ARGENTINE RED SHRIMP ONSHORE FISHERY IMPROVEMENT PROJECT

ONBOARD OBSERVERS PROGRAM FINAL REPORT
2015-2016 fishing season

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In order to implement a fishery improvement project (FIP) for the Argentine red shrimp (*Pleoticus muelleri*) in Puerto Rawson, the 2015-2016 fishing season was monitored with a privately-funded onboard observers program.

The team of onboard observers was coordinated by the Hydrobiology Laboratory of the Faculty of Natural Sciences at Trelew's Patagonian National University San Juan Bosco (UNPSJB) from December to March. The team included three biologists, two of them with experience onboard, and two senior Biology students, one of them with a lot of experience onboard. In addition, to reinforce coverage we got in touch with two observers from the Onboard Observers Program of the Province Chubut.

68 days onboard were monitored from December to March in 9 vessels, property of 4 different companies: 7 days in December, 27 in January, 15 in February and 18 days in March (Table 1).

The sets under observation were located in two fishing areas, north of Puerto Rawson in the area known as "El Pozón" and south of the port in the fishing area known as "Isla Escondida". In the northern area, the few sets observed in December were located close to the provincial jurisdiction but the sets observed between January and March were close to the coast. In the southern area, there was a shift further south as the fishing season advanced (Fig. 1).

Average set duration was of 66 minutes (±22'), the duration ranged between 15 to 170 minutes (almost three hours) but the frequency histogram of sets duration showed a normal curb with a mean in one hour, with these values located at both ends. Average depth of the sets was 37.3m, with small deviation (± 7.3 m).

Argentine red shrimp CPUE, expressed in kilograms per hour, showed great fluctuation but a clear decreasing trend as the fishing season progressed (Fig. 2, Fig 3a and Table 2). This decreasing trend towards the end of the season could also be observed in the San Jorge Gulf, when the ice-chilling trawlers fleet was in operation.

The average shrimp CPUE throughout the fishing season was 2526 kg/h (± 2305), the season opening with 4368 kg/h in December and finishing at 735 kg/h in March (Table 2). Best yields were recorded close to the provincial jurisdiction limit and worst yields in the south of the fishing area (Fig. 3b and 3c).

Argentine red shrimp discard was not a common practice. Occasionally, it was discarded in the last set because it was impossible to stow onboard all the content of the net. Some skippers are careful and they perform short sets when the hold is almost full. This discard **is not common practice**, but it exists nonetheless. It occurs in high yield months and areas. Of the 690 red shrimp tons caught in the sets under observation, 13 tons were discarded in 9 sets, two in December, five in January and two in February.

Regarding bycatch, hake (*Merluccius hubbsi*) CPUE expressed in kilogram/hour in the coastal fleet was very low and variable, with an ascending trend towards the end of the season (Fig. 2). Average hake CPUE values reached 140 kg/h only in March. In the other months, average values were below 50 kg/h. Latitude is the variable that best illustrates fluctuations in hake yields, highest hake yields were recorded towards the south of the fishing area (Fig. 4 and 5) although towards the end of the season, highest yields were recorded north of 43°60´S. No vessel landed hake.

Monitoring protocols included recording the weight of all the bycatch separated by group: invertebrates, bony fish, elephant fish (*Callorhynchus callorhynchus*) batoids and sharks. The complete weight of each one of the groups could only be performed in 135 sets of the 287 sets recorded. The remaining sets were missing some group; for example, the invertebrates group was missing although the batoids and sharks were described in detail.

In order to assess the relationship between bycatch and target species, 135 sets were analyzed as follows: 23 in December, 46 in January, 18 in February and 48 in March (Table 3). Without standardizing for trawling hours, the relationship between bycatch/total catch is low. If analyzed on a monthly basis, the relationship grows towards the end of the season but it still remains under 0,08 (Table 3).

The bycatch weight reported is low: in the 135 sets, 344 shrimp tons were reported and the total bycatch represented 29 tons, including mainly hake (16 tons – 4.7%), invertebrates (7 tons – 2.01%), other bony fish (3 tons - 0.74%) and chondrichthyans (1 ton – 0.28%), among them elephant fish (*Callorhynchus callorhynchus*), batoids and sharks (Table 3, Fig. 6 and Fig. 7).

The analysis was also carried out per group to assess the rate per group of interest with a larger number of sets. The weight of red shrimp and invertebrates was recorded in 222 sets, showing an invertebrates/target species rate of 0.024 (Table 4).

If we consider the sets in which bony fish and target species were recorded, 246 sets, the bony fish rate without considering hake (*Merluccius hubbsi*) was of 0.01. If hake was added, the bony fish/target species rate reached 0.03. Within the bony fish group, hake was the species that contributed the most in weight (13,167 kg), followed by Argentine queenfish (*Stromateus brasiliensis*) 648 kg, hawkfish (*Cheilodactylus bergi*) 467 kg, jack mackerel (*Trachurus lathami*) 483 kg, flounder (several species) 313 kg, salmon (*Pseudopercis semifasciata*) 307 kg, Brazilian flathead (*Percophis *brasiliensis*) 166 kg, silver warehou (*Seriolella porosa*) 73 kg, seabass (*Acanthistius brasilianus*) 52 kg and mackerel (*Scomber japonicus*) 21 kg. In some sets, both weight as well as number of individuals were recorded: 419 individuals were recorded in 328 kg of Argentine queenfish, 1028 individuals in 151 kg of hawkfish, in the case of jack mackerel 349 individuals were recorded in 51 kg, 704 individuals were recorded in 165 kg of founder, 65 individuals were recorded in 227 kg of salmon, 100 individuals were recorded in 14 kg of Brazilian flathead, 76 individuals in 27 kg of silver warehou, 55 individuals in 28 kg of seabass and 55 individuals in 21 kg of jack mackerel.

Regarding chondrichthyans, elephant fish is the species that contributes the most to bycatch. Notwithstanding, the elephant fish/target species bycatch rate was very low, 0.002. For this species 794 individuals were recorded in 746 kg. The batoids or sharks/target species rate is even lower: 0.001, in 368 kg of batoids 535 individuals were recorded from different species of skates and rays and southern eagle ray. In sharks, the main species caught is narrownose smoothhound (*Mustelus schmitti*) (220 kg), and in 119 kg 357 individuals of this species were recorded. The other species caught were tope shark (*Galeorhinus galeus*), 41 kg and 8 individuals, and hidden angelshark (*Squatina guggenheim*), 27 kg and 11 individuals.

Bycatch was also recorded at the species level. The observers recorded for each set those species caught together with the target species and determined abundance in number according to four categories: dominant (species represents more than 50% of the catch in number, its presence determines the general appearance of the catch), abundant (between 25 and 50%, its presence is easily observed), common (between 5 and 25%, it is observed if attention is paid and catches are stirred), rare (less than 5%, few individuals) and very rare (less than five individuals). In addition to the abundance category, the bycatch destination was also recorded: if it was entirely boxed, partially boxed or totally discarded.

In 232 sets, a description was performed indicating bycatch species, recording qualitative abundance and destination of the catch. A total of 30 species of bony fish, 16 species of chondrichthyans, including one chimaera and one southern hagfish species with a single record were included. The species with a rate of occurrence above 35% were: hawkfish (89%), Brazilian flathead (80%), elephant fish (67%), hake (67%), *Paralichthys isosceles* (47%), Argentine queenfish (44%), southwest Atlantic butterfish (*Stromateus brasiliensis*) (38%) and narrownose smoothhound (38%) (Table 5 and 6). Also high were the rates of occurrence of jack mackerel (32%), Brazilian sandperch (*Pinguipes brasilianus*) (28%), flatfish (*Xystreuris rasile*) (28%) and Patagonian flounder (*Paralichthys patagonicus*) (28%). Despite the high rates of occurrence, only hake and jack mackerel were abundant in some catches, but with a percentage below 1% in the total sets where they were recorded.

Hake was recorded as common in catches in 17% of the sets where it was caught and jack mackerel in 23%. The rest of the species were recorded as rare or very rare in catches. All species are discarded in a percentage above 90%, only salmon was made use of in 15% of the sets in which it was recorded in the catches (Table 5 and 6). Preliminary analyses indicate that the area under study is a breeding and reproductive area. The presence of chondrichthyans eggs is evidence.

As regards invertebrates, algae, tunicate, porifera (only one species was identified), cnidarians, echiura and annelids (only one species was identified) were recorded. Tunicate were the invertebrates with the highest rate of occurrence recorded in 99% of the sets observed. Some observers identified echinoderms at the species level, recording seven starfish species, the group with the highest rate of occurrence within this phylum. Regarding molluscs, only the cephalopods group could be identified at the species level, calamarete (*Loligo sp*.) was the most frequent species in 77 % of the sets observed. Eleven crustaceans species were recorded, including shrimp, the target species. Crabs, swim crabs (*Platyxanthus patagonicus*) and spider crab (*Libidoclea granaria*) were the most frequent (Table 7). With the exception of red shrimp, dominant and abundant in catches, peiso (*Peiso petrunkevitchi*) was also recorded, considered as common together with ascidians in rates close to 30 % of the sets were they were identified. The remaining species were recorded as rare or very rare. All species are discarded with the exception of Tehuelche octopus (*Octopus tehuelche*) that was made use of in 15% of the sets where it was identified. However, its abundance was always rare or very rare.

Finally, observers pointed at an irregular treatment of the rubbish produced onboard. Some vessels brought back everything to port whereas others either threw everything away or kept only part of the rubbish produced.

About Logistics

Five companies took part in the project: Pesquera Veraz, Cabo Vírgenes, Conarpesa, Iberconsa and Food Partners; only the vessels proposed by Conarpesa were monitored with adequate coverage. Food Partners offered two vessels that did not have a fishing license during the entire fishing season. Iberconsa offered 14 vessels, 3 coastal and 11 artisanal, but it did not provide the authorizations to go onboard as required by the Argentine Coast Guard, or only it did it when the season was coming to an end. Therefore, there was a single boarding in one of the coastal vessels that had an onboard observer from Chubut. Cabo Vírgenes offered 10 vessels, 4 coastal and 6 artisanal. In one of the coastal vessels it was impossible to include the observers because it did not have additional space in the life-rafts and the remaining three coastal vessels were covered by onboard observers from the Province of Chubut. It was only possible to go onboard in the few days in which the Chubut observers abandoned the vessel. This was also the case in the two vessels offered by the company Pesquera Veraz. Summarizing, of the 36 vessels proposed, only 15 could be monitored: it was possible to operate them, they had additional space in the life-rafts for onboard observers and they timely presented notice to the Argentine Coast Guard. Of these 15 vessels, 4 were artisanal vessels and 11 coastal, seven belonged to

Conarpesa and the remaining 5 were occupied by observers from Chubut, so they were not available all the time required.

As regards the artisanal vessels, only one boarding was performed. These vessels have serious problems for monitoring, as there is not enough room for an onboard observer to develop his/her task with an adequate level of safety. We believe it is important to monitor those vessels as there is scarce information about them but a new modus operandi will have to be found.

The Onboard Observers Program of the Province of Chubut offers good coverage of the coastal vessels. Even though protocols are not as exhaustive as those required by the FIP, we believe that the data gathered by the Province of Chubut could contribute to the necessary analysis required by the FIP. Moreover, if the Secretariat of Fisheries is involved, it may be possible to appoint a group of observers to develop the protocols required by the FIP. This, together with the University observers could achieve good coverage of high technical quality. It is important to notice that the Onboard Observers Program of the Province of Chubut does not offer coverage of the artisanal vessels either, due to the reasons previously exposed.

Recommendations and conclusions

Biology senior students and professionals in the onboard observers team have provided detailed information whose quality exceeds the required protocols. The main problem is the availability of vessels. Either the onboard observers team is enlarged or it will be necessary to add to the monitoring effort a group of observers from the Province of Chubut, coordinating both working protocols.

In fact, the integration with the Onboard Observers Program of the Province of Chubut is of paramount importance as the provincial program has wider coverage. Having access to the data provided by the provincial program will guarantee a better assessment of the fishery.

The coverage strategy of the artisanal fishery should be discussed, as the provincial program does not cover it either.

Also, private companies should be more committed. Otherwise, it will be impossible to fulfill all the necessary paper work required by the Argentine Coast Guards. The latter should also offer its support in helping observers to go onboard.

The coastal fleet fishes for Argentine red shrimp in the provincial jurisdiction in an area of one degree by one, between 43º and 44º S and between 64º30 W and the coastline.

As it is also the case in the Argentine red shrimp fishery that takes place in the San Jorge Gulf and neighboring waters, red shrimp yields decrease towards the end of the season. Argentine red shrimp discard is not common practice but it exists nonetheless.

Hake yields are low and they are determined by latitude. Highest yields were achieved towards the south and towards the end of the season. Hake/Argentine red shrimp rate is very low, the same as all bycatch/target species rate.

Only the target species is landed, as it is also the case in the San Jorge Gulf and neighboring waters red shrimp fishery. The little landed that is not red shrimp is for the vessel crew (known as “escrute”, in Spanish).

Thirty bony fish species, 16 cartilaginous fish species and one southern hagfish species were recorded. In the ice-chilling trawler fleet that operates in the San Jorge Gulf and neighboring waters, 44 bony fish species, 20 cartilaginous fish species and two southern hagfish species were recorded.

Preliminary analyses indicate that the area under study is a breeding and reproductive area of several bony and cartilaginous fish species. It will be necessary to continue our research to establish its space-time limits.

Figure 8 indicates the steps to follow approved by the partners of FIP.

TABLES AND FIGURES

Table 1: Trips within the Argentine red shrimp onshore Fishery Improvement Project (Chubut, Argentina). Detail per observer, vessel, company and month.

			Fishing Days			
Observer	**Vessel**	**Company**	**Dec**	**Jan**	**Feb**	**Mar**
MARIO ROBERT	JORGE DANIEL	Iberconsa	1			
JUAN JOSE ROMERO	DON VICENTE VUOSSO	Iberconsa	6			
JULIAN RUIBAL	ALVAREZ ENTRENA IV	Conarpesa		8		
RAUL MAXIMILIANO SILVA	ALVAREZ ENTRENA IV	Conarpesa			4	1
MARIO ROBERT	ALVAREZ ENTRENA IV	Conarpesa				2
MARIO ROBERT	CALABRIA	Conarpesa		5		2
RAUL MAXIMILIANO SILVA	DIEGO FERNANDO	Conarpesa		11		8
NELSON BOVCON	TRABAJAMOS	Cabo Vírgenes		3		
MARIO ROBERT	TRABAJAMOS	Cabo Vírgenes			3	
CRISTIAN CORNEJO	DESEADO	Cabo Vírgenes				2
RAUL MAXIMILIANO SILVA	DON BOCHA	Pesquera Veraz			4	
CRISTIAN MARINAO	VIRGEN DEL MILAGRO	Pesquera Veraz			4	3
7 observers	**9 vessels**	**4 companies**	**7**	**27**	**15**	**18**

Table 2: Sets observed per month, total trawling hours expressed in minutes, total shrimp and hake catch recorded, and average red shrimp and hake CPUE expressed as kilogram hour and calculated as average of CPUE per set.

	Sets	**Total Duration**	**Shrimp Cat. (kg)**	**Shrimp Ave. (kg_hs)**	**Shrimp Dev.**	**Hake Cat. (kg)**	**Hake Ave. (kg_hs)**	**Hake Dev.**	**Rate**
December	28	1704	113850	4376.7	2539.4	621	26.2	35.3	0.01
January	134	7640	356158	3076.0	2433.2	2378	20.2	50.2	0.01
February	53	3382	141483	2589.9	1797.8	2063	35.3	78.0	0.01
March	72	6492	78202	735.2	556.9	15144	135.8	188.7	0.19
Total	**287**	**19218**	**689693**	**2525.9**	**2304.7**	**28212**	**86.7**	**550.0**	**0.04**

Table 3: Description of those sets where it was possible to record both target species weight as well as those groups in which bycatch was divided: hake, invertebrates, bony fish, elephant fish, batoids and sharks. Trawling hours observed are expressed in minutes, all catches expressed in kilos

	Sets	Total Duration	Red Shrimp	Others	Bycat./Red Shrimp Rate	Hake	Invert.	Bony	Elephant	Batoids	Sharks
Dec	23	1393	108400	9770	**0.090**	8497	732	473	57	5	7
Jan	46	2622	144545	5501	**0.038**	1773	2705	723	221	40	38
Feb	18	1077	48135	1768	**0.037**	347	1073	220	106	7	15
Mar	48	4255	42692	11803	**0.276**	6971	2978	1327	148	334	45
Total	**135**	**9347**	**343772**	**28841**	**0.084**	**17587**	**7488**	**2742**	**533**	**387**	**105**
Percentage over total catch						**4.72**	**2.01**	**0.74**	**0.14**	**0.10**	**0.04**

Table 4: Bycatch per group. It includes those sets where the group and the target species were recorded and it shows shrimp and hake catch in those sets. FO stands for Rate of Occurrence.

Sets	Red Shrimp	Hake	Group		FO	Group/Red Shrimp Rate
222	540248	17562	Invert.	13086	98.2	**0.024**
246	587037	13167	Bony	4070	86.6	**0.007**
203	497460	12859	Rooster	746.6	66.5	**0.002**
163	377809	12166	Batoids	431.1	52.8	**0.001**
255	604666	17769	Sharks	327.5	28.2	**0.001**

Table 5: Description of the bycatch of bony fish at the level of species, rate of occurrence per species, rate of occurrence per abundance category: Do (dominant), Ab (abundant), Co (common), Ra (rare) y MRa (very rare) and y rate of occurrence per destination category: Boxed, Part. Boxed (partially boxed) and Disc. (discarded).

Class		Order - Family	Scientific Name	Common Name	Register Number	Rate of Occurence	do	ab	co	ra	mr	Boxed	Part. Boxec	Disc.
Myxini	Myxiniformes	Myxinidae	*Myxine australis*	Mixin dos orificios	1	0.43					100			100
Osteichthyes	Clupeiformes	Engraulidae	*Engraulis anchoita*	Anchoita	20	8.62				40.0	60.0			100
	Gadiformes	Merlucciidae	*Merluccius hubbsi*	Merluza	155	66.81		0.6	17.4	61.9	20.0	1.0	5.2	94.2
	Ophidiformes	Ophidiidae	*Genypterus blacodes*	Abadejo manchado	5	2.16					100			100
			Raneya brasiliensis	Raneya	34	14.66					100			100
	Batrachoidiformes	Batrachoididae	*Triathalassothia argentina*	Pez Sapo	28	12.07				7.1	92.9			100
	Atheriniformes	Atherinidae	*Odontesthes smitti*	Pejerrey cola amarilla	3	1.29					100			100
	Scorpaeniformes	Congiopodidae	*Congiopodus peruviano*	Chanchito	24	10.34				41.7	58.3			100
		Triglidae	*Prionotus nudigula*	Testolin rojo	3	1.29				33.3	66.7			100
		Agonidae	*Agonopsis chiloensis*	Acorazado	36	15.52				8.3	91.7			100
	Perciformes	Serranidae	*Acanthistius patachonicus*	Mero	27	11.64				33.3	66.7	3.7		96.3
		Carangidae	*Parona signata*	Palometa Pintada	102	43.97			1.0	51.0	48.0	3.9	2.0	94.1
			Trachurus lathami	Jurel	74	31.90		1.4	23.0	36.5	39.2			100
		Sciaenidae	*Cynoscion guatucupa*	Pescadilla	23	9.91				13.0	87.0	4.3		95.7
		Cheilodactylidae	*Nemadactylus bergi*	Castañeta	206	88.79			3.9	76.2	19.9			100
		Mullidae	*Mullus argentinae*	Trilla	11	4.74				18.2	81.8			100
		Bovichthidae	*Cottoperca gobio*	Cotoperca	1	0.43					100			100
		Nototheniidae	*Patagonotothen ramsayi*	Nototenia ramsayi	7	3.02					100			100
		Eleginopidae	*Eleginops maclovinus*	Robalo	1	0.43					100			100
		Percophidae	*Percophis brasiliensis*	Pez Palo	185	79.74			0.5	67.6	31.9			100
		Pinguipedidae	*Pinguipes brasilianus*	Turquito	65	28.02				20.0	80.0	1.5		98.5
			Pseudopercis semifasciata	Salmon	33	14.22				27.3	72.7	15.2		84.8
		Gempylidae	*Thyrsitops lepidopodea*	Caballa Blanca	40	17.24				17.5	82.5			100
		Scombridae	*Scomber japonicus*	Caballa	54	23.28				27.8	72.2	7.4		92.6
		Centrolophidae	*Seriorella porosa*	Savorin	48	20.69				27.1	72.9			100
		Stromateidae	*Stromateus brasiliensis*	Pampanito	88	37.93				30.7	69.3			100
		Clinidae	*Ribeiroclinus eigenmanni*	Camuflado	1	0.43					100			100
	Pleuronectiformes	Paralichthyidae	*Xystreuris rasile*	Lenguado Rasile	64	27.59				39.1	60.9			100
			Paralichthys isosceles	Lenguado Isosceles	110	47.41				48.2	51.8			100
			Paralichthys patagonicus	Lenguado Patagonico	64	27.59			1.6	45.3	53.1		1.6	98.4
			Paralichthys sp.	Lenguado	20	8.62			10.0	75.0	15.0			100
		Pleuronectidae	*Oncopterus darwini*	Lenguado de Gancho	11	4.74				90.9	9.1			100

Table 6: Description of cartilaginous fish bycatch per species, rate of occurrence per species, rate of occurrence per abundance category: Do (dominant), Ab (abundant), Co (common), Ra (rare) and MRa (very rare) and rate of occurrence per destination category: Boxed, Part. Boxed (partially boxed) and Disc. (discarded).

Class		Order - Family	Scientific name	Common Name	Register Number	Rate of Occurence	do	ab	co	ra	mr	Boxed	Part. Boxed	Disc.
Elasmobranchii	Carcharhiniformes	Triakidae	*Mustelus schmitti*	Gatuzo	89	38.36			1.1	38.2	60.7			100
			Galeorhinus galeus	Cazon	6	2.59					100			100
	Squaliformes	Squalidae	*Squalus acanthias*	Espinoso con manchas	5	2.16				20.0	80.0			100
	Squatiniformes	Squatinidae	*Squatina guggenheim*	Pez Angel	37	15.95				8.1	91.9	2.7		97.3
	Torpediniformes	Narcinidae	*Discopyge tschudii*	Torpedo	43	18.53				25.6	74.4			100
	Rajiformes	Rajidae	*Atlantoraja castelnaui*	Raya a lunares	5	2.16					100			100
			Dipturus trachyderma	Raya traquiderma	6	2.59				16.7	83.3			100
			Psammobatis normani	Raya marron claro	33	14.22				21.2	78.8			100
			Psammobatis bergi	Raya reticulada	1	0.43					100			100
			Psammobatis lentiginosa	Raya lentiginosa	1	0.43					100			100
			Psammobatis extenta	Raya de orlas	1	0.43					100			100
			Sympterygia bonapartii	Raya marmolada	36	15.52				25.0	75.0			100
			Sympterygia acuta	Raya acuta	7	3.02					100			100
			Zearaja chilensis	Raya hocicuda chilensis	1	0.43				100.0				100
	Myliobatiformes	Myliobatidae	*Myliobatis goodei*	Chucho	14	6.03				14.3	85.7			100
				Huevo de gallo	49	21.12				42.9	57.1			100
				Huevo rajiformes	10	4.31				30.0	70.0			100
				Huevo sympterigia sp	1	0.43					100			100
				Huevo raya reticulada	5	2.16					100			100
				Huevo raya de orla	1	0.43					100			100
Holocephali	Chimaeriformes	Callorynchidae	*Callorhinchus callorhynchus*	Gallo	156	67.24				50.0	50.0	2.6	3.8	93.6

Table 7: Description of invertebrates bycatch, rate of occurrence per species or group, rate of occurrence per abundance category: Do (dominant), Ab (abundant), Co (common), Ra (rare) and MRa (very rare) and rate of occurrence per destination category: Boxed, Part. Boxed (partially boxed) and Disc. (discarded).

	Scientific Name	Groups/Species	Register Number	Rate of Occurrence	do	ab	co	ra	mr	Boxed	Part. Boxed	Disc.
		Algas	53	22.84				62.3	37.7			100
Urochordates	Tunicados	Ascidias	230	99.14	0.4	3.5	27.4	47.8	20.9			100
Porifera		Esponjas	72	31.03				50.0	50.0			100
	Tedania sp.	Esponja Amarilla	18	7.76				83.3	16.7			100
Cnidarians		Medusa	1	0.43				100				100
		Anemona	34	14.66				64.7	35.3			100
Echiura		Equiurido	14	6.03				100				100
Annelids		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
Echinoderms	*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
Molluscs - Bivalves		Almeja	45	19.40			8.9	57.8	33.3			100
		Vieira	2	0.86					100			100
Molluscs - Gasteropods		Caracol	1	0.43					100			100
		Nudibranquio	47	20.26				61.7	38.3			100
		Fisurela	16	6.90				100				100
Molluscs - Cephalopods	*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
Crustaceans												
Stomatopoda	*Pterygosquilla armata armata*	Heterosquilla armata	1	0.43					100			100
Decapoda - Dendrobranchiata	*Peisos 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

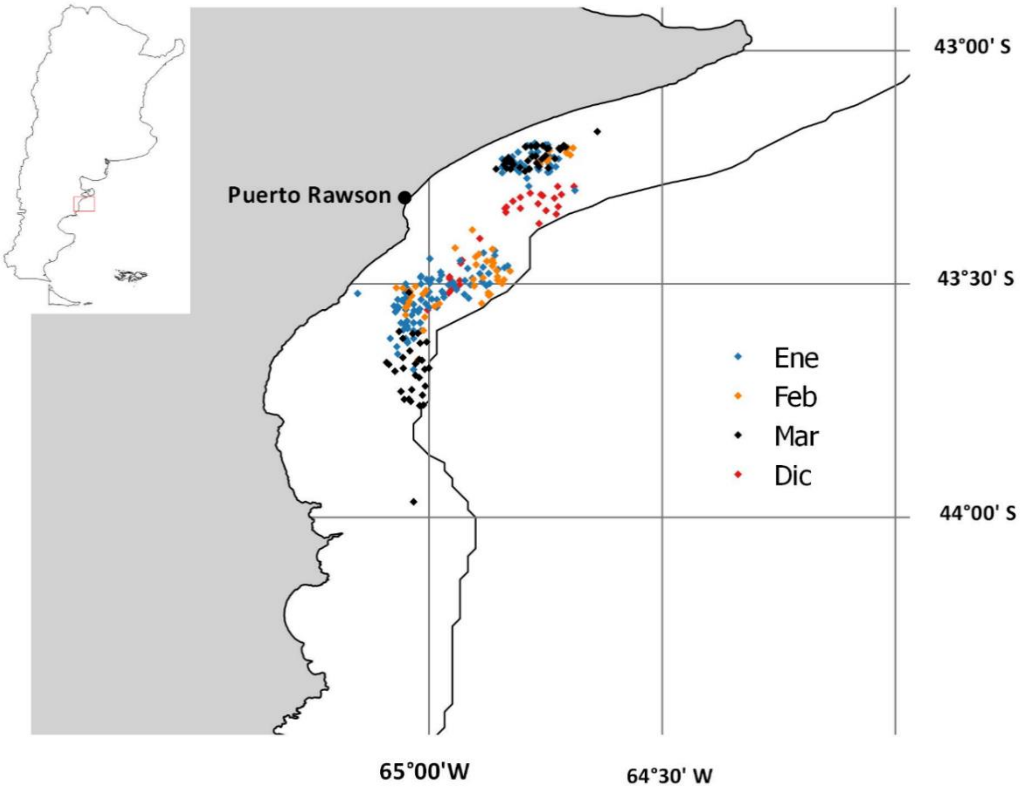

Fig. 1: Fishing sets observed per month within the Onboard Observers Project implemented as part of the Argentine red shrimp onshore Fishery Improvement Project (Chubut, Argentina).

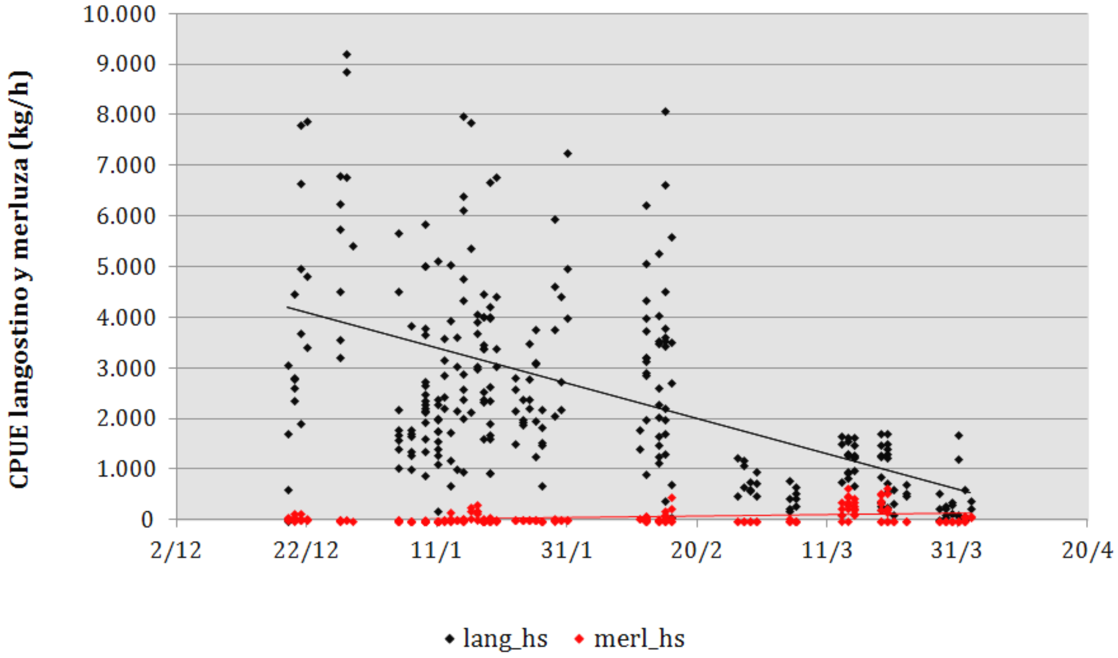

Fig. 2: Argentine red shrimp (lang_hs) and hake (merl_hs) CPUE expressed in kilograms hour per fishing day monitored.

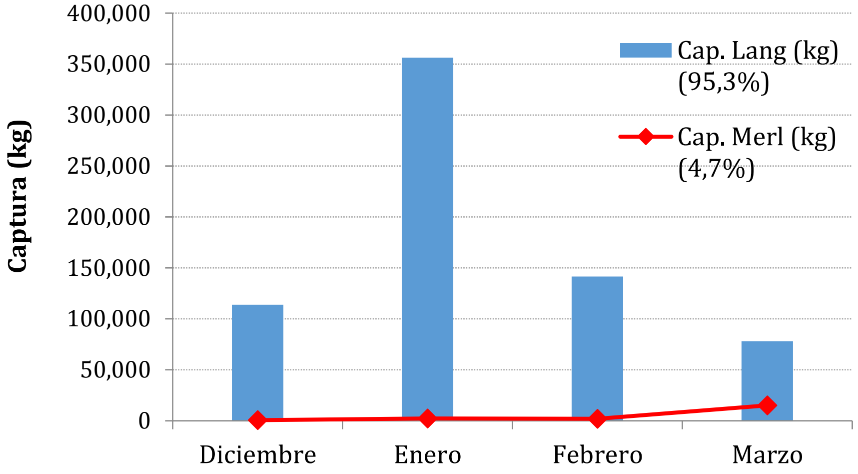

Fig. 3a: Total catch of red shrimp (Cap. Lang) and hake (Cap. Merl), expressed in Kg for the months of December, January, February and March.

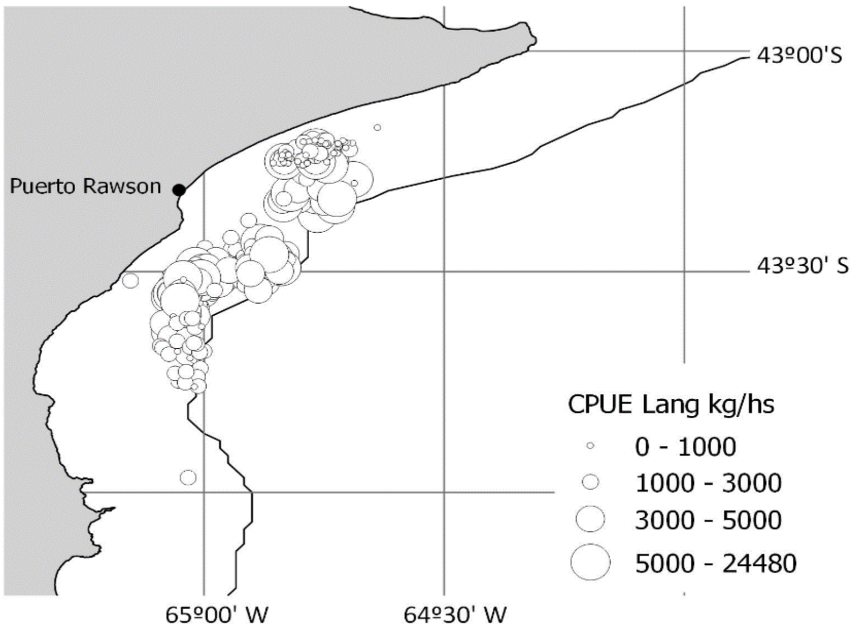

Fig. 3b: Red shrimp CPUE (kg/hs) per set in the months from December to March.

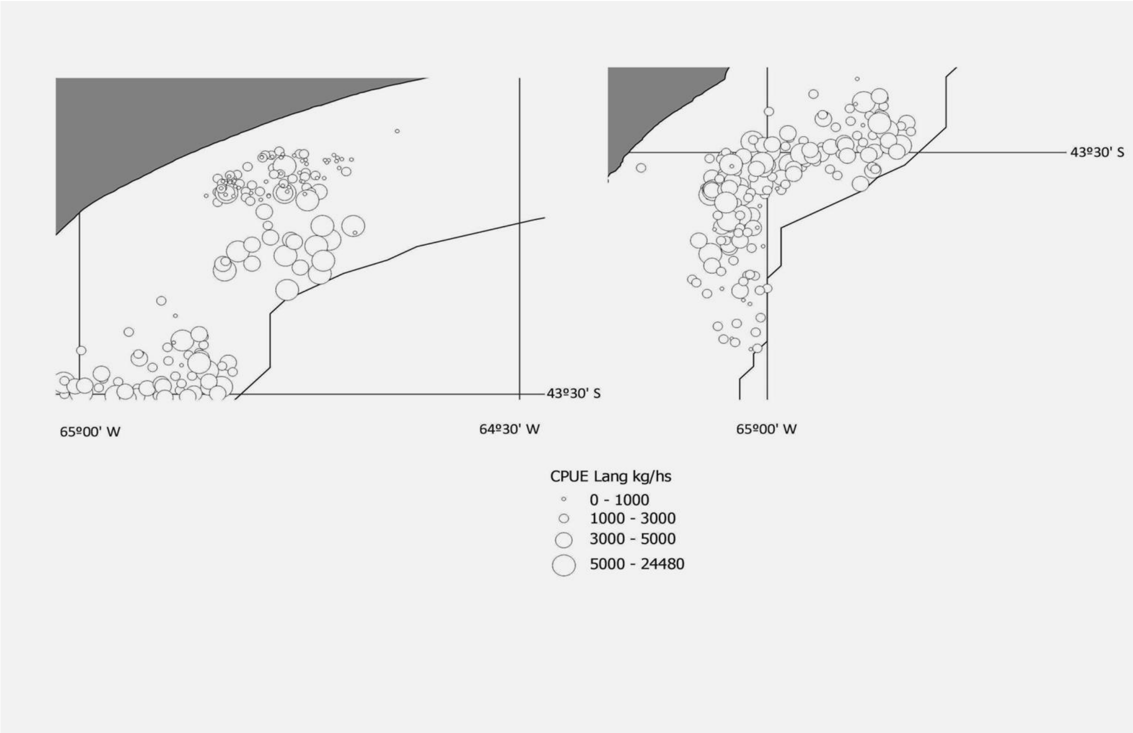

Fig. 3c: Red shrimp CPUE expressed as kg/h in northern and southern areas.

Fig. 4: Hake CPUE (kg/hr) for latitude in the coastal fleet of Puerto Rawson. [March (north) - Marzo (norte); March (south) - Marzo (sur); April (north) - Abril (norte); April (south) - Abril (sur); Evitar = Avoid]

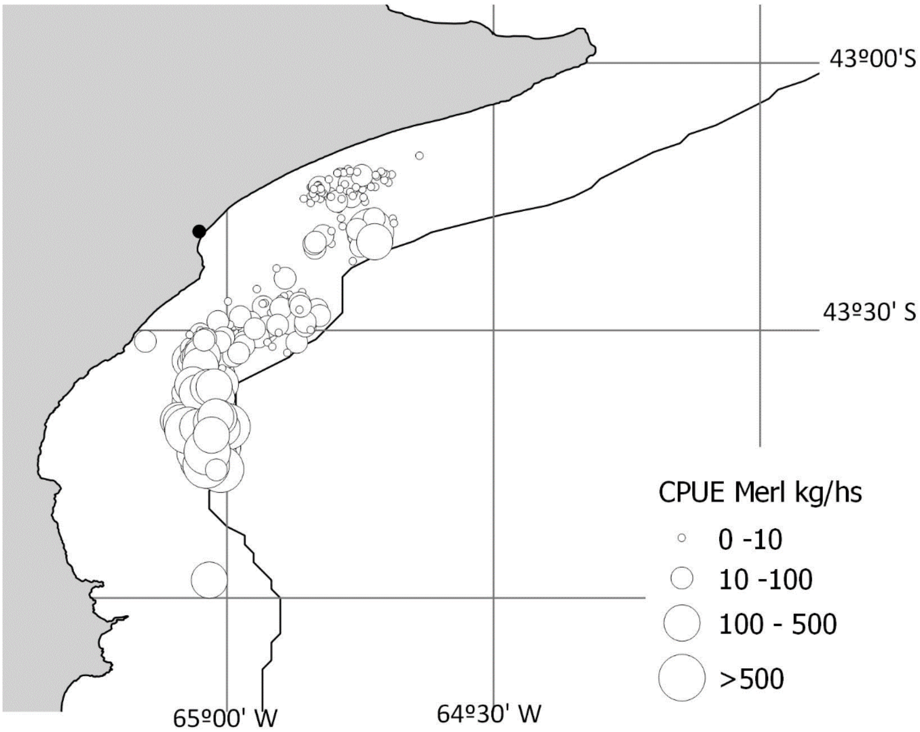

Fig. 5: Hake CPUE (kg/hr) per set in the months from December to March.

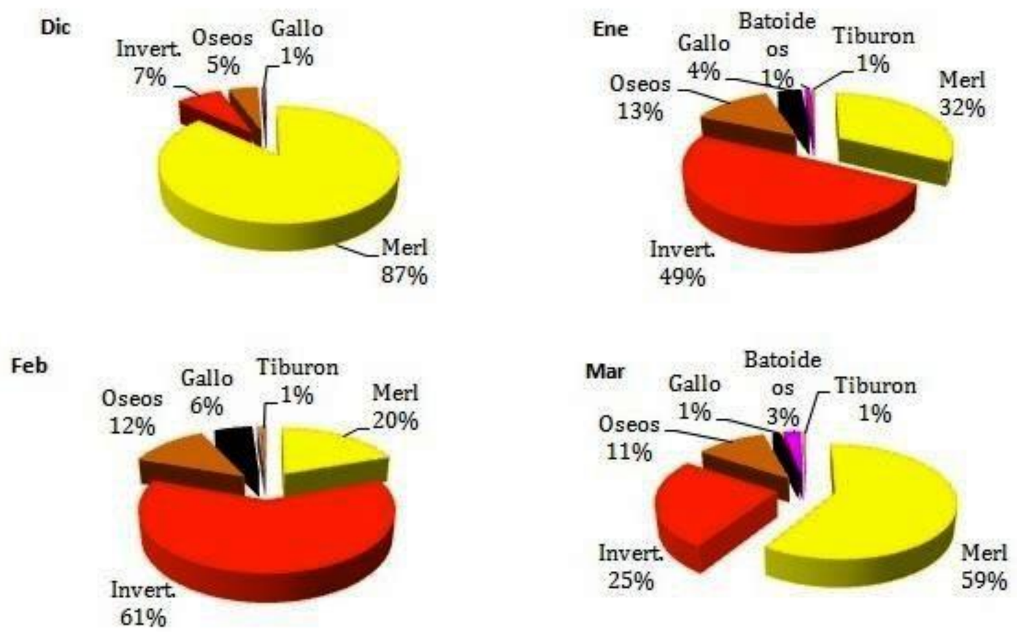

Fig. 6: Monthly distribution of bycatch rates. [Invert = Invertebrates; Oseos = Bony fish; Gallo = Elephant fish; Merl = Hake; Batoideo = Batoid; Tiburon = Shark].

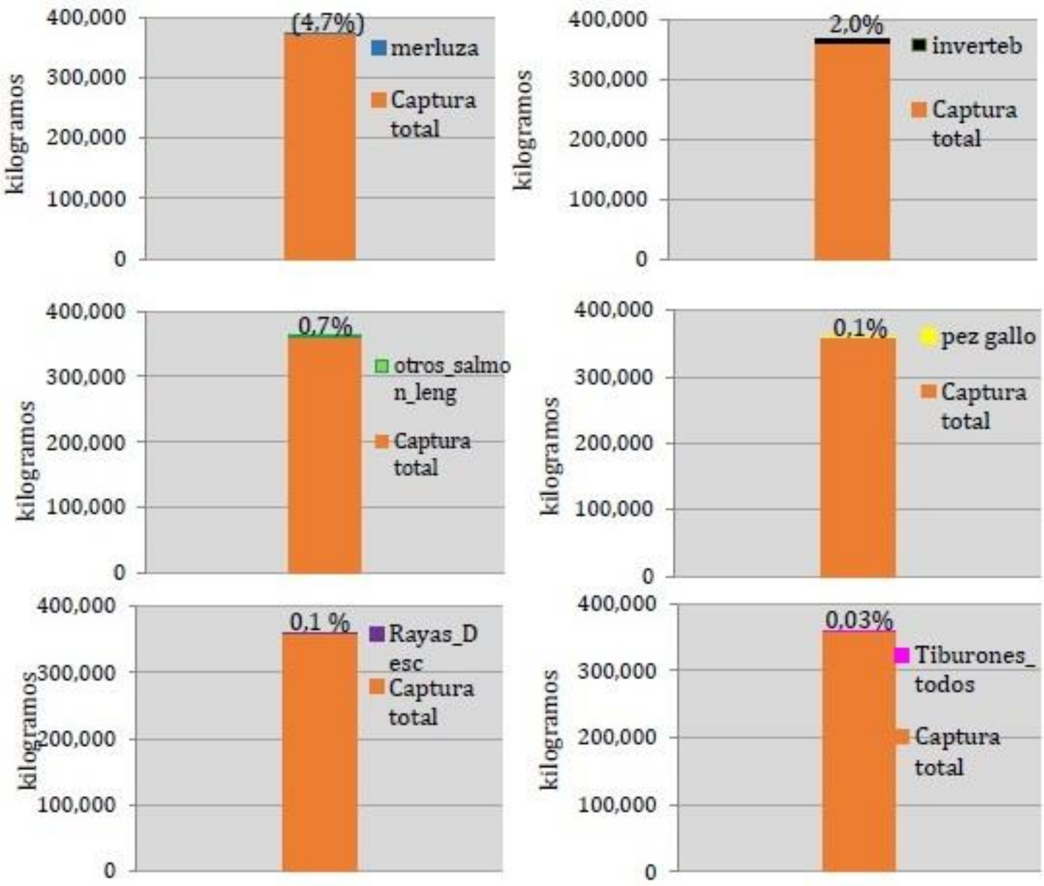

Fig. 7: Total catch of different species on total catch (kg). [Captura total = Total catch; Merluza = Hake< Inverteb = Invertebrates; Otros salmon_leng = Others salmons and flatfish; Pez gallo = Elephant fish; Rayas_Desc = Discarded rays; Tiburones_todos = All sharks].

1	Publish the Onboard Observers Program report for the 2015-2016 fishing season.
2	Update the FIP public report with this progress and issue a press communication about it.
3	Systematize the available information on stock status to show that it fluctuates around a target reference point or a proxy, and request that this is henceforth a part of INIDEP's work with provincial scientists.
4	Request approval of a Management Plan for the fishery, including a permanent self-assessment procedure with participatory mechanisms.
5	Keep the Onboard Observers Program to sustain the score achieved for P2 (Interaction with the Ecosystem).

Fig. 8: Next steps for this FIP.