DOI: 10.3856/vol39-issue1-fulltext-16

Short Communication

The Patagonian scallop fishing grounds in shelf break frontal areas: the non assessed benthic fraction

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ABSTRACT. In this study, a Picard dredge was used to sample the benthic community in shelf break frontal areas off Argentina in order to detect species that could be sensitive to fishing activities but are not usually caught during the annual monitoring of Patagonian scallop and associated fauna. The present results show at least 62 taxa not reported previously as components of the benthos in the scallop grounds that are potentially subjected to trawling disturbance.

Keywords: by-catch, Patagonian scallop fishery, infauna, Picard dredge, biodiversity, shelf-break front, Argentina.

Bancos de pesca de vieira patagónica en áreas del frente de talud: fracción bentónica no evaluada

RESUMEN. En este trabajo se utilizó una rastra Picard para muestrear la comunidad bentónica en áreas del frente de talud, Argentina, para detectar especies que serían sensibles a la actividad pesquera pero no son capturadas usualmente durante los monitoreos anuales de vieira patagónica y fauna asociada. Los resultados muestran que al menos 62 taxa, no reportados previamente como componentes del bentos en los bancos de vieira, están potencialmente sujetos a perturbaciones por el arrastre.

Palabras clave: fauna acompañante, pesquería de vieira patagónica, infauna, rastra Picard, biodiversidad, frente de talud, Argentina.

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In general, bottom-trawl fisheries are considered as one of the most disturbing antropogenic impacts on the sea floor and a variety of effects are well documented. They can disturb benthic species and habitats and can reduce biomass, production and diversity of the communities, which at the end may change ecosystem properties (Collie *et al.*, 2000; Kaiser *et al.*, 2000; Hiddink *et al.*, 2006a, 2006b). A shift from communities dominated by individuals with large adult body sizes towards high abundances of individuals of small body sizes, a loss in biodiversity and richness and a decrease in the biomass of colonial and fragile organisms in trawled areas were frequently registered (McConnaughey *et al.*, 2000; Veale *et al.*, 2000; Marine Research Council, 2002). Even though, not all the communities show reduced diversity. There are evidences of profound and highly statistically-significant changes at the scallop fishing grounds in the Bay of Fundy (Canada) where no loss of species and no change in average number of taxa per station were reported but dominance of many species drasticallychanged (Kenchington *et al*., 2007).

In 1996 a new scallop fishery (*Zygochlamys patagonica*) on the Argentinean continental shelf was developed (Lasta & Bremec, 1998). The fishing grounds are located along the 100 m isobath, in productive areas associated to a shelf break frontal system (Acha *et al.*, 2003). Since then several studies were conducted to assess the composition and structure of the benthic assemblage that conform the incidental catch of fishery (Bremec & Lasta, 2002; Bremec *et al.*, 2003; Bremec & Schejter, 2005; Schejter & Bremec, 2007a, 2007b). Among their main findings we can highlight the maintenance of a consistent pool of macroinvertebrate species associated to the Patagonian scallop since 1995 (baseline condition), without any significant temporal pattern related to the fishery (Schejter & Bremec 2007b; Schejter *et al.*, 2008). The by-catch studies are usually carried out with a large dredge (non selective of scallop size), which samples only a fraction of the benthic communities subjected to the fishery disturbance and mainly epifaunal. In the present study a Picard dredge was used to sample the broad community, in order to detect other species that might be expected to be sensible to fishing activities which are not sampled during the stock assessment. The main objective of this study is to identify the species composition of the infaunal benthic fraction smaller than 10 mm, usually not collected with scallop gears, but subjected to trawling.

The study area extends between 39º and 44ºS and 84 to 150 m depth. Samples were collected with two different sampling tools in the same areas (Fig. 1). Sixteen samples were collected with scallop gear (2.5 m dredge, 10 mm mesh size) during March and October 2005 and April and May 2006 (R/V "Capitán Cánepa" and R/V "Oca Balda", INIDEP). Material was frozen on board and identified at laboratory. Two cruises were conducted during October 2005 and March 2006 (R/V ARA "Puerto Deseado") and 7 samples were taken with Picard dredge (23 cm x 60 cm mouth, close bag). Material was sieved on board through a 1 mm mesh size and identified at laboratory. In order to know the composition of the infaunal benthic fraction not assessed regularly and its relative importance within the benthic habitat, we compared the Picard dredge samples with the scallop gear samples considering species richness in two different areas influenced by the shelf break front, where Patagonian scallop fishing grounds are trawled. PRIMER (licensed software) was used for similarity analysis (SIMPER, ANOSIM). A total of 136 species was identified in this study; 123 of them were registered in the Picard dredge samples (n = 7) and 61 in the scallop gear samples (n = 16). Forty eight species were shared in both samplings and 11 species were only collected with scallop gear. This is explained because some of the species only can be collected with larger devices that sweep larger areas. In the present case 74 taxa were only collected with Picard dredge. However, 12 of these taxa were occasionally found in samples obtained with the scallop gear during annual monitoring cruises developed during the previous ten years, between 1995 and 2004 (Bremec & Lasta, 2002, Bremec &

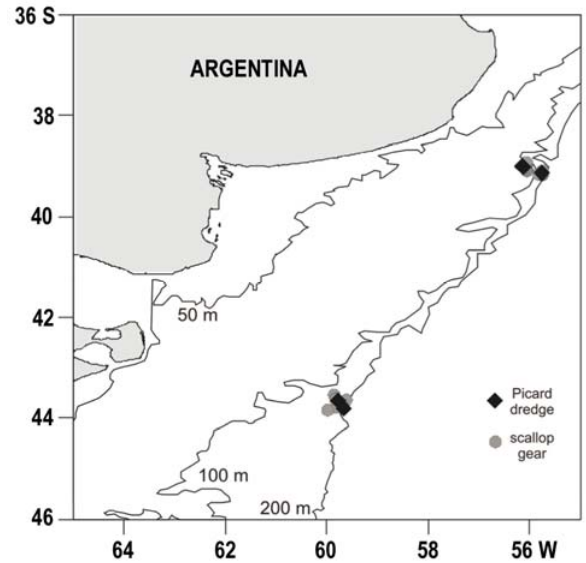

Figure 1. Location of Picard dredge and scallop gear samples in the shelf break frontal areas, Argentine sea.

Figura 1. Ubicación geográfica de muestras obtenidas con rastra vieirera y Picard en áreas de frente de talud en el mar argentino.

Schejter, 2005; Schejter & Bremec, 2007b). Total shared taxa (48 + 12) represents 44.1% of the species collected during this study. The remaining 62 taxa exclusively collected with Picard dredge, mainly infaunal crustaceans and polychaetes, usually not retained with the scallop gear, are listed in Table 1. Bryozoans, hydrozoans and porifera, major groups that sum up nearly 60 species (Genzano *et al.*, 2009; López-Gappa & Landoni, 2009; Schejter *et al.*, 2006, 2008) remained as single taxa in the present study. Species richness in both sampling methods was also evaluated by means of species accumulation curves using the samples-based rarefaction method of the EstimateS 8.2 program (Colwell, 2009). The expected richness (S obs) is the accumulation function of species per number of samples (n = 7 Picard dredge, n = 16 scallop gear). The expected richness function is called *Mao Tau* = expected species accumulation curves. Even with a limited number of samples collected with Picard dredge, the curves show that the scallop gear losses a considerable fraction of benthic species (Fig. 2), those only retained in the Picard dredge and shown in Table 1.

A homogeneous assemblage was found for samples collected with the scallop gear (SIMPER test average similarity: 56.2%); the main taxa that characterized this group are *Zygochlamys patagonica*, *Ophiactis asperula*, *Pseudocnus dubiosus*, *Alcyonium* sp., *Ophiacanta vivipara, Ophiura lymani*, *Sterechinus*

Table 1. List of taxa exclusively collected with Picard dredge in Patagonian scallop grounds at the shelf break front, Argentine sea. unid.: unidentified.

Tabla 1. Lista de taxones exclusivamente colectados con rastra Picard en bancos de vieira patagónica en el frente de talud, mar Argentino. unid.: no identificado.

Taxa	
Cnidaria	Crustacea
Millepora sp.	*Allotanais* sp.
Platyhelmintes	*Ampelisca* sp.
Platyhelmintes unid.	*Atyloella dentata*
Polychaeta	*Atyloella magellanica*
Aglaophamus sp.	*Chaetacturus* sp.
Ampharetidae 1	*Diastylis planifrons*
Ampharetidae 2	*Edotia oculata*
Capitellidae	Gnathiidae
Cirratulidae	Hyperiidae
Lumbrinereis sp.	*Ianthopsis laveis*
Maldanidae 1	*Iathrippa menziesi*
Maldanidae 2	*Iathrippa* sp.
Nephtydae	*Joeropsis curvicornis*
Nereididae	Lysianassidae 1
Onuphis sp.	Lysianassidae 2
Ophelidae	Lysianassidae 3
Orbiniidae	*Macrochiridothea stebbingi*
Phyllodocidae	*Makrokylindrus bacescui*
Polynoidae 1	Melitidae 1
Polynoidae 2	Melitidae 2
Sabellidae	Melitidae 3
Serpulidae 1	Melitidae 4
Serpulidae 2	Melitidae 5
Syllidae	*Moruloidea darwinii*
Terebellidae 1	Munnopsidae
Terebellidae 2	Oniscoidea
Sipunculida	Photidae
Sipunculida unid.	Phoxocephalidae 1
Echiurida	Phoxocephalidae 2
Echiurida unid.	Phoxocephalidae 3
Mollusca	*Rectacturus* sp.
Capulus compressus	Valvifera
Cylichnina georgiana	Holothuroidea
	Cladodactyla crocea
	Holothuroidea unid.

agassizi, Porifera, *Ctenodiscus australis*, *Chaetopterus* sp., *Flabellum* sp. and *Serolis schytei*. This assemblage was persistent in time and characterizes the Patagonian scallop fishing grounds, as previously mentioned by Bremec & Lasta (2002), Bremec & Schejter (2005) and Schejter & Bremec (2007b). Picard samples did not cluster an homogeneous group (SIMPER test average similarity: 32.1%). Average

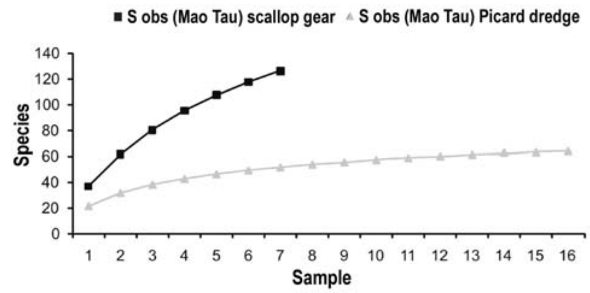

Figure 2. Species accumulation curves of samples-based rarefaction (Mao Tau).

Figura 2. Curvas de acumulación de especies mediante el estimador (Mao Tau).

dissimilarity between samples from Piccard dredge and scallop gear was 69.5% (SIMPER test), differences also confirmed by the ANOSIM test (Global R: 0.846, $P < 0.1\%$). Cummulative dissimilarity of taxa that were only registered in Piccard dredge samples reached 48.9%. These expected results contribute to the knowledge of the benthic biodiversity in shelf break frontal areas and show that the non-currently assessed infaunal fraction is highly diverse. Although larger body-sized infauna are more susceptible to damage (Bergman & Hup 1992; Lindeboom & De Groot, 1998) than smaller body-sized fauna (Gilkinson *et al.*, 1998; Bergman & Van Santbrink, 2000), it must be taken into account that ecological processes such as production are function of body mass (Dickie *et al.*, 1987). However, studies developed in the North Sea suggest that biomass and production levels of infaunal communities were related to trawling intensity and sediment characteristics (Jennings *et al.*, 2002; Queirós *et al.*, 2006; Hinz *et al.*, 2009). In the present case, general knowledge on the biology and distribution of the small taxa is lacking and both spatial and temporal studies should be conducted to assess the impact of fishing in the study area, as bottom trawling affects the lower levels of the food-web that are an important energy source to higher ones (Kaiser *et al.*, 2000; Jennings *et al.*, 2001; Hermsen *et al.*, 2003).

ACKNOWLEDGEMENTS

Cumacea and other Isopoda were identified by Dr. D. Rocatagliatta. F. Vázquez sampled on board the RV ARA Puerto Deseado. Financial support: GEF PATAGONIA SHN PROJECT, PICT PICT 2006-1553, PICT 2007-02200, Inter-American Institute for Global Change Research (IAI) CRN 2076 which is supported by the US National Science Foundation

(Grant GEO-0452325) and INIDEP (INIDEP Contribution Nº 1627).

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Received: 9 April 2010; Accepted: 14 December 2010

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