, Roux and Fernández carried out a survey, trying to identify the features of the Patagonian shrimp fishing grounds in the San Jorge Gulf and the Patagonian coastline. This survey showed that the benthic invertebrate fauna related to the fishing grounds included communities of molluscs, echinoderms, polychaetes, bryozoans, coelenterates, sponges, algae, nemertea, brachiopod, echiura and chordata. Currently, the identification of the bycatch of the coastal Patagonian shrimp fishery in Rawson has confirmed the description made in that survey. Indeed, the FIP's Onboard Observers Program found that the benthic invertebrate fauna includes algae, tunicates, sponges, cnidarians, echinoderms, annelids and crustaceans. (CeDePesca & FCN - UNPSJB, 2016).

Table 4. Description of the invertebrate by-catch, rate of ocurrence per group or species, rate of ocurrence per abundance category: Do (dominant), Ab (abundant), Co (common), Ra (rare) y MRa (very rare) and rate of ocurrence (CeDePesca & FCN - UNPSJB, 2016)

	Nombre cientifico	Grupos/Especies	nro registro	FO	do	ab	co	ra	mr	Encaj.	Parc. Encaj.	Desc.
		Algas	53	22.84				62.3	37.7			100
Urocordados	Tunicados	Ascidias	230	99.14	0.4	3.5	27.4	47.8	20.9			100
Poriferos		Esponjas	72	31.03				50.0	50.0			100
	Tedania sp.	Esponja Amarilla	18	7.76				83.3	16.7			100
Cnidarios		Medusa	1	0.43				100				100
		Anemona	34	14.66				64.7	35.3			100
Equiuridos		Equiurido	14	6.03				100				100
Anelidos		Tubos y gusanos poliquetos	46	19.83				60.9	39.1			100
	Aphrodita longicornis	Raton de mar	38	16.38				57.9	42.1			100
Equinodermos	*Arbacia dufresnei*	Erizo Verde	17	7.33				94.1	5.9			100
		Pepinos de mar	11	4.74			9.1	72.7	18.2			100
		Estrella	49	21.12				10.2	87.8			100
		Estrella Amarilla	1	0.43					100			100
	Calyptraster sp.	Estrella carnosa	7	3.02					100			100
	Comasterias lurida	Estrella comasteria	14	6.03				42.9	57.1			100
	Acodontaster sp.	Estrella Gris	20	8.62				30.0	70.0			100
		Estrella Naranja	53	22.84				34.0	66.0			100
	Paronia sp.	Estrella Roja	1	0.43					100			100
	Odontasteridae	Estrella sheriff	8	3.45				12.5	87.5			100
Moluscos - Bivalvos		Almeja	45	19.40			8.9	57.8	33.3			100
		Vieira	2	0.86					100			100
Moluscos - Gasteropodo		Caracol	1	0.43					100			100
		Nudibranquio	47	20.26				61.7	38.3			100
		Fisurela	16	6.90				100				100
Moluscos - Cefalopodos	*Illex argentinus*	Calamar	74	31.90			9.5	75.7	14.9			100
	Loligo sp.	Calamarete	178	76.72			1.7	74.2	24.2	1.1	3.4	95.5
	Semirossia tenera	Sepia	1	0.43					100			100
		Pulpo colorado	1	0.43				100				100
	Octopus tehuelche	Pulpito	7	3.02				28.6	71.4	14.3		85.7
		Pulpo	9	3.88					100			100
		Pulpo de dos hileras	10	4.31					100			100
		Pulpo de una hilera	10	4.31				10.0	90.0			100
Crustacea												
Stomatopoda	*Pterygosquilla armata armata*	Heterosquilla armata	1	0.43					100			100
Decapoda - Dendrobranchiata	*Pelsos petrunkevitchi*	Peiso	20	8.62	10.0	20.0	30.0	40.0				100
	Pleoticus muelleri	Langostino	232	100	90.0	6.5	3.4			99.6	0.4	
Decapoda - Anomura	*Munida subrugosa*	Bogavante	36	15.52				38.9	61.1			100
Decapoda - Brachyura	*Libidoclea granaria*	Cangrejo araña	127	54.74			0.8	42.5	56.7			100
	Leurocyclus tuberculosus	Cangrejo araña chato	23	9.91				8.7	91.3			100
	Eurypodius latreillei	Cangrejo araña peludo	12	5.17				33.3	66.7			100
	Ovalipes trimaculatus	Cangrejo Nadador	84	36.21			1.2	28.6	70.2			100
	Peltarion spinosulum	Cangrejo Tractor	23	9.91				65.2	34.8			100
	Platyxanthus patagonicus	Necora	183	78.88			0.5	42.1	57.4			100
	Rochinia gracilipes	Cangrejo Rochinia	4	1.72					100			100

Table 5. PF12: Scoring regeneration of biota based on age, growth, and recolonisation of biota.93p. (MSC, 2014)

Sub-biome	Using available data			Using surrogate when data are not available					
	Annual	Less than decadal	More than decadal	No epifauna	Small erect/ encrusting	Large erect (sponges)	Large erect (ascidians and bryozoans)	Seagrass communities/ mixed faunal communities/ hard corals	Crinoids/ solitary/mixed communities/ hard and soft corals
Coastal margin (<25 m)	1	2	3	1	1	1	1	2	1
Inner shelf (25-100 m)	2	3	4	2	2	2	2	2	2
Outer shelf (100-200 m)	1	2	3	1	1	3	2	3	3
Upper slope (200-700 m)	1	2	3	1	1	3	3	3	3
Mid-slope (700-1,500 m)	1	2	3	1	2	3	3	3	3

- In the **coastal margin sub-biome,** with presence of small low-encrusting biota, the category corresponds to "small erect/ encrusting" in the table. Therefore, it receives a **score of 1.**
- In the **inner shelf sub-biome**, with presence of small low-encrusting biota, the category corresponds to "small erect/ encrusting" in the table. Therefore, it receives a **score of 2.**

2.1.2 Natural Disturbances

Biota susceptible to natural disturbances, typical of the associated habitat, has the intrinsic capacity of recovering at a faster or slower rate. Such disturbances are due to factors such as tides, local currents, storms or waves. The habitat depth is the key factor that determines to what extent the biota could be affected.

Gulfs and peninsulas located in the Patagonian area work as "sediment traps", due to the huge hydraulic energy produced by the action of the wide tides that influence the shelf. The coastal zone of the Argentine continental shelf is under the influence of the Patagonian current that flows between the Malvinas current and the coast. The Patagonian current is a stable water mass, whose water temperatures range between 5° and 16ºC and its salinity between 33 and 33.55. (Bastida , Roux, & Martinez, 1992).

Instead, the area of the Argentine continental shelf located between Tierra de Fuego and the Valdez Peninsula is considered as a transition area because it is under the strong influence of the Patagonian Sub Antarctic current. (Bastida , Roux, & Martinez, 1992)

Table 6. PF13: Scoring natural disturbance. Pg. 94. (MSC, 2014)

Attribute	Score		
	1	2	3
Natural disturbance	Regular or severe natural disturbance	Irregular or moderate natural disturbance	No natural disturbance
Natural disturbance (in absence of information)	Coastal margin and shallow inner shelf (<60 m)	Deep inner shelf and outer shelf (60-200 m)	Slope (>200 m)

In this case, we take the attribute as described in absence of specific information, where the scores for natural disturbances in the coastal margin and the inner-shelf is as follows:

- **Coastal margin**: Coastal margin and shallow inner shelf (<60 m), for a **score of 1.**
  → Shrimp catch records during the 2015-2016 fishing season were composed of sets conducted between 20.8 – 55.2m depth. (CeDePesca & FCN - UNPSJB, 2016)
- **Inner shelf:** Deep inner shelf and outer shelf (60-200m), for a **score of 2**
  → Shrimp catch records during the 2015-2016 fishing season were composed of sets conducted between 60.7 – 78m. (CeDePesca, 2016)

2.2 Interaction of habitat with the fishing gear

2.2.1. Removability of biota

This attribute receives a score depending on the likelihood of the attached biota receiving an impact, being removed or killed due to the interaction with the fishing gear. The biota's vulnerability to the fishing gear depends on features such as its weight, size, robustness, flexibility and species complexity. Thus, those organisms that are big, erect, inflexible or delicate are more vulnerable to removability or to physical damage than small, flexible or burrowing organisms.

Table 7. PF14: Scoring the removability of biota attributes. Pg. 95. (MSC, 2014)

Gear type	Removability of biota		
	Low, robust, small (<5 cm), smooth, or flexible biota OR robust, deep-burrowing biota	Erect, medium (<30 cm), moderately rugose, or inflexible biota OR moderately robust, shallow-burrowing biota	Tall, delicate, large (>30 cm high), rugose, or inflexible biota OR delicate, shallow-burrowing biota
Hand collection	1	1	1
Demersal longline	1	1	2
Handline	1	1	2
Trap	1	2	2
Bottom gill net or other entangling net	1	2	3
Danish seine	1	2	3
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)	1	3	3
Dredge	3	3	3

Considering that the biota associated to fishing grounds both in the coastal margin as well as in the inner shelf includes a mix of small low-encrusting invertebrate communities (see sections 1.1 and 2.1.1) and the fact that the catch is performed using demersal trawls, the score for this attribute is:

- **Coastal margin**: it receives a **score of 1.**
- **Inner shelf:** it receives a **score of 1.**

2.2.2. Removability of substratum

The scoring of this attribute relates to the fragments of rock or grain that result from the breaking of larger rocks, and the likelihood of the substratum being moved. Fine sediments are more vulnerable to impacts because they are easier to be moved at the time of the impact; however, their resilience is bigger than those substratums that include rock fragments and sessile fauna that can be more easily affected. The cumulative capacity of the fine substratum seabeds and the presence of endobenthos fauna (buried) makes them more resistant.

Some studies (Roux & Fernandez, 1997) claimed that the shrimp fleet that operates in the San Jorge Gulf and the coastline of the Chubut province, neither has an impact on the sedimentological composition nor on the associated fauna there established. Data gathered by the researchers indicate that "the seabed is similar to those found in other fishing grounds from different seas". Moreover, they claim that the seabeds present "normal characteristics to be expected given the shrimp fishing activities". However, according to the analysis methodology, given the high likelihood of removability of substratum, it is considered high risk.

Table 8. PF14: Scoring the removability of substratum attributes. Pg. 95. (MSC, 2014)

Gear type	Removability of substratum		
	Immovable (bedrock and boulders >3 m)	<6 cm (transferable)	6 cm - 3 m (removable)
Hand collection	1	1	2
Demersal longline	1	1	1
Handline	1	1	1
Trap	1	1	1
Bottom gill net or other entangling net	1	1	1
Danish seine	1	2	3
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)	1	3	3
Dredge	1	3	3

Bearing in mind that the Patagonian shrimp catch is performed using demersal trawls both in the coastal margin as well as in the inner shelf, with sub-biomes with flat geomorphology of fine sediments, the type of grain being small in size (see sections 1.1 and 1.2) the scoring of this attribute is:

- **Coastal margin**: it receives a **score of 3.**
- **Inner shelf:** it receives a **score of 3.**

2.2.2. Substratum Hardness

The scoring of this attribute depends on the substratum composition. Here we consider if the seabed will degrade or not when it interacts with the fishing gear. It is to be expected that those substratums with hard/rocky seabeds will be more resistant to the impact.

The Argentine continental shelf presents fine and medium sands. In some places there are high percentages of gravel and bioclasts (<2mm) derived from different invertebrate groups (Bastida , Roux, & Martinez, 1992).

In the area between the Valdez Peninsula and parallel 49°S, the sediment includes wide diversity of bioclasts, mostly those derived from molluscs and bryozoans (Bastida , Roux, & Martinez, 1992).

Therefore, these are soft beds where molluscs, polychaetes, echinoderms and crustaceans are abundant. In the area corresponding to the Chubut coastline, gravel and sand are predominant, of medium coarse composition, favoring the establishment of benthic fauna with the predominance of bryozoans, sponges and coelenterates.

Table 9. PF15: Scoring the substratum hardness attributes. Pg. 97. (MSC, 2014)

Gear type	Substratum hardness		
	Hard (igneous, sedimentary, or heavily consolidated rock types)	Soft (lightly consolidated, weathered, or biogenic)	Sediments (unconsoli-dated)
Hand collection	1	2	3
Demersal longline	1	2	3
Handline	1	2	3
Trap	1	2	3
Bottom gill net or other entangling net	1	2	3
Danish seine	1	2	3
Demersal trawl (including, pair, otter twin-rig, and otter multi-rig)	1	2	3
Dredge	1	2	3

The Patagonian shrimp catch takes place using demersal trawls in the coastal and inner shelf sub-biomes. The plains contain fine particle sediments (see sections 1.1 and 1.2). Therefore, the scoring for this attribute is:

- **Coastal margin**: it receives a **score of 3.**
- **Inner shelf:** it receives a **score of 3.**

2.2.3. Substratum Ruggedness

The scoring of this attribute is based on the features of the relief, the ruggedness and seabed slope. Thus, rugged seabeds and steep slope seabeds are less accessible to the fishing gear.

The Argentine continental shelf presents a simple topography before the 100m depth, where it becomes more complex. The Patagonian shelf presents undulations in areas where sands are predominant and less ruggedness in comparison with the shelf in Tierra de Fuego, where more relief types are to be found, with steep slopes and periglacial formations (Roux & Fernandez, 1997).

Table 10. PF15: Scoring the substratum ruggedness attributes. Pg. 97. (MSC, 2014)

Gear type	Substratum ruggedness		
	High relief (>1 m), high outcrop, or rugged surface structure (cracks, crevices, overhangs, large boulders, rock walls)	Low relief (<1.0 m), rough surface structure (rubble, small boulders, rock edges), subcrop, or low outcrop	Flat, simple surface structure (mounds, undulations, ripples), current rippled, wave rippled, or irregular
Hand collection	3	3	1
Demersal longline	2	3	3
Handline	2	3	3
Trap	2	3	3
Bottom gill net or other entangling net	2	3	3
Danish seine	1	1	3
Demersal trawl (including, pair, otter twin-rig, and otter multi-rig)	1	3	3
Dredge	1	1	3

As the Patagonian shrimp catch takes place in seabeds without slope – categorized as *sediment plains* (see section 1.2) the scoring for this attribute in the coastal margin and inner shelf is:

- **Coastal margin**: it receives a **score of 3.**
- **Inner shelf:** it receives a **score of 3.**

2.2.4 Seabed Slope

The scoring of this attribute considers the impact on the habitat resulting from the slope steepness and mobility of the substratums after the interaction with the fishing gear. The degree of slope is taken into account.

The Argentine continental shelf is mostly homogenous, presenting smooth slopes, channels and ridges, whose origin is probably due to the presence of submarine coastlines in former times (Bastida , Roux, & Martinez, 1992).

Table 11. PF15: Scoring the seabed slope attributes. Pg. 97. (MSC, 2014)

Gear type	Seabed slope		
	Low degree (<1): Plains in coastal margin, inner or outer shelf or mid-slope OR terraces in mid-slope OR rocky banks/ fringing reefs in coastal margin, inner or outer shelf, or upper or mid-slope	Medium degree (1-10): Terraces in outer shelf or upper slope	High degree (>10): Canyons in outer shelf, or upper or mid-slope OR seamounts/ bioherms in coastal margin, inner shelf, or upper or mid-slope
Hand collection	1	2	3
Demersal longline	1	2	3
Handline	1	2	3
Trap	1	2	3
Bottom gill net or other entangling net	1	2	3
Danish seine	1	2	3
Demersal trawl (including, pair, otter twin-rig, and otter multi-rig)	1	2	3
Dredge	1	2	3

As the shrimp catch occurs in the coastal margin and inner shelf, where there is no slope in the continental shelf (see section 1.2.), the scoring for this attribute in the sub-biomes mentioned here above is:

- **Coastal margin**: Low degree of slope in the seabed (<1), plains in the coastal margin. It receives a **score of 1.**
- **Inner shelf:** Low degree of slope in the seabed (<1), plains in the inner shelf. It receives a **score of 1.**

3. SPATIAL ATTRIBUTES

Depending on the fishing gear used, the standard classifies the number of encounters needed to cause an impact.

According to the standard, in the case of the Patagonian shrimp onshore fishery that uses demersal trawls both in the coastal margin as well as in the inner shelf, the number of encounters needed to cause impact would be:

- **Coastal margin**: A single encounter is needed to cause impact.
- **Inner shelf:** A single encounter is needed to cause impact.

Table 12. GPF10: Number of encounters needed to cause impact. Pg. 333.

Gear type	Many encounters needed to cause impact	Some encounters needed to cause impact	Single encounter needed to cause impact
Hand collection	✓		
Handline	✓		
Demersal longline		✓	
Bottom gill net or other entangling net		✓	
Danish seine		✓	
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)			✓
Dredge			✓

3.1 Fishing gear footprint

The scoring of this attribute considers the fishing gear and the number of encounters needed to cause impact on the habitat.

Table 13. PF16: Scoring the gear footprint attribute. Pg. 98. (MSC, 2014)

Gear type	Gear footprint score
Hand collection	1
Handline	1
Trap	1
Demersal longline	2
Bottom gill net or other entangling net	2
Danish seine	2
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)	3
Dredge	3

According to the standard and considering the use of demersal trawls, both in the coastal margin as well as in the inner shelf, the scoring for this attribute would be:

- **Coastal margin**: Demersal trawl - **score 3.**
- **Inner shelf:** Demersal trawl **- score 3.**

3.2 Spatial Overlap

The scoring of this attribute considers the spatial overlap between habitat distribution and the extension of the areas where the Unit of Assessment (UoA) operates, in this case, the coastal fleet.

Table 14. PF17: Scoring spatial attributes. Pg. 99.

Spatial attribute	Score					
	0.5	1	1.5	2	2.5	3
Spatial overlap	UoA overlap with a habitat is ≤15%	UoA overlap with a habitat is ≤30%	UoA overlap with a habitat is ≤45%	UoA overlap with a habitat is ≤60%	UoA overlap with a habitat is ≤75%	UoA overlap with a habitat is >75%

The scoring for this attribute is:

- **Coastal margin**: UoA overlap with habitat is ≤30% - **score 1**
- **Inner shelf:** UoA overlap with habitat is ≤30% - **-score 1**

Figures 1 and 2 illustrate that the shrimp catch area in the Patagonian coastline, specifically in the coastal waters of Rawson, represents significantly less than 30% of the total distribution that corresponds to the habitats described here above, composed of sand and gravel. Soft beds with fine sediments (sands) are distributed in 65% of the Argentine continental shelf. Sands are the most abundant sediments of the platform. Furthermore, gravel represents together with shells, 25% of the continental shelf. Their distribution is uneven and sometimes they are located in outer areas. (INIDEP, 1997).

Fig. 1 Sediments distribution in the Argentine continental shelf and the Patagonian shrimp onshore fishery catch area (yellow areas inside the red square). Taken and modified from: (INIDEP, 1997)

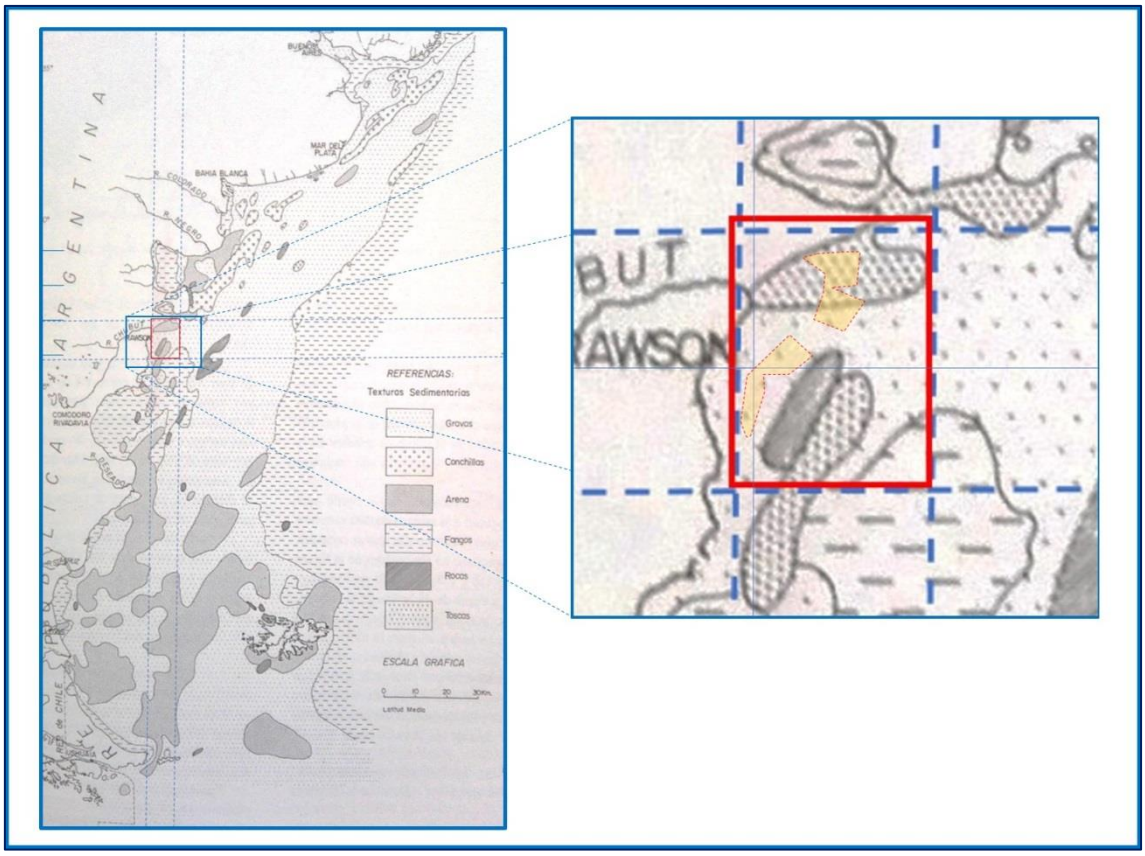
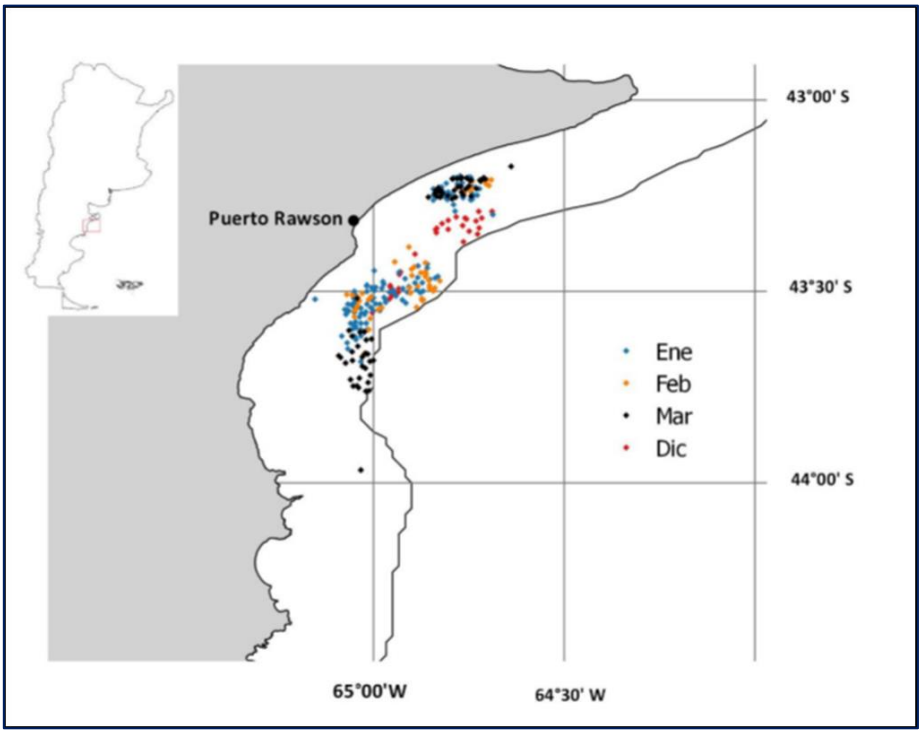


Fig. 2 Sets observed per month under the monitoring of the Onboard Observers Program implemented as part of the FIP for the Patagonian shrimp onshore fishery (Chubut, Argentina). Taken from: (CeDePesca & FCN - UNPSJB, 2016)



3.3. Encounterability

The scoring of this attribute is based on the likelihood of the fishing gear encountering the habitats analyzed during the development of the fishing activity.

The likelihood of encounterability is 100%, precisely because these habitats are seek for setting the nets as the Patagonian shrimp is a species linked to soft beds.

Table 15. PF17: Scoring spatial attributes. Pg. 99.

Spatial attribute	Score					
	0.5	1	1.5	2	2.5	3
Encounter-ability	Likelihood of encounter-ability is ≤15%	Likelihood of encounter-ability is ≤30%	Likelihood of encounter-ability is ≤45%	Likelihood of encounter-ability is ≤60%	Likelihood of encounter-ability is ≤75%	Likelihood of encounter-ability is >75%

According to the standard, the scoring for this attribute is:

- **Coastal margin**: the likelihood of encounterability between the fishing gear and the habitat is ≥75% - **score 3.**
- **Inner shelf:** the likelihood of encounterability between the fishing gear and the habitat is ≥75% **-score 3.**

4. FINAL SCORE MSC - PI 2.4.1 CS

As a result of the risk analysis performed, the Performance Indicator (PI) 2.4.1 is found in the range of 60-79 points.

Table 16. Final MSC CSA Score

Only main habitats scored?			Yes				Consequence score [1-3]								Spatial score [0.5-3]							
Habitat details							Habitat productivity		Gear-habitat interaction					Consequence score								
Scoring element	UoA/Gear type	Biome	Sub-biome	Feature	Habitat type	Depth (m)	Regeneration of biota	Natural disturbance	Removability of biota	Removability of substratum	Substratum hardness	Substratum ruggedness	Seabed slope		Gear footprint	Spatial overlap	Encounterability	Spatial score	CSA score	MSC CSA-derived score		
1	UoA/Bottom trawling	Coast	Coastal margin	Sediment plains	Fine, simple surface structure,small invertebrate communities	0-25m	1	1	1	3	3	3	1	1,67	3	1	3	2,08	2,67	82	Low	≥80
2	UoA/Bottom trawling	Coast	Inner shelf	Sediment plains	Fine, simple surface structure, small invertebrate communities	25-100m	2	2	1	3	3	3	1	2,11	3	1	3	2,08	2,96	69	Med	60-79

5. BIBLIOGRAPHY

B. D., Roux, A., Fernández, M., Piñero, R., & Fishcback, C. (2000). Ficha de la especie: Langostino - Pleoticus muelleri. *Pesquerías de Argentina 1997 - 1999*, 179-190.

Bastida , R., Roux, A., & Martinez, D. (1992). *Bentihic comunities of the Argentine continental shelf.* Argentina: Oceanologica Acta - Vol 15 - No.6.

Boschi, E. (1997). Las Pesquerías de crustàceos decápodos en el litoral de la República Argentina. *Investigaciones Marinas - Valparaiso, 25*, 19-40.

CeDePesca. (2016). Base de datos - Captura de Langostino - Rawson-Chubut - Octubre - Diciembre 2016.

CeDePesca, & FCN - UNPSJB, L. (2016). *INFORME DEL PROGRAMA DE OBSERVADORES A BORDO Temporada 2015-2016.* Argentina: PROYECTO DE MEJORA DE LA PESQUERÍA COSTERA DE LANGOSTINO - CeDePesca - Laboratorio de Hidrobiología - FCN - UNPSJB.

INIDEP. (1997). *EL MAR ARGENTINO Y SUS RECURSOS PESQUEROS - Tomo 1 Antededentes históricos de las exploraciones en el mar y las caracteristicas ambientales.* Mar del Plata - Argentina: Instituto Nacional de Investigación y Desarrollo Pesquero .

MSC. (2014). *MSC Fisheries Certification Requirements and Guidance.* London - United Kingdom: Version 2.0, 1st October, 2014.

R. A., & P. R. (2006). Crustàceos decápodos y estomatòpodos asociados a la pesquería del langostino patagonico Pleoticus mulleri (BATE, 1988) en el Golfo San Jorge, Argentina. *Revista Investigación y Desarrollo Pesquero, No. 18*, 33-43.

Roux, A. M., & F. M. (1997). *CARACTERIZACION DE LOS FONDOS DE PESCA DEL LANGOSTINO PATAGONICO Pleoticus muelleri EN EL GOLFO DE SAN JORGE Y LITORAL DE LA PROVINCIA DE CHUBUT - ARGENTINA.* Mar del Plata, R. Argentina: INIDEP - Informe Técnico 13.

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