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Monitoring results of marine debris at Cape Shirreff, Livingston Island, South Shetland Islands, during the Antarctic season 1995/96[1].

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ABSTRACT

The principal results of the monitoring survey on marine debris carried out at Cape Shirreff, Livingston Island, during the Antarctic season 1995/96 are given.

During the present survey a total of 4,251 articles with a total weight of 65.8 kg were obtained. As it occurred in previous seasons, plastic was the principal item (4,015 pieces) with a 94.45%; followed by glass (147 pieces), 3.46%; metal (77 pieces), 1.81%; and paper (12 pieces), with a 0.28%. From plastic item, those used in fisheries were 1,195 articles (strapping bands and net pieces). The total density of marine debris collected on the site have increased from 0.65 articles/m^2 in 1993/94 to 1.02 in 1994/95, and 1.52 in 1995/96.

Some *Larus dominicanus, Chionis alba,* and *Pygoscelis antarctica* continue using some plastic fibres to build their nests. On the other hand, four specimens of *Arctocephalus gazella* were observed with neck collars: two juveniles, and two three month old pups. All these animals were immobilized in order to take their neck collars off; after that they were released.

As it occurred in the Antarctic season 1994/95, several plastic pieces (51) show evidences of having been processed into incinerators before been thrown into the water. Therefore, it is possible to infer that the ashes produced may have been also disposed into the sea. If so, it would be an action against the international agreements about protection of the sea.

Upon this basis, it is suggested that CCAMLR may produce a booklet with didactic information and guidelines about basical and fundamental actions to be taken especially on board of fishing ships in order to avoid marine pollution with garbage produced on board, as well as to be used for teaching activities by captains, and chiefs of fishery crews before embarking. This would be a complement to present CCAMLR actions and Conservation Measures on the avoidance of incidental mortality of Antarctic marine animals.

Key words: Marine debris, entanglements, CCAMLR, CEMP Site, Antarctica.

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Resultados del seguimiento de desechos marinos en cabo Shirreff, isla Livingston, islas Shetland del Sur, durante la temporada antártica 1995/96[1].

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RESUMEN

Se da a conocer el resultado de las investigaciones sobre el seguimiento de desechos marinos efectuado en cabo Shirreff, isla Livingston, durante la temporada antártica 1995/96. Durante el desarrollo del trabajo se recolectaron 4.251 artículos, con un peso total de 65,8 kg. Tal como sucedió en temporadas previas, el plástico fue el principal ítem (4.015 artículos), con el 94,45% del total; a continuación siguieron los vidrios (147 trozos), con el 3,46 %; sigue el metal (77 piezas), con el 1,81%; finalizando con el papel (12 artículos), con el 0,28%. Del total de los plásticos, se encontraron 1.195 artículos usados en las pesquerías (zunchos plásticos y restos de redes). La densidad total de los desechos marinos recolectados en el lugar aumentó desde 0,65 artículos/m^2 en la temporada 1993/94 a 1,02 en la expedición 1994/95 y a 1,52 durante la temporada 1995/96.

Algunas gaviotas, *Larus dominicanus*, palomas antárticas, *Chionis alba*, y pingüinos antárticos, *Pygoscelis antarctica,* continúan usando algunas fibras plásticas para construir sus nidos. Además, se observaron cuatro ejemplares de *Arctocephalus gazella*, con collares plásticos: dos juveniles y dos cachorros, estos últimos de tres meses de edad. Todos ellos fueron inmovilizados para removerles las ligaduras y luego fueron liberados.

Tal como sucedió en la temporada antártica 1994/95, varios trozos plásticos (51) presentaron evidencias de haber sido tratados en incineradores. Por lo tanto, es posible inferir que las cenizas producidas también fueron lanzadas al mar. Si esto es así, sería un hecho contrario a los acuerdos internacionales sobre la protección del mar.

Sobre la base de estos antecedentes, se sugiere que la CCRVMA elabore folletos con información didáctica y guías sencillas acerca de los fundamentos básicos y de las principales acciones a desarrollar, especialmente a bordo de los buques pesqueros, con el fin de evitar la contaminación marina, como así también para ser usados en actividades docentes previas al embarque de capitanes y patrones pesqueros. Estas actividades complementarían aquellas acciones y los actuales esfuerzos y Medidas de Conservación adoptadas por la CCRVMA para evitar la mortalidad incidental de la fauna marina antártica.

Palabras clave: Desechos marinos, enmallamientos, CCRVMA, Sitio CEMP, Antártica.

INTRODUCTION

With the purpose of monitoring the marine debris problem on the beaches of Cape Shirreff (CEMP Site), Livingston Island, and its impact caused on the animal population on the site, a base line was established during the Antarctic season 1993/94 (Torres and Jorquera, 1995a). After that, two

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surveys were carried out in that place during the following summer seasons 1994/95 and 1995/96. Then, the purpose of this paper is to inform about the results obtained during these surveys, and also suggest to CCAMLR to put in practice some educational actions to promote the protection of the marine environment and biota among the people involved in fishing and other activities in the waters of the Convention area, in order to minimize the marine debris problem.

METHOD

As it was reported before (Torres and Jorquera, 1994) all 36 places indicated in Fig. 1 were surveyed by foot, collecting marine debris and clasifying them into four items: plastic, metal, glass, and paper material. The labeled garbage was stored into plastic bags and transported by boat to the ship.

Other marine debris were collected, at the end of the breeding period, from every accesible nest of kelp gull, *Larus dominicanus*, sheathbill, *Chionis alba*, and chinstrap penguin, *Pygoscelis antarctica*. Besides, net pieces were removed from the neck of two juveniles of A. *gazella*, and a straping band and a plastic six-pack were removed from two three month old pups (Torres *et al.*, 1996). All this material was sent to the Instituto de Investigaciones y Ensayes de Materiales (IDIEM), Universidad de Chile, where it was analized and classified.

The map used in the survey was that of Fig. 1 to a scale 1:4.200 (Torres, 1993), and in general the collection was conducted following the guidelines proposed by CCAMLR (1993). An special care was taken in order to avoid any disturbance in the breeding colonies, especially those located near the beaches, such as those of penguins and fur seals.

RESULTS AND DISCUSSION

In Table 1 it is shown the amount of pieces obtained by beach, and their correspondant weight. The total weight was 65.8 kg for a total of 4,251 articles. This figure is high compared with those of the two previous seasons, but their respective weight is low, as it is shown in Fig. 2. It is observed an increase of 1,507 pieces compared with the previous season 1994/95. And as it occurred in the survey 1995/96, a continued decrease of weight garbage was observed. In this ocassion there were 171.8 kg less than the previous one; this is because the plastic was the main item collected. In fact, as it is shown in Table 2, among all items collected, plastic was composed by 4,015 pieces (94,45%), meanwhile the metalic articles were 77 (1.81%), the glass pieces were 147 (3.46%), and 12 paper pieces (0.28%). The percentage of each item is shown in Fig. 3, in which the figures of the two previous seasons are included with comparative purposes. It is important to note that plastic maintains a high relative importance (more than 90%) during these three seasons.

The above means that plastic is one of the most important materials, especially that used in fishing operations. This is possible to be inferred because of the high number of articles used in fisheries, such as strapping bands (574, 381 and 543 during the last three seasons) and ropes, some pieces of nets included (194, 176 and 392, respectively) in relation to the total amount of plastic item during the respective seasons: 1,612, 2,477 and 4,015 articles.

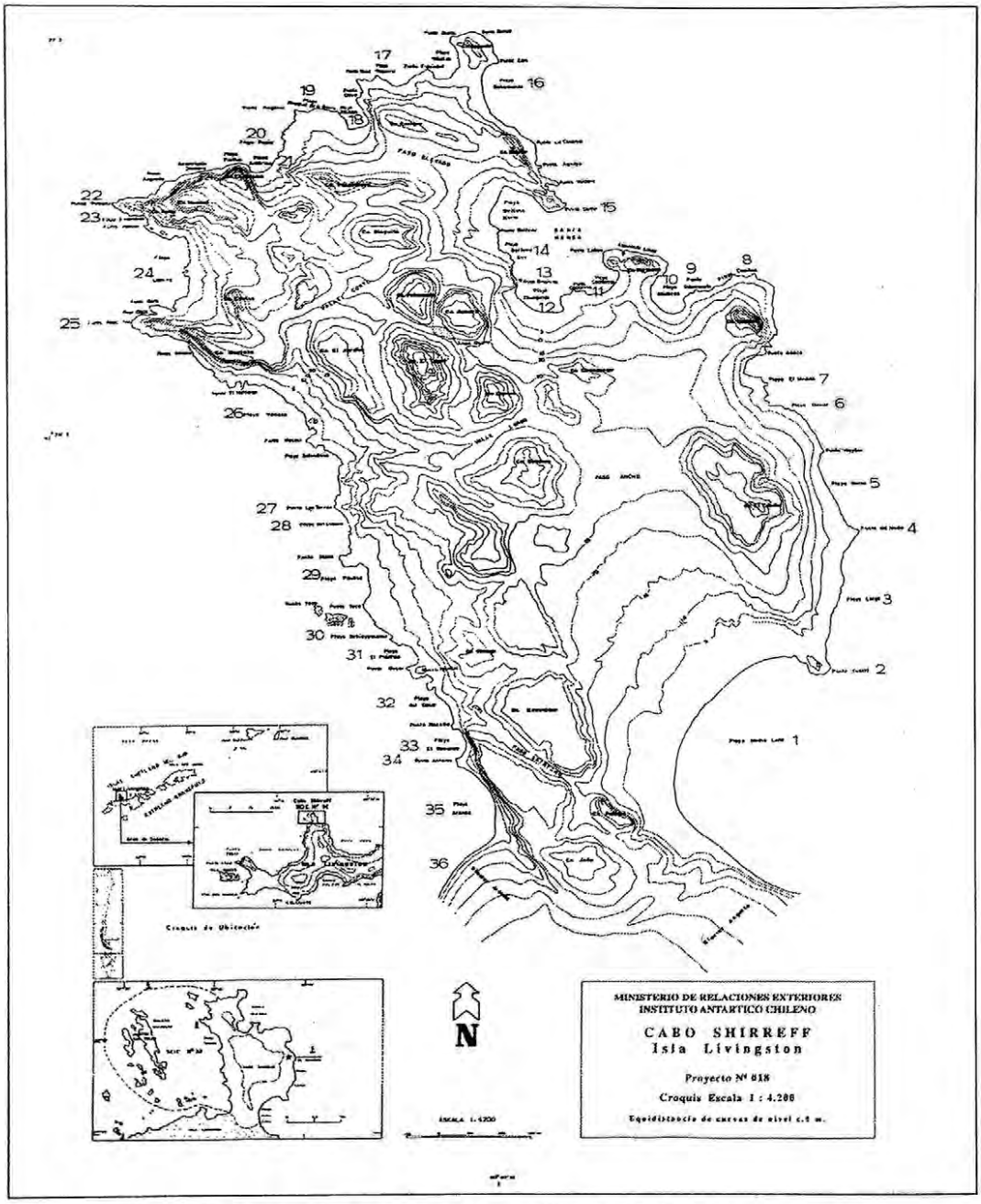

Fig. 1. Number and place names where marine debris were collected in 1995/96 Antarctic summer.

In our opinion, the other plastic or synthetic fibres may come from some touristic groups, logistic activities, and in some way from the scientific ones and other operations carried out by ships, on board of which people use domestic and personnal articles stored in plastic bottles. Besides, it is important to note that pieces, and granules of polystyrene have increased during the last three seasons (143, 242, and 1,351, respectively). This clearly means that the use of this kind of material has increased and its dispersion possibly has been caused by the wind during storms and fallen into the sea, or thrown

intentionally into the sea. If this problem has occurred in the Convention Area after the elaboration of the Protocol to the Antarctic Treaty on Environmental Protection (04.01.91), this means that a transgression to the Article 7 "Forbiden Products", Annex III, has taken place.

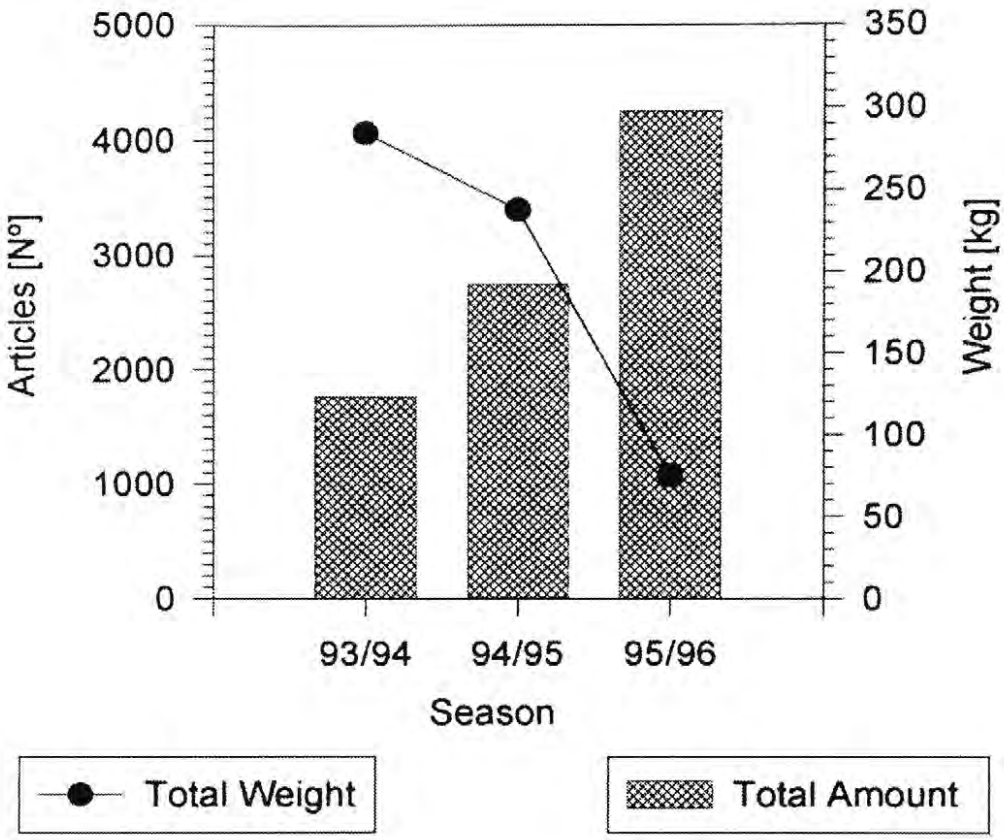

Fig. 2. Amount and weights of all items of marine debris collected during the Antarctic seasons 1993/94, 1994/95 and 1995/96.

In order to compare the amount of articles of each item by beach, in Fig. 4 it is possible to see that the places of the eastern side as well as the western side of Cape Shirreff accumulate the main part of marine debris, as it was stated previously (Torres and Jorquera, 1995b), due to the local currents and predominant winds in the area.

With respect to the impact caused by this kind of garbage on the local fauna, this time we observed plastic fibres in 3 nests of kelp gulls, *Larus dominicanus*, in 3 nests of sheathbill, *Chionis alba*, and in one nest of chinstratp penguin, *Pygoscelis antarctica*. In this season four individuals of *A. gazella*, two juveniles and two three month old pups, were released from entanglement. One pup had a strapping band with a loop, and the other had a six pack in its neck. This is the first finding of pup entanglement in the CEMP Site (Torres *et al.*, 1996). During this season we also found a handful of 35 strapping bands making loops. This is an action against the Conservation Measure 63/XII, which may cause damage to Antarctic fur seals, including pups, as it was recorded.

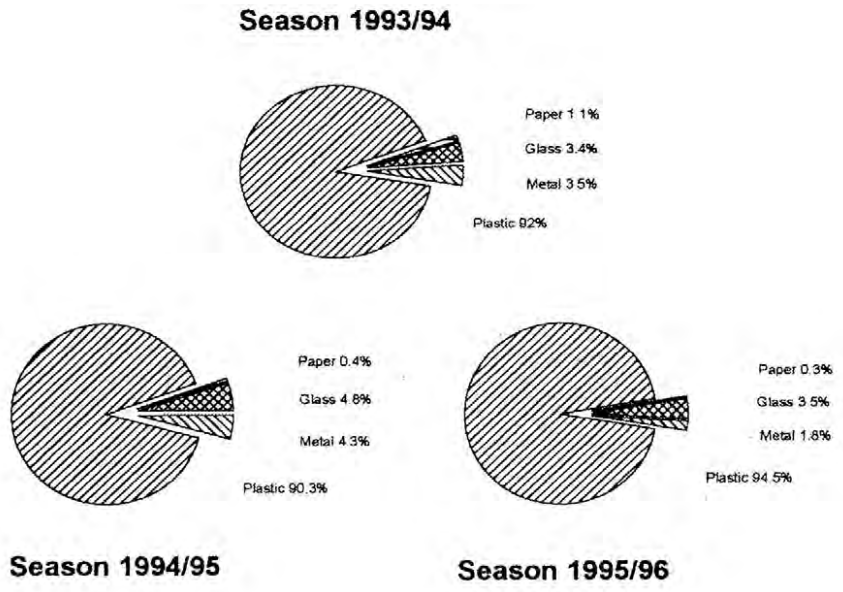

Fig. 3. Percentage of marine debris items collected at Cape Shirreff in the 1993/94, 1994/95 and 1995/96 Antarctic summer seasons.

On the other hand, as it occurred during the survey carried out in the 1994/95 season, some plastic garbage collected (51 pieces) show evidences of having been processed into incinerators before being thrown into the water. In consequence, it is possible to infer that the ashes produced out of this process have been also disposed into the sea (Torres and Jorquera, 1995). If such an action has been performed in the waters of the Convention Area, it would be an action against the Protocol to the Antarctic Treaty on Environmental Protection.

In relation to the 147 glass pieces recorded, 142 were fragments and 5 bottles. With respect to these fragments, we can infer that they are pieces of bottles broken by waves against the rocks, which pieces appeared on the surface of the beaches by the tide action, which has revolved the littoral substrata. Due to this, the glass edges are worn-out.

The 77 metallic pieces were mainly fragments of copper wires (32), top pieces of lighters (31), spray cylinders (9), and beer cans (5). It is important to note that just during this season it was possible to remove from Cape Shirreff 5 oil drums stranded there several years ago. This material has not been considered among the 77 pieces, because this finding was informed previously. By the way, it is important to note that three big size garbages are still remaining at the CEMP Site: A floater, stranded in the "El Remanso" beach (N°33 in Fig. 1) trapped by the littoral snow and ice, being difficult to be removed; and two oil drums located in the "Norte" beach at San Telmo Islets. These oil drums have been difficult to remove because they are located in a breeding area of *A. gazella*.

With regard to the paper item, it was composed by 12 pieces: 10 of carton tubes, some of them relatively recent, and 2 fragments of similar objects.

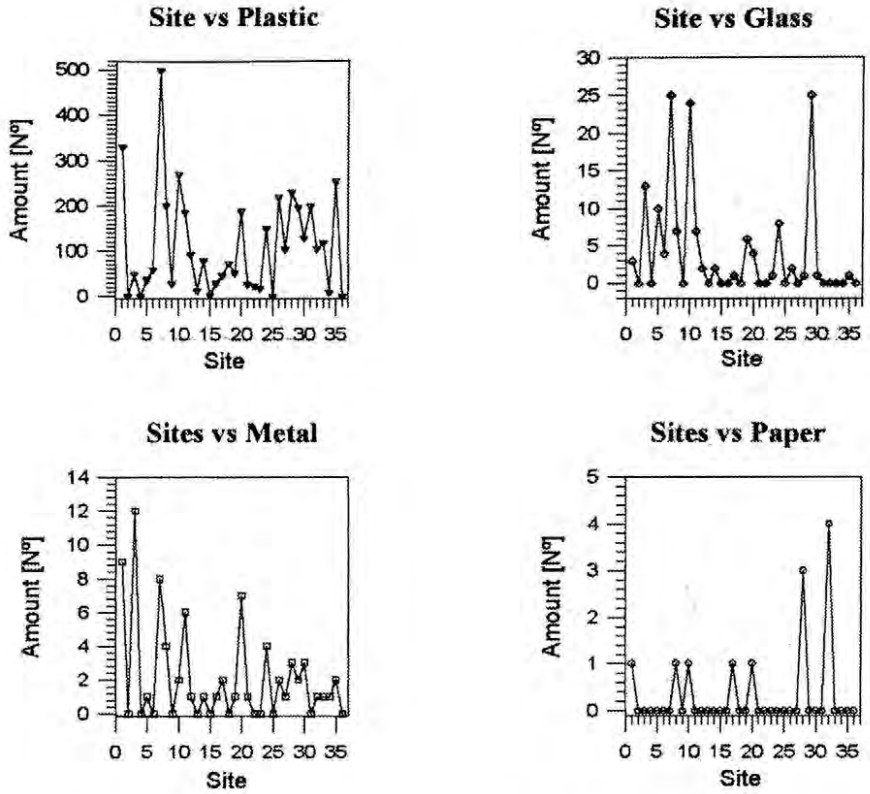

Fig. 4. Amount of plastic, glass, metal and paper by sites collected at Cape Shirreff (from East to West) in the Antarctic season 1995/96.

The total density of marine debris collected at Cape Shirreff, when a base line was established there during the Antarctic season 1993/94, it was 0.65 articles/m^2. In 1994/95 the total density was 1.02 articles/m^2; and during the Antarctic season 1995/96 the value was 1.52 articles/m^2. This is another evidence that marine debris continue increasing at Cape Shirreff.

During the analysis of pieces of all items collected at Cape Shirreff, it is possible to identify trademarks from new procedences not registered before in the CEMP Site: Italy and Malaysia, which are added to the other previous ones, as it is shown in Table 3.

As it was stated by Torres and Jorquera (1995), the increasing number of place origins not previously recorded indicate in some way that:

i) The activities carried out on board of ships (fishing, tourism, logistics, scientific activities, and others) inside and immediately outside of the Convention Area, have increased as well as the production of garbage.

ii) Some garbage originated on board of those ships, voluntarily or not, has been eliminated into the sea.

Table 1

Sites of Cape Shirreff cited from East (E) to West (W), with a total number and weight of pieces of marine debris collected in the 1995/96 Antarctic summer.

Sites		Pieces	Weight (kg)
1. Playa Media Luna	(E)	344	5.78
2. Punta Yusseff	(E)	0	0.0
3. Playa Larga	(E)	74	0.62
4. Punta del Medio	(E)	0	0.0
5. Playa Marko	(E)	48	0.46
6. Playa Daniel	(E)	63	0.37
7. Playa El Módulo	(E)	533	4.93
8. Playa Copihue	(E)	214	2.47
9. Punta Odontoceto	(E)	28	0.20
10. Playa Maderas	(E)	297	9.05
11. Playa Cachorros	(E)	199	1.16
12. Playa Chungungo	(E)	96	0.15
13. Roca Granito	(E)	12	0.10
14. Playa Ballena Sur	(E)	82	0.43
15. Punta Delfín	(E)	2	0.001
16 Playa Bahamonde	(E)	30	0.26
17. Playa Roquerío	(N)	49	4.42
18. Playa Alcázar	(N)	73	0.56
19. Playa O.P de la B.	(N)	58	1.47
20. Playa Papúa	(N)	200	3.72
21. Playa Antártico	(N)	29	0.001
22. Punta Poblete	(N)	23	0.0007
23. Playa Escondida	(W)	18	0.03
24. Playa Lobería	(W)	162	1.50
25. Punta Rapa Nui	(W)	0	0.0
26. Playa Yámana	(W)	223	1.91
27. Punta Las Torres	(W)	105	2.70
28. Playa del Lobero	(W)	236	11.46
29. Playa Paulina	(W)	223	2.87
30. Playa Schiapacasse	(W)	132	1.89
31. Playa El Plástico	(W)	202	2.85
32. Playa del Canal	(W)	109	0.90
33. Playa El Remanso	(W)	119	1.46
34. Punta Antonio	(W)	10	0.20
35. Playa Aranda	(W)	257	3.39
36. Glaciar Aranda	(W)	0	0.0
Total		4,251	65.81

Table 2

Littoral places of Cape Shirreff from East (E) to West (W), and the respective quantities of items of marine debris collected in the 1995/96 Antarctic summer.

Sites		Number of Items			
		Plastic	Metal	Glass	Paper
1. Playa Media Luna	(E)	331	9	9	1
2. Punta Yusseff	(E)	0	0	0	0
3. Playa Larga	(E)	49	12	13	0
4. Punta del Medio	(E)	0	0	0	0
5. Playa Marko	(E)	37	1	10	0
6. Playa Daniel	(E)	59	0	4	0
7. Playa El Módulo	(E)	500	3	25	0
8. Playa Copihue	(E)	202	4	7	1
9. Punta Odontoceto	(E)	28	0	0	0
10. Playa Maderas	(E)	270	2	24	1
11.Playa Cachorros	(E)	186	6	7	0
12. Playa Chungungo	(E)	93	1	3	0
13. Roca Granito	(E)	12	0	0	0
14. Playa Ballena Sur	(E)	79	1	2	0
15. Punta Delfín	(E)	2	2	0	0
16. Playa Bahamonde	(E)	29	1	0	0
17. Playa Roquerío	(N)	45	2	1	1
18. Playa Alcázar	(N)	73	0	0	0
19. Playa O.P.de la B.	(N)	51	1	6	0
20. Playa Papúa	(N)	188	7	4	1
21. Playa Antártico	(N)	27	1	0	0
22. Punta Poblete	(N)	23	0	0	0
23. Playa Escondida	(W)	17	0	1	0
24. Playa Lobería	(W)	150	4	8	0
25. Punta Rapa Nui	(W)	0	0	0	0
26. Playa Yámana	(W)	219	2	2	0
27.Punta Las Torres	(W)	104	1	0	0
28. Playa del Lobero	(W)	231	3	1	3
29. Playa Paulina	(W)	196	2	25	0
30. Playa Schiapacasse	(W)	129	2	1	0
31. Playa El Plástico	(W)	199	3	0	0
32. Playa del Canal	(W)	105	0	0	4
33. Playa El Remanso	(W)	118	1	0	0
34. Punta Antonio	(W)	9	1	0	0
35. Playa Aranda	(W)	254	2	1	0
36. Glaciar Aranda	(W)	0	0	0	0
Total		4,015	77	147	12

Table 3

Record sumaries of trade marks registered from all items of marine debris collected from different Antarctic seasons at Cape Shirreff, Livingston Island

Origin / Season	Arg.	Aus.	Bra.	Bul.	Can.	Chi.	Cha.	Den.	Fra.	Ger.	Gre.	H-K.	Ita.	Jap.	Kor.	Mal.	Net.	Nor.	NZ	Pol.	Rom	Rus.	SAf	Sin.	Spa.	Swe.	UK.	Uru.	USA
1984/85	X									X				X						X		X					X		
1987/88	X		X											X				X	X										
1990/91	X						X							X				X									X		
1992/93	X									X				X	X		X					X				X	X		X
1993/94		X	X		X	X					X			X								X	X				X		X
1994/95	X			X		X	X	X	X	X		X		X			X	X						X	X		X	X	X
1995/96	X	X	X	X		X	X		X	X			X	X	X	X			X		X	X	X		X		X		X

Arg.	=	Argentine	**Chi.**	=	Chile	**Gre.**	=	Greece	**Mal.**	=	Malaysia	**Rom.**	=	Romania	**Swe.**	=	Sweden
Aus.	=	Australia	**Cha.**	=	China	**H-K**	=	Hong Kong	**Net.**	=	Netherland	**Rus.**	=	Rusia	**UK.**	=	United Kingdom
Bra.	=	Brazil	**Den.**	=	Denmark	**Ita.**	=	Italy	**Nor.**	=	Norway	**SAf.**	=	South Africa	**Uru.**	=	Uruguay
Bul.	=	Bulgaria	**Fra.**	=	France	**Jap.**	=	Japan	**NZ.**	=	New Zealand	**Sin.**	=	Singapore	**USA**	=	United States
Can.	=	Canada	**Ger.**	=	Germany	**Kor.**	=	Korea	**Pol.**	=	Poland	**Spa.**	=	Spain			

Consequently, in the present status of the international agreements related with the protection of marine ecosystem and biota, it is expected that no pollution can occur. Nevertheless, season after season, marine debris continue arriving to the shores of several Antarctic and subantarctic islands. Therefore, we suggest that CCAMLR may produce a booklet, with didactic information and guidelines about the basical and fundamental actions to be taken on board , in order to avoid marine pollution with garbage, to be used by each Party involved at least in any kind of fishing activity carried out in Antarctic waters. Besides, this booklet would be used both as a part of teaching activities given to captains, and chiefs of fishery crews, before being embarked and remembering that no garbage should be thrown into the sea. This would be a complement to the present CCAMLR effort and Conservation Measures agreed on the avoidance of incidental mortality of Antarctic marine animals.

CONCLUSIONS

1. As it has been recorded in previous surveys, the arrival of marine debris at Cape Shirreff continues increasing in number and density, but with a decreasing in weight.

2. The plastic material is the predominant item with a 94.45% of the total items collected.

3. There is an evident increasing of marine debris with pieces elaborated and possibly imported from countries that would have not direct relation with Antarctic activities.

4. As it was recorded in the previous season, some plastic litter has been partially incinerated, which makes infer that other remains produced in that activity, such as ashes, should have been thrown into the sea.

5. Some kelp gulls, sheath bills, and chinstrap penguins continue using plastic fibres when building their nests.

6. Antarctic fur seals also continue appearing entangled. This time four animnals were seen, and for the first time, two of them were three month old pups, and all of them were released.

7. As it was recorded in the previous season, the most important stranded mass of marine debris was found along the east and west coast of Cape Shirreff.

8. It is suggested that CCAMLR may produce documents with basic information about the international regulations on the protection of marine environment, in order to teach captains and crews of fishing fleets, as well as to be applied widely in other ships that operate with different purposes in the waters of the Southern Ocean.

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