

Operational interactions between Cape fur seals *Arctocephalus pusillus pusillus* and fisheries off the Eastern Cape coast of South Africa: part three, entanglement in man-made debris

INTRODUCTION

Entanglement in man-made debris lost or discarded from fishing vessels is a contributing factor to the decline of *Callorhinus ursinus*, northern fur seals (Flower, 1985, 1987; Stewart & Yochem, 1987), and is a potential threat to other species of fur seals, including *Arctocephalus pusillus doriferus*, Australian fur seal (Pembererton *et. al.*, 1992; Prendergast & Johnson, 1996) and *Arctocephalus gazella*, Antarctic fur seals (Croxall *et. al.*, 1990). Much of the debris discarded and lost by fishing vessels is not biodegradable and therefore remains at sea for a long time. Furthermore, much of the debris floats and therefore has the potential to entrap seals swimming at sea. Seals may become entangled when playing with the debris; trying to remove entangled fish from the debris; or attempting to haul-out and rest on the debris (Laist, 1987). Many entangled animals subsequently die.

The Cape (South African) fur seal, *Arctocephalus pusillus pusillus*, occurs only on the coasts of South Africa and Namibia, and is the only resident seal species in southern Africa. Breeding rookeries are distributed from Black Rocks (33° 50'S, 26°16'E) in Algoa Bay, on the south east coast of Southern African, to Cape Cross (21° 46'S, 13° 58'E) in Namibia. The majority of seals occur on the west coast. The remainder of the population (*c.* 8.5%; 140 000 seals in 1993), inhabits the south/east coast, between False Bay and Algoa Bay, at five breeding colonies and one haul-out site (J.H.M. David, pers. comm.). Their distribution overlaps important commercial fishing grounds. Therefore, Cape fur seals are occasionally seen with man-made objects around their necks, predominantly mono-filament line and string made of synthetic fibre. Other objects include fishing net, plastic straps, rubber O-rings and wire (Shaughnessy, 1980).

In recent years, fishing effort in Eastern Cape waters (Plettenberg Bay, 33°07'S, 23°25'E, to the Kwazulu-Natal border, 31°05'S, 30°11'E) has increased significantly. This has resulted in an increase in lost or discarded trawl nets and trawl net fragments, ropes and lines. In the trawl fishing industry, commercial bottom trawl skippers are likely to lose or damage nets as they extend their fishing grounds. Fragments of net float to the surface or remain on the sea bed depending on the net material. An estimated 2–3 sets of gear are lost per year by the inshore trawl fleet (Peter Sims, pers. comm.). Longline fishermen frequently lose 100s of meters of rope, especially off Cape St Francis where the currents are strong and fast moving (Peter Sims, pers. comm.). The effect of this on the local seal population is not known.

The present study documents the incidence and nature of entanglement of Cape fur seals off the Eastern Cape coast of South Africa.

METHODS

Data was collected from three sources: (i) observations at Black Rocks seal colony, Algoa Bay and Rondekloppe haul-out site, Plettenberg Bay; (ii) examination of stranded (dead) seals; and (iii) examination of seals brought into the Port Elizabeth Oceanarium (PEO) for rehabilitation.

Between 10 March 1993 and 20 January 1995, seven day trips were made to Black Rocks to assess the number of seals entangled in man-made debris. Counts began at 0800 hrs from an inflatable boat, *c.* 10 m from the colony, and were completed on foot.

Between January 1991 and August 1996, seals beached (dead) or injured along the coast were examined for signs of entanglement. In addition, old Port Elizabeth Museum (PEM) stranding forms and PEO log books (1987–1991) were examined for records of entangled seals.

Where possible, the following information was recorded: date of observation; location; sex; age group of entangled animal; the type of object the animal was entangled in; and the position of the object on the body of the seal. Entangled animals were classified as pups; juveniles (7 months to 2 years) and subadults/adults (≥ 3 years of age).

To determine the percentage of entangled animals at the two seal colonies, ground counts of entangled seals were conducted during the breeding season, when the number of animals was maximal. These took place at Black Rocks on 16 November 1993 and 20 December 1993; and at Rondekloppe on 5 December 1994. The total number of seals at Black Rocks was estimated from near vertical aerial photographs taken on 24 December 1993 following Stewardson (1999).

RESULTS

Black Rocks seal colony

During the seven day trips to Black Rocks seal colony, a total of 10 entangled seals was observed (Table 11(c).1). Four animals were entangled in mono-filament line, five in rope, and one in unidentified material which had embedded deep into the neck of the animal. Juveniles accounted for 30% of entanglements and subadult/adults accounted for 70%. The ratio of entangled females to entangled males was 1 : 8.

In addition, at least three seal pups entangled in a section of discarded trawl net were reported near Black Rocks on 28 December 1992 by the skipper of *Sea Princess*, Mr D. Rodocanachi. It is probable that the young pups (*c.* 4 weeks of age) become entrapped in the net while playing, and were then carried away



Fig. 11(c).1 Cape fur seals trapped in the factory area of commercial trawl vessels are often killed, secured with rope, hauled up onto the deck, and thrown over board. Dead animals which enter the factory area with the catch are also removed in this way (photo: C. Urquhart).



Fig. 11(c).2 Cape fur seals entangled in a trawl net fragment hauls-out at Port Elizabeth Harbour (photo: Eastern Province Herald).

from the colony as the net drifted with the current. Wind speed was 10 knots in a W-SW direction. Swell height was 0.5 m.

Stranded (dead) seals

From January 1991 to December 1995, a total of 77 Cape fur seals were found beached (dead) along the Eastern Cape coast. Only one of these animals (1.30%) was entangled in man-made debris (PEM2351).

Examination of old stranding records (1987 to 1991) indicated that at least three seals had died because of entanglement in man-made debris. Two animals were entangled in trawl net fragments and one in rope. One of these animals (PEM1644) was observed alive c. 2 week prior to the stranding with the net fragment entangled around its neck.

Stranded seals 'tied in rope'

Occasionally stranded seals 'tied in rope' wash ashore along the Eastern Cape coast. These animals become trapped in the factory area of a commercial trawl vessel and are subsequently killed (if not already dead). They are secured with rope, hauled up on deck, and then thrown overboard.

From 1992 to 1995, three seals 'tied in rope' were observed along the Eastern Cape coast:

On 8 November 1995 the carcass of one adult male (PEM2454), 196 cm in length, was found at Noordhoek (34°02', 25°39') with rope tied around its girth.

In 1992/1993, the carcasses of two large adult males with rope around their neck and girth were photographed by a newspaper photographer (Fig. 11(c).1). The exact details were not reported.

These three animals have been excluded from analysis.

Live Cape fur seals treated at the Port Elizabeth Oceanarium

From January 1987 to September 1991, a minimum of eight entangled Cape fur seals were treated at the Port Elizabeth Oceanarium (Table 11(c).1). Two animals were entangled in mono-filament line, three in trawl net fragment (Fig. 11(c).2), and three in rope.

Table 11(c).1 *Cape fur seals entangled in man-made debris off the Eastern Cape coast of South Africa*

Date	Location	Sex	Age group	Mono-filament line	Trawl net	Rope	Position of object	Other comments	
Observations at seal colonies									
1	28 Dec 1992		Black Rocks	–	Pup		* ¹	Body	
2	28 Dec 1992		Black Rocks	–	Pup		* ¹	Body	
3	28 Dec 1992		Black Rocks	–	Pup		* ¹	Body	
4	10 Mar 1993		Black Rocks	–	S/A	*		Neck	
5	16 Nov 1993	M	Black Rocks	M	S/A	–	–	Neck	Line cutting through skin Wound too deep to identify the type of material
6	20 Dec 1993	M	Black Rocks	M	S/A	*		Neck	Line cutting through skin
7	20 Dec 1993	M	Black Rocks	M	S/A		*	Neck	
8	20 Jan 1994	F	Black Rocks	F	S/A	*		Neck	Line cutting through skin
9	22 Mar 1994	M	Black Rocks	M	S/A		*	Neck	Line cutting through skin
10	15 Sep 1994	M	Black Rocks	M	Juv		*	Neck	Line cutting through skin
11	15 Sep 1994	M	Black Rocks	M	Juv		*	Neck	Line cutting through skin
12	15 Sep 1994	M	Black Rocks	M	Juv		*	Neck	Line cutting through skin
13	20 Jan 1995	M	Black Rocks	M	S/A	*		Neck	Line cutting through skin
14	5 Dec 1994	M	Rondeklippe	M	S/A	* ²		Neck	120 pound fishing line cutting into the muscle (deep wound)
15	2 Dec 1994	F	Rondeklippe	F	–		* ³	Body	PEM2351; SBL 113 cm; body mass 23 kg
Stranded (dead) seals									
16	7 Nov 1987	F	Jeffreys Bay (34°03'S, 24°55'E)	F	A		*	Neck	PEM1478; SBL 164 cm; body mass 48 kg
17	16 Sep 1989	–	Seaview (34°01'S, 25°17'E)	–	S/A		*	Neck	PEM1644; SBL 136 cm
18	4 Oct 1989	–	Seaview (34°01'S, 25°17'E)	–	S/A		*	Body	PEM1647; SBL 127 cm; very thin
Live seals rehabilitated at the Port Elizabeth Oceanarium									
19	1 Dec 1987	M	Bushy Park	M	Juv		*	Neck	± 2 y of age
20	13 Jan 1988	–	–	–	S/A		*	Body	
21	24 Jun 1988	M	–	M	S/A		*	Neck	Rope cutting through skin
22	31 Dec 1988	M	–	M	S/A		*	Body	Mesh cutting into muscle (deep wounds)
23	10 Jul 1990	–	–	–	–	*		Neck	Line cutting through skin ⁴
24	29 Dec 1990	–	Port Elizabeth Harbour (33°58'S, 25°37'E)	–	–		*	Neck	
25	10 Aug 1994	M	King's Beach (33°58'S, 25°39'E)	M	Pup	*		Neck	Line cutting into muscle (deep wound & infection)
26	10 Oct 1994	–	Port Elizabeth Harbour (33°58'S, 25°37'E)	–	–		*	Neck	Line cutting through skin
26						7	9	9	

¹ All three pups were entangled in the same piece of trawl net. The entangled pups were drifting away from Black Rocks.

² Possibly snoek line (seals at Rondeklippe regularly frequent the 'snoek patch') or longline.

³ The trawl mesh measured 270 cm in length and 160 cm in width.

⁴ Seal had been gaffed by fishermen.

PEM, Port Elizabeth Museum accession number.

SBL, standard body length (straight line from tip of snout to tip of tail with the animal lying on its back).

Incidence of entanglement at Black Rocks

The total population estimate for the 1993 breeding season at Black Rocks was 915 animals (i.e., 183 pups counted from aerial photographs). One entangled seal was observed on 16 November 1993, and two entangled seals were observed on 20 December 1993. Therefore, the minimum estimated frequency of entanglement for the Black Rocks colony in 1993 was *c.* 0.11–0.22%. During the seven field trips to Black Rocks, a mean of 1.4 entangled seals was observed per trip.

Incidence of entanglement at Rondeklippe

The total population estimate for the 1994 breeding season at Rondeklippe was 11 animals (small haul-out site). One entangled seal was observed on 2 December 1994, and a second entangled animal was observed on 5 December 1994. This suggested that even though there are a small number of seals using this haul-out site, the frequency of entanglement was high.

One of the animals was a female (PEM2351) entangled in a triangular piece of trawl net which measured 270 cm in length and 160 cm in width. She was observed alive on 2 December 1994 but died five days later. The second animal was an old male with 120+ pound fishing line looped twice around its neck. The line was probably used by longline or snoek fishermen.

DISCUSSION

Type of objects

A total of 26 Cape fur seals entangled in man-made debris were recorded along the Eastern Cape coast of South Africa (Table 11(a). 1). Mono-filament line accounted for 28% of entanglements; trawl net fragments accounted for 36%, and rope accounted for 36%. One object, a neck collar embedded deep into the flesh, was not identified. Other objects such as straps, rubber O-rings and wire reported by Shaughnessy (1980) were not observed in the present study.

Off the Eastern Cape coast, the bottom trawl fishery use 110 mm stretched mesh for the hake fishery, and 85 mm for the horse mackerel fishery. This is made of polyethylene with nylon codends. Seals become entangled in this material when whole nets are lost; pieces of damaged net break off or are discarded; or when entrapped seals tear free from the nets. As trawlers extend their fishing grounds they are likely to loose/damage gear.

The moni-filament lines are likely to be from the squid, longlining and teleost-handline fisheries. Hake longliners are active south of Plettenberg Bay, whereas squid jig fishermen mainly operate

eastwards of Plettenberg Bay to Algoa Bay. When seals take fish/squid directly from fishing lines they can become entangled. They also can become entangled in lost or discarded fishing line floating at the water surface.

Ropes come from numerous sources, especially the longlining sectors. Hundred's of meters of rope are lost regularly by longliners, especially near Cape St Francis where bottom currents are strong. The ropes entangle and drift westwards onto the central Agulhas Bank (Peter Sims. pers. comm.).

Entangled fishing line was located at Black Rocks on three separate occasions. A narrow piece of trawl net *c.* 2.5 m in length was also observed. It is not clear if these objects were washed up onto Black Rocks; or carried their by seals who managed to dislodge themselves from the material.

Age class of entangled animals

Of the 22 animals for which age class was recorded, pups accounted for 18.2% (*n* = 4) of entanglements, juveniles accounted for 18.2% (*n* = 4), and subadult/adults accounted for 63.6% (*n* = 14). Possibly reasons why older animals are more likely to become entangled than younger animals are: (i) older animals have learnt to associate fishing vessels with food and are therefore more likely to take fish from lines/nets; and (ii) older animals travel further distances than young animals and therefore have a greater probability of encountering floating debris.

Sex ratio of entangled animals

Of the 20 animals for which sex was recorded, 13 were males and seven were females (1 female : 1.86 males). Possibly reasons why more males than females become entangled in marine debris are: (i) males are more likely to travel further from the rookery and therefore have a greater probability of encountering floating debris than females; and (ii) males may be more likely to approach fishing vessels and take fish from lines.

Incidence of entanglement

The minimum estimated frequency of entanglement for Cape fur seals at the Black Rocks colony in 1993 was *c.* 0.11–0.22% (present study). The incidence of entanglement among other species of fur seals is: 1.9% for the Australian fur seal in Tasmanian waters (Pemberton *et. al.*, 1992); 0.4% for the northern fur seals (Fowler, 1987), and 0.4–1.0% for Antarctic fur seals (Croxall *et. al.*, 1990). Therefore, the incidence of entanglement for Cape fur seals is comparatively low. Shaughnessy (1980) reported that the incidence of entanglement of immature Cape fur seals on the south and west coast of South Africa was 0.11–0.66% (Shaughnessy, 1980). Estimates for Black Rocks are towards the lower end of this range (present study).

Fate of entangled seals

The majority of objects (73%) were neck collars. These collars are made of highly durable materials. As the animal grows, the neck collar tightens, and cuts through the skin, into the muscle. If the collar does not fall off the animal, pressure on the oesophagus and trachea may impede feeding and respiration. The animal may subsequently die of starvation or strangulation. Furthermore the open wound may become infected, and the animal may subsequently die of septicemia. In the present study, 11 collars had cut into the skin of the animal, and three had penetrated the muscle. The neck wound of one animal was infected.

Entanglement in trawl fragments impedes general movement, travel and foraging ability. The entangled animal is also at risk of drowning and is more vulnerable to predation. Feldkamp *et al.*, (1989) found that net fragments over 200 g can elevate the energetic cost of travel of northern fur seals. In order to maintain body condition, daily food intake must therefore be increased. Entangled animals unable to consume sufficient food soon become weak and die. Lactating females may be unable to produce sufficient milk. Their pups may subsequently starve.

CONCLUSION

Cape fur seals off the Eastern Cape coast are occasionally entangled in man-made debris, e.g., trawl nets, mono-filament line and rope. Depending on the type of material, the entangled animal may suffer physical injury, develop septicemia, died of strangulation, die of starvation, or drown.

Although debris-related mortality does not appear to impact significantly on the local seal population, much of the materials which entangles seals is highly durable, and floats at the water surface for long periods. Such material is likely to accumulate in areas of up- or down- welling where the animals feed, e.g., regular surveys of the 43 mile Mosgas pipeline (central Agulhas Bank) using video cameras frequently shows tangles of rope and sections of netting (Peter Sims, pers. comm.). As the fishing industry continues to expand, more synthetic material will accumulate, and the incidence of entanglement in this area will subsequently increase. Therefore continued monitoring of the population, and the nature of entanglement, is essential.

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