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CATCH COMPOSITION OF THE DEEP SEA SHRIMP FISHERY (*SOLENOCERA AGASSIZI* FAXON, 1893; *FARFANTEPENAEUS CALIFORNIENSIS* HOLMES, 1900 AND *FARFANTEPENAEUS BREVIROSTRIS* KINGSLEY, 1878) IN THE COLOMBIAN PACIFIC OCEAN

*COMPOSICION DE LA CAPTURA EN LA PESQUERIA DEL CAMARON DE AGUAS PROFUNDAS (*SOLENOCERA AGASSIZI *FAXON, 1893;* FARFANTEPENAEUS CALIFORNIENSIS *HOLMES, 1900, Y* FARFANTEPENAEUS BREVIROSTRIS *KINGSLEY, 1878) DEL OCEANO PACIFICO COLOMBIANO*

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ABSTRACT

The Colombian deep sea shrimp fishery is carried out by vessels with double bottom trawl fishing gear. There is a wide variety in the catch composition species, in which many of them have a wide distribution depth range. Fifty four fish species of 35 families, 11 crustacean species of 11 families, and one mollusk species were identified. Some holothurians, gastropods, echinoderms and other mollusks also appeared occasionally. The joint analysis of the current and former studies determined 85 species in the catch composition of this fishery. The Colombian bottom trawl fishery is actually using the turtle excluder device as the only technical adaptation of the fishing gear to reduce the bycatch turtles, but seems to exclude other big size commercial bycatch. There are some non-commercial bycatch species suitable for human consumption, but they are discarded due to their low price in the market, low abundance or bad aspect for the consumer.

KEYWORDS: Deep sea shrimp, catch composition, faunal bycatch.

RESUMEN

La pesca del camarón de aguas profundas se realiza en Colombia utilizando barcos con redes de arrastre de fondo con aparejo doble. Existe una amplia variedad de especies capturadas en la pesquería del camarón de aguas profundas, donde muchas de éstas presentan un amplio rango de distribución batimétrica. Se identificaron 54 especies de peces pertenecientes a 35 familias y 11 especies de crustáceos de 11 familias y una especie de molusco. Otros moluscos, holotúridos y equinodermos aparecen también ocasionalmente en la composición de la captura. El análisis de éste y otros trabajos anteriores determina un total de 85 especies reportadas como parte de la composición de la captura de esta pesquería. La flota pesquera de arrastre del camarón de aguas someras y profundas de Colombia utiliza los dispositivos excluidores de tortugas como única adaptación técnica en el aparejo de pesca, con miras a evitar la aparición de tortugas, los cuales al parecer también excluyen fauna acompañante de gran tamaño. Algunas especies de la fauna acompañante no comercial son comestibles, pero son descartadas dado su bajo precio en el mercado, poca abundancia o aspecto físico no atractivo para el consumidor.

PALABRAS CLAVES: Camarón de aguas profundas, composición de la captura, fauna acompañante.

INTRODUCTION

The bycatch of the tropical multi-species fisheries, specially the shrimp bottom trawl fishery, is often discarded. However, the amount of discarded bycatch differs among regions; In Asia a relatively small amount of the bycatch is discarded, if compared with Africa and Latin America, where a high percentage of the bycatch is thrown back to the sea. In Latin America and the Caribbean the shrimp fishery take more than one million tons as bycatch, in which approximately 80% is discarded, with the exceptions of Cuba and El Salvador, where almost all of the bycatch is utilized (Clucas & Teutscher 1999).

In Colombia, both shallow and deep trawl fishery use vessels with a double bottom trawl gear as the one described by Fyson (1982). The bottom trawl deep sea shrimp fishery is made from 40 fathoms depth (72m), and addressed to catch species such as *Farfantepenaeus californiensis* Holmes 1900 ("camarón Café" or "Chocolate"), *Farfantepenaeus brevirostris* Kingsley 1878 ("camarón pink"), and *Solenocera agassizi* Faxon, 1893 ("camarón coliflor"). *Heterocarpus* spp. (*Heterocarpus vicarius* Faxon, 1895 and/or *Heterocarpus hostilis* Faxon, 1893; "camarón cabezudo"). They are usually bycatch species but may become the main targeting species at deeper depths, captured mainly by bottom traps.

The shallow water shrimp bycatch have been studied in Latin America by Grande-Vidal & Díaz-López (1981), Alvares-León & Bernal-Solano (1983), Campos (1983a, 1983b, 1986), Martínez (1986), Clucas (1997), Bello (1998), Cabello *et al*. (1998), Cisneros (1998), Garcia & Avalos, (1998), Florez del Valle (1998), Marcano (1998), Font (1998), Morales (1998), and López (1999). There are some other descriptive, fish taxonomic and zoogeographic studies, whose samples were taken on shrimp bottom trawl fishing vessels in the Colombian Pacific Ocean (Alvarez-León & Bernal-Solano 1983; Rubio 1987;1988 a, b; Castillo 1998).

On the other hand, very little is known about the catch composition of the deep sea shrimp fishery. There are a few reports about the deep sea shrimp bycatch for the species *Pandalus borealis* Kroyer, 1838 and *Aristaeomorpha foliacea* (Risso 1827) (Poulsen 1973; Ultang & Oynes 1978; Howard 1983, and Bianchini 1999), and Lambert (1989) reported the fish bycatch in the deep sea shrimp fishery of Mozambique. In Colombia, Sierra (1976) and Alvarez-León & Ben-Tuvia (1989) reported the commercially important and most frequent bycatch species in the Pacific Ocean, respectively.

The present study addresses the Colombian Pacific Ocean deep sea shrimp catch composition, including commercial and non-commercial species, compares results with the former studies mentioned above in the area, and makes some remarks about the use of the turtle excluder device (TED), as the only technical adaptation to reduce the bycatch in the area.

MATERIALS AND METHODS

Between April 1993 and March 1994, monthly samples were taken on board of commercial deep sea shrimp fishing vessels with headquarters in the port of Buenaventura, Colombia. Three sampling geographic zones were determined, depending on the geomorphology of the continental shelf: North zone from the limit with Panama to Cabo Corrientes, Central zone from Cabo Corrientes to Golfo de Tortugas, and South zone, from Golfo de Tortugas to the limit with Ecuador (Fig. 1). Main species samples (deep sea shrimp) were taken according to the method established by Pauly (1983). Bycatch species were separated and identified on board as much as possible. In case of being unable to identify some specimens in the field, samples were taken, fixed in 10% formalin, and brought to the laboratory for further identification analysis. The fish taxonomic identification was done following the taxonomic keys of Chirichigno (1974), Bussing and López (1983), Rubio (1988b), and Fisher *et al*. (1995); The crustacean identification followed the taxonomic keys of Lemaitre and Alvarez-León (1992), and Fisher *et al*. (1995). Synonymies were corrected using Chirichigno & Vélez (1998), Chirichigno& Cornejo (2001), Fishbase (Froese and Pauly, 2005) and Eschmeyer (www.calacademy.org).

Samples were taken between 20 and 200 fathoms depth (36 and 360 m, respectively). Samples of 2-4 hours trawl from 40 fathoms depth (72 m) and deeper were chosen for this study, which corresponds to the deep sea waters according to the Colombian fishery law (Law 13 of 1990).

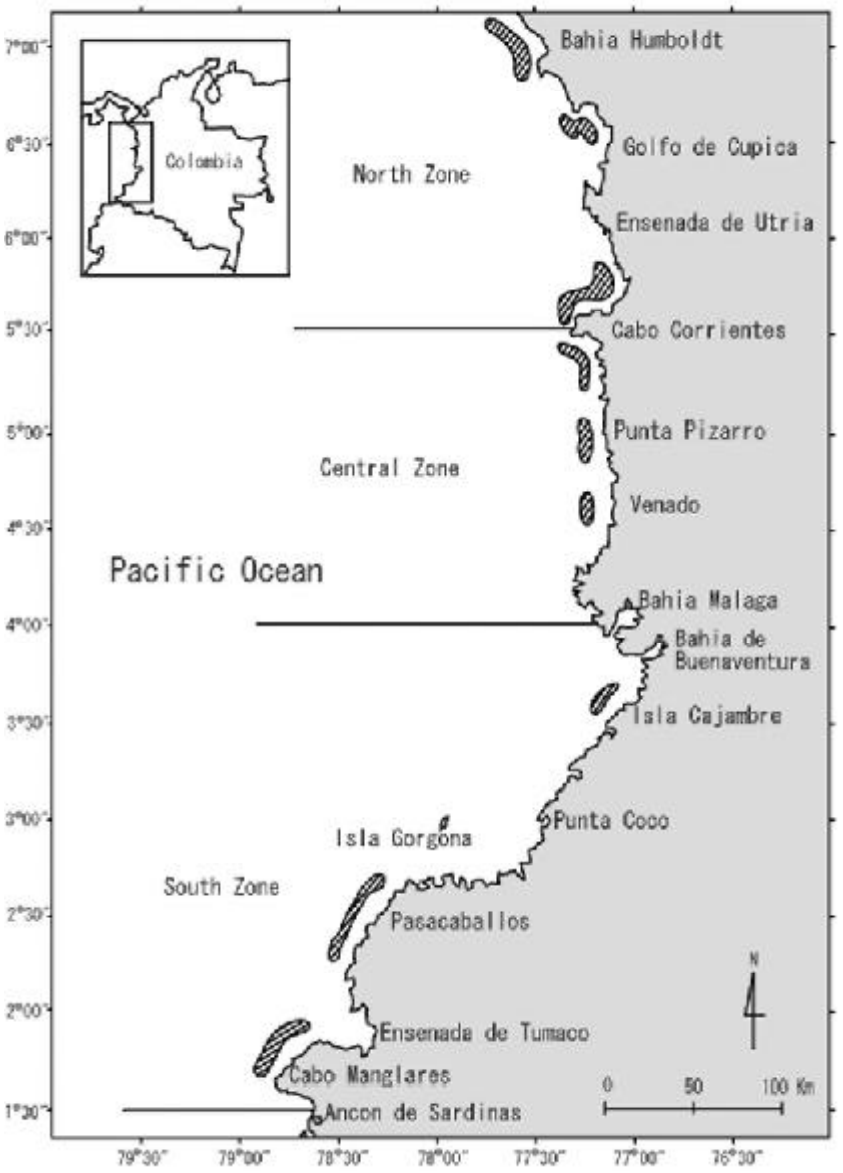

FIGURE 1. Fishing grounds (dashed lines) of the deep sea shrimp fishery during the present study in the Colombian Pacific Ocean.

FIGURA 1. Lugares de pesca del camarón de aguas profundas en el Océano Pacífico colombiano en el presente estudio.

TABLE IA: List of the deep sea shrimp catch composition species identified.

TABLA IA: Lista de las especies identificadas como parte de la composición de la captura del camarón de aguas profundas.

	Family		Scientific name	Local name	Retained	Discarded
1.	Carcharhinidae	1.	*Galeorhinus galeus* (Linnaeus, 1758)	Toyo	†	
2.	Squatinidae	2.	*Squatina armata* (Philippi, 1887)	Angelote		†
3.	Rhinobatidae	3.	*Zapteryx exasperata* (Jordan & Gilbert, 1880)	Raya guitarra		†
4.	Rajidae	4.	*Raja velezi* Chirichigno F., 1973	Raya bruja	†	
5.	Muraenidae	5.	*Muraena* sp.	Morena		†
6.	Ophichthidae	6.	*Ophichthus remiger* (Valenciennes, 1842)	Congrio		†
		7.	*Ophichthus triserialis* (Kaup, 1856)			†
7.	Congridae	8.	*Ariosoma* sp.	Congrio		†
8.	Sternophtychidae	9.	* *Argyropelecus lynchnus* Garman, 1899	Pez hacha		†
9.	Synodontidae	10.	*Synodus* sp.	Peje huevo		†
10.	Chlorophtalmidae	11.	*Chlorophthalmus mento* Garman, 1899	Ojón		†
11.	Moridae	12.	* *Phisiculus nematopus* Gilbert, 1890	Carbonero de fango		†
12.	Macrouridae	13.	* *Coelorhincus canus* (Garman, 1899)	Cola de ratón		†
13.	Ophidiidae	14.	*Brotula clarkae* Hubbs, 1944	Merluza	†	
		15.	*Ophidium fulvum* (Hildebrand & Barton, 1949)	Congrio tejedor		†
		16.	*Lepophidium prorates* (Jordan & Bollman, 1890)	Congrio plateado		†
14.	Lophiidae	17.	* *Lophiodes caulinaris* (Garman, 1899)	Bocón		†
15.	Ogcocephalidae	18.	*Zalieutes elater* (Jordan & Gilbert, 1882)	Murciélago		†
16.	Antennariidae	19.	* *Antennarius avalonis* Jordan & Starks, 1907	Pescador		†
17.	Scorpaenidae	20.	* *Scorpaena russula* Jordan & Bollman, 1890	Peje Diablo	†	
18.	Triglidae	21.	*Bellator gymnostethus* Gilbert, 1892	Peje Rey		†
		22.	*Prionotus stephanophrys* Lockington, 1881	Peje Rey	†	
		23.	*Prionotus albirostris* Jordan & Bollman, 1890	Peje Rey		†
		24.	*Prionotus ruscarius* Gilbert & Starks, 1904	Peje Rey		†
19.	Peristediidae	25.	*Prionotus punctatus* (Bloch, 1793)	Peje Rey		†
		26.	* *Peristedion barbiger* Garman, 1899			†
		27.	* *Peristedion ecuadorensis* Teague, 1961			†

* Species found only over 40 fathoms depth.

Continuation TABLE I B

	Family		Scientific name	Local name	Retained	Discarded
20.	Serranidae	28.	* *Hemanthias signifer* (Garman, 1899)	Pargo terlenca	†	
		29.	*Diplectrum euryplectrum* Jordan & Bollman, 1890	Cagua	†	
		30.	* *Hemanthias peruanus* (Steindachner, 1875)	Pargo nylon	†	
		31.	*Paralabrax humeralis* (Valenciennes, 1828)	Cabrilla	†	
		32.	*Epinephelus acanthistius* (Gilbert, 1892)	Cherna roja	†	
		33.	*Epinephelus cifuentesi* Lavenberg & Grove, 1993	Cherna café	†	
21.	Ophistognatidae	34.	* *Ophistognatus* sp.	Bocagrande		†
22.	Malacanthidae	35.	*Caulolatilus affinis* Gill, 1865	Cabezón	†	
23.	Echeneidae	36.	*Remora remora* (Linnaeus, 1758)	Rémora		†
24.	Lutjanidae	37.	*Lutjanus guttatus* (Steindachner, 1869)	Pargo	†	
		38.	*Lutjanus jordani* (Gilbert, 1898)	Pargo rojo	†	
25.	Sciaenidae	39.	*Umbrina dorsalis* Gill, 1862			†
		40.	*Macrodon mordax* (Gilbert & Starks, 1904)			†
26.	Stromateidae	41.	*Peprilus medius* (Peters, 1869)	Manteco	†	
		42.	*Peprilus snyderi* Gilbert & Starks, 1904	Manteco	†	
27.	Uranoscopidae	43.	* *Kathetostoma averruncus* Jordan & Bollman, 1890	Buldog		†
28.	Gobiidae	44.	*Gobiosoma paradoxum* (Gunther, 1861)	Gobio		†
		45.	*Bathygobius andrei* (Sauvage, 1880)	Gobio		†
29.	Trichiuridae	46.	*Trichiurus* sp.	Sable		†
30.	Scombridae	47.	*Scomber japonicus* (Houttuyn, 1782)		†	
31.	Paralichthydae	48	*Citharichthys gilberti* Jenkins & Evermann, 1889	Lenguado		†
		49.	*Cyclopsetta querna* (Jordan & Bollman, 1890)	Lenguado	†	
		50.	*Hippoglossina tetrophthalma* (Gilbert, 1890)	Lenguado		†
32.	Cynoglossidae	51.	*Symphurus* sp.	Lengüeta		†
33.	Balistidae	52.	*Pseudobalistes naufragium* (Jordan & Starks, 1895)	Chancho de franjas	†	
34.	Tetraodontidae	53.	*Sphoeroides annulatus* (Jenyns, 1842)	Tamborero		†
35.	Diodontidae	54.	*Diodon hystrix* Linnaeus, 1758	Pez erizo		†

* Species found only over 40 fathoms depth.

RESULTS

The catch composition of the deep sea shrimp fishery found during this study is listed in Tables I A, I B and II. Fifty four fish species from 35 families (six up to the genera), 11 crustacean species from 11 families two species up to the genera) and one mollusk for a total of 66 species were identified.

There was a variety of deep sea shrimp bycatch species with a wide depth distribution range. From 54 fish species identified, only 12 were exclusively deep sea species, while eight of the 11 crustacean species identified belong to deeper waters (tables I and II, species marked with asterisk *). Other species had a wide range of depth distribution, and could be found in shallow waters as well (from 0 to 40 fathoms depth).

The most frequent fish species during the period of study (> 90% of appearance) were *Citharichtys gilberti* Jenkins & Evermann 1889, *Cyclopsetta querna* (Jordan & Bollman 1890), *Hippoglossina tetrophtalma* (Gilbert 1890) (Paralichthydae); *Ophichthus remiger* (Valenciennes 1842), *Ophichthus triserialis* (Kaup 1856) (Ophichthidae); *Brotula clarkae*, Hubbs 1944, *Ophidium fulvum* (Hildebrand & Barton 1949), *Lepophidium prorates* Jordan & Bollman 1890 (Ophidiidae); *Hemanthias signifier* (Garman 1899), *Hemanthias peruanus* (Steindachner 1875), *Diplectrum euryplectrum* Jordan & Bollman 1890 (Serranidae); *Peprilus medius* (Peters 1869), *Peprilus snyderi* Gilbert & Starks 1904 (Stromateidae); *Bellator gymnostethus* Gilbert 1892, *Prionotus stephanophrys* Lockington 1881, *Prionotus albirostris* Jordan & Bollman 1890, *Prionotus ruscarius* Gilbert &Starks 1904, and *Prionotus punctatus* (Bloch 1793) (Triglidae).

Economically important fish species with a wide depth distribution range were: *Macrodon mordax* (Gilbert & Starks 1904), *Umbrina dorsalis* Gill, 1862 (Sciaenidae), *P. medius*, *P. snyderi* (Stromateidae), *B. clarkae* (Ophidiidae), *Epinephelus acanthistius* Gilbert 1892, *Paralabrax humeralis* (Valenciennes 1828), *D. euryplectrum* (Serranidae), *C. querna* (Paralichthydae) and *P. stephanophrys* (Triglidae). Fish species with a commercial value found only in deep waters were *H. signifer* and *H. peruanus* (Serranidae).

The most frequent bycatch crustacean species were *Maiopsis panamensis* Faxon 1893, *Portunus iridiscens* Rathbun 1893, *Squilla biformis* Bigelow 1891, *Latreutes antiborealis* Holthius 1952, and *Heterocarpus* spp. (*H. vicarius* and/or *H. hostilis*, which are commercially important). Mollusks such as the squid *Lolliguncula panamensis* Berry 1911 (Loliginidae) and some octopuses (*Octopus* spp.) also appeared frequently in the catch composition. Some gastropods, holothurians and echinoderms (shells, bivalves, sea cucumbers, starfishes, sea urchins, etc.) appeared sporadically as well, but weren't identified in detail.

TABLE II: Deep sea shrimp catch composition species of crustaceans and mollusks identified.

TABLA II: Crustáceos y moluscos identificados como parte de la composición de la captura del camarón de aguas profundas.

	Family		Scientific name	Local name	Retained	Discarded
	Crustacea:					
1.	Hippolytidae	1.	* *Latreutes antiborealis* Holthuis, 1952	Camarón de ocelo		†
2.	Pandalidae	2.	* *Heterocarpus* spp.	Camarón cabezudo		†
3.	Axiidae	3.	* *Acanthaxius caespitosus* (Squires, 1979)	Camarón o langosta peluda de profundidad		†
4.	Paguridae	4.	* *Xylopagurus cancellarius* Walton	Hermitaño madera		†
5.	Galatheidae	5.	* *Pleuroncodes monodon* H. Milne Edward, 1837	Langostilla		†
6.	Gonodactylidae	6.	*Gonodactylus* sp.	Camarón bravo		†
7.	Squillidae	7.	*Squilla biformis* Bigelow, 1891	Camarón bravo		†
8.	Calappidae	8.	* *Acanthocarpus delsolari* Garth, 1973	Cangrejo espinoso		†
9.	Majidae	9.	* *Maiopsis panamensis* Faxon, 1893	Centollo		†
10.	Parthenopidae	10.	* *Parthenope triangula* (Stimpson ,1860)	Cangrejo de profundidad		†
11.	Portunidae	11.	* *Portunus iridiscens* Rathbun,1893	Jaiba mora		†
	Molusca:					
1.	Loliginidae	1.	*Lolliguncula panamensis* Berry, 1911	Calamar	†	

From 54 fish species identified, 19 species are usually retained on board. The remaining ones are discarded. All crustacean species are discarded while the only mollusk identified is retained. Species retained are to be sold or for self consumption.

DISCUSSION

There is a general world concern about the bottom trawl bycatch. Detailed analysis of the information showed a world bycatch captures of 27 million tons average per year, from which the tropical shrimp trawl fisheries has the highest percentage accounting for one third of the global total (Alverson *et al*. 1994). In Colombia there is also an increasing concern about the bottom trawl shrimp bycatch, but this is a quite recent field of study, specially the deep sea shrimp bycatch, due to the quite recent growth of the deep sea shrimp fishery in the Pacific Ocean.

Only two studies have been reported regarding the deep sea shrimp bycatch in the Colombian Pacific Ocean. Sierra (1976) reported nine commercially important bycatch fish species in the deep sea shrimp *Solenocera agassizi* fishery, which poorly agree in the number of species reported in this study. The fish species reported by Sierra (1976) are *Mycteroperca xenarcha* Jordan 1888, *Cynoponticus coniceps* (Jordan & Gilbert 1882), *Parapsettus panamensis* (Steindachner 1875), *Echinorhinus cookei* Pietschmann 1928, *Heterodontus quoyi* (Fréminville 1840), *E. acanthistius*, *H. signifier*, *L. prorates* and *B. clarkae*, from which five species were reported in this study too (*B. clarkae*, *L. prorates*, *E. acanthistius*, *H. signifer* and *H. peruanus*). Alvarez-León & Ben-Tuvia (1989) reported the 26 most important fish species captured by the deep sea shrimp fishery in the Colombian Pacific Ocean, from which nine species coincide with our study (*Lophoides caulinaris* (Garman 1899), *Zalieutes elater* (Jordan & Gilbert 1882), *Caulolatis affinis* Gill 1865, *E. acanthistius*, *H. signifer*, *H. peruanus*, *B.clarkae*, *L. prorrates*, and *C. querna*). On the other hand, the species reported by Sierra (1976), were also reported by Alvarez-León and Ben-Tuvia (1989) excepting *H. quoyi*. Tables III A, III B and III C compare the species reported in the three studies.

The crustacean bycatch has no commercial value in Colombia, excepting the big head shrimp *Heterocarpus* spp., which is retained on board only when it become the target species captured by traps at deeper depth. Sierra (1976) reported *Pleuroncodes monodon* H. Milne Edward 1837, *Heterocarpus* sp., and *Maiopsis* sp., coinciding with our reports. Among mollusks reported, the squid *L. panamensis* has a moderate commercial value in the Colombian fish market as well. The whole species reported until now as catch composition of the deep sea shrimp fishery accounts a total of 85 species identified (73 fish species from 43 families, 11 crustacean species from 11 families, and 1 mollusk species) (Tables III A, III B and III C).

The poor coincidence in the number of species reported in the deep sea shrimp fishery among the studies may be caused by the following factors: (i) Sierra (1976), and Alvarez-León & Ben-Tuvia (1989) analyzed the most frequent species with a real or potential economic value, while this study reported frequent and rare species with or without any commercial value. (ii) The current study reported a variety of species with a wide range of depth distribution, in which many species might be found in shallow waters as well, while the other two studies reported mainly deep sea species. (iii) This study included crustaceans and mollusks as part of the catch composition while the other studies included three crustacean species (two of them up to genera) or only fish as reported above.

No qualitative differences in the catch composition by sampling area were found in this study. However, the purple crab *P. iridiscens* seemed to be more abundant in the north zone, while the little lobster *P. monodon* seemed to be more abundant in the central and south zones.

The Colombian bottom trawl fishery vessels are currently using the TED as the only technical adaptation of the fishing gear to reduce the incidental capture of turtles. However the measure wasn't well accepted by the vessel crews, since the TED greatly reduce the volume of commercial bycatch, especially big size fish, which are normally sold to increase their economic income. No other excluder device has been tested so far in the region. In countries like Australia, Germany and Japan, different mesh sizes, coden shapes, TEDs and bycatch reduction devices (BRDs) have been tested in order to reduce the bycatch captures (Wienbeck 1998-1999; Kenelly 1999; Robins *et al*. 1999; Broadhurst 2000; Matsushita 2000).

TABLE III A: Comparison of the deep sea shrimp catch composition fish species in three studies.
* = present in one study; x = present in two studies; o = present in all.

TABLA III A: Comparación de la composición de la captura del camarón de aguas profundas en tres estudios realizados.
* = presente en un estudio, x = presente en dos estudios, o = presente en todos.

	Family		Scientific name	This study	Alvarez Leon & Ben-Tuvia, 1989	Sierra, 1976
1.	Heterodontidae	1.	*Heterodontus mexicanus* Taylor & Castro-Aguirre, 1972		*	
		2.	*Heterodontus quoyi* (Fréminville, 1840)			*
2.	Triakidae	3.	*Mustelus lunulatus* Jordan & Gilbert, 1882		*	
3.	Carcharhinidae	4.	*Galeorhinus galeus* (Linnaeus, 1758)	*		
4.	Echinorhinidae	5.	*Echinorhinus cookei* Pietschmann, 1928		x	x
5.	Squatinidae	6.	*Squatina armata* (Philippi, 1887)	*		
6.	Rhinobatidae	7.	*Zapterix exasperata* (Jordan & Gilbert, 1880)	*		
7.	Rajidae	8.	*Raya velezi* Chirichigno F., 1973	*		
8.	Muraenidae	9.	*Muraena* sp.	*		
9.	Ophichthidae	10.	*Ophichtus remiger* (Valenciennes, 1842)	*		
		11.	*Ophichtus triserialis* (Kaup, 1856)	*		
10.	Muraenesocidae	12.	*Cynoponticus coniceps* (Jordan & Gilbert, 1882)		x	x
11.	Congridae	13.	*Ariosoma* sp.	*		
12.	Sternophtychidae	14.	*Argyropelecus lynchnus* Garman, 1889	*		
13.	Sinodontidae	15.	*Synodus* sp.	*		
		16.	*Synodus scituliceps* Jordan & Gilbert, 1882		*	
14.	Chlorophtalmidae	17.	*Chlorophtalmus mento* Garman, 1899	*		
15.	Moridae	18.	*Phisiculus nematopus* Gilbert, 1890	*		
16.	Merlucciidae	19.	*Merluccius angustimanus* Garman, 1899		*	
17.	Macrouridae	20.	*Caelorinchus canus* (Garman, 1899)	*		
		21.	*Trachyrincus helolepis* Gilbert, 1892		*	
18.	Ophidiidae	22.	*Brotula clarkae* Hubbs, 1944	o	o	o
		23.	*Olophidium fulvum* (Hildebrand & Barton, 1949)	*		
		24.	*Lepophidium prorates* (Jordan & Bollman, 1890)	o	o	o

TABLE III B: Comparison of the deep sea shrimp catch composition fish species in three studies.
* = present in one study; x = present in two studies; o = present in all. (Continuation).

TABLA III B: Comparación de la composición de la captura del camarón de aguas profundas en tres estudios realizados.
* = presente en un estudio, x = presente en dos estudios, o = presente en todos. (Continuación).

	Family		Scientific name	This study	Alvarez León & Ben-Tuvia, 1989	Sierra 1976
19.	Bythitidae	25.	*Ogilbia ventralis* (Gill, 1863)		*	
20.	Batrachoididae	26.	*Aphos porosus* (Valenciennes, 1837)		*	
21.	Lophiidae	27.	*Lophiodes caulinaris* (Garman, 1899)	x	x	
22.	Ogcocephalidae	28.	*Zalieutes elater* (Jordan & Gilbert, 1882)	x	x	
23.	Antennariidae	29.	*Antennarius avalonis* Jordan & Starks, 1907	*		
24.	Scorpaenidae	30.	*Scorpaena russula* Jordan & Bollman, 1890	*		
		31.	*Pontinus furcirhinus* Garman, 1899		*	
25.	Triglidae	32.	*Bellator gymostethus* Gilbert, 1892	*		
		33.	*Prionotus albirostris* Jordan & Bollman, 1890	*		
		34.	*Prionotus punctatus* (Bloch, 1793)	*		
		35.	*Prionotus ruscarius* Gilbert & Starks, 1904	*		
		36.	*Prionotus stephanophrys* Lockington, 1881	*		
26.	Peristediidae	37.	*Peristedion barbiger* Garman, 1899	*		
		38.	*Peristedion ecuadorensis* Teague, 1961	*		
27.	Ephippidae	39.	*Parapsettus panamensis* (Steindachner, 1875)			*
28.	Serranidae	40.	*Diplectrum euriplectrum* Jordan & Bollman, 1890	*		
		41.	*Diplectrum macropoma* (Gunther, 1864)		*	
		42.	*Diplectrum pacificum* Meek & Hildebrand, 1925		*	
		43.	*Epinephelus acanthistius (*Gilbert, 1892)	o	o	o
		44.	*Epinephelus cifuentesi* Lavenberg & Grove, 1993	*		
		45.	*Hemanthias peruanus* (Steindachner, 1875)	o	o	o
		46.	*Hemanthias signifer* (Garman, 1899)	o	o	o
		47.	*Mycteroperca xenarcha* Jordan, 1888		x	x
		48.	*Paralabrax humeralis* (Valenciennes, 1828)	*		

TABLE III C: Comparison of the deep sea shrimp catch composition fish species in three studies. * = present in one study; x = present in two studies; o = present in all. (Continuation).

TABLA III C: Comparación de la composición de la captura del camarón de aguas profundas en tres estudios realizados. * = presente en un estudio, x = presente en dos estudios, o = presente en todos. (Continuación).

	Family		Scientific name	This study	Alvarez León & Ben-Tuvia, 1989	Sierra 1976
		49.	*Pronotogrammus eos* Gilbert, 1890		*	
29.	Opisthognatidae	50.	*Opisthognatus punctatus* Peters, 1869		*	
		51.	*Opisthognatus* sp.	*		
30.	Malacanthidae	52.	*Caulolatilus affinis* Gill, 1865	x	x	
31.	Echeneidae	53.	*Remora remora* (Linnaeus, 1758)	*		
32.	Lutjanidae	54.	*Lutjanus guttatus* (Steindachner, 1869)	*		
		55.	*Lutjanus jordani* (Gilbert, 1898)	*		
33.	Sciaenidae	56.	*Macrodon mordax* (Gilbert & Starks, 1904)	*		
		57.	*Umbrina dorsalis* Gill, 1892	*		
34.	Stromateidae	58.	*Peprilus medius* (Peters, 1869)	*		
		59.	*Peprilus snyderi* Gilbert & Starks, 1904	*		
35.	Uranoscopidae	60.	*Kathetostoma averruncus* Jordan & Bollman, 1890	*		
36.	Gobiidae	61.	*Bathygobius andrei* (Sauvage, 1880)	*		
		62.	*Gobiosoma paradoxum* (Gunther, 1861)	*		
37.	Trichiuridae	63.	*Trichiurus lepturus* Linnaeus, 1758		*	
		64.	*Trichiurus* sp.	*		
38.	Scombridae	65.	*Scomber japonicus* Houttuyn, 1782	*		
39.	Paralichthydae	66.	*Ancylopsetta dendritica* Gilbert, 1890		*	
		67.	*Citharichthys gilberti* Jenkins & Evermann, 1889	*		
		68.	*Cyclopsetta querna* (Jordan & Bollman, 1890)	x	x	
		69.	*Hippoglossina tetrophthalma* (Gilbert, 1890)	*		
40.	Cynoglossidae	70.	*Symphurus* sp.	*		
41.	Balistidae	71.	*Pseudobalistes naufragium* (Jordan & Starks, 1895)	*		
42.	Tetradontidae	72	*Sphoeroides annulatus* (Jenyns, 1842)	*		
43.	Diodontidae	73.	*Diodon hystrix* Linnaeus, 1758	*		

There are some bycatch species suitable for human consumption in the deep sea shrimp fishery of the Colombian Pacific Ocean, but its low price in the market, low abundance, or bad physical aspect make for them to be discarded. Further studies are needed to quantify the amount of bycatch retained and discarded, so that an eventual use of the discarded bycatch can be proposed.

The analysis of the deep sea shrimp catch composition in the Colombian Pacific Ocean helped the National Institute for Fisheries and Aquaculture to establish research proposals in some commercial resources such as the hake *B. clarkae* and the big head shrimp *Heterocarpus* spp.

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