

Operational interactions between Cape fur seals *Arctocephalus pusillus pusillus* and fisheries off the Eastern Cape coast of South Africa: part two, squid jigging and line fishing

INTRODUCTION

The “inshore” fishing area off the south and east coasts of South Africa extends from Cape Agulhas (20° E) in the west, to the Great Fish River (27°10' E) in the east, and seawards to the 110 m depth contour (Appendix 11(b).1). The main commercial fisheries based in this region are inshore bottom trawling, squid jigging, hand-line fishing, and hake-directed longline (experimental fishery commenced in 1994) (Peter Sims, pers. comm.).

Recently fishing effort in Eastern Cape waters (Plettenberg Bay, 33° 07'S, 23°25'E, to the Kwazulu-Natal boarder, 31°05'S, 30°11'E) has increased significantly, particularly that for line fish and chokker squid. In 1992–1995, 234–254 squid vessels and 403–438 line fish vessels operated between Port Alfred and Mossel Bay¹. White squid grossed between R46,236,024.00–R118,909,710.00 per annum, and line fish grossed between R9,459, 522.00–R16,600,173.00 per annum¹ (Chris Wilke, pers. comm.).

The main line fish species in this region are hake (*Merluccius* sp.), silver fish (*Argyrozona argyrozona*), panga (*Pterogymnus laniarius*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus hololepidotus*), yellow-tail (*Seriola lalandi*), santer (*Cheimerius nufar*), red steenbras (*Petrus rupestris*), Cape gurnard (*Chelidonichthys capensis*), red stumpnose (*Chrysoblephus gibbiceps*), roman (*Chrysoblephus laticeps*), dageraad (*Chrysoblephus cristiceps*), mackerel (*Scomber japonicus*) and elf (*Pomatomus saltatrix*) (*Karina Vermaak, pers. comm.*). Snoek (*Thyrsites atun*) and kingklip (*Genypterus capensis*) are also targeted, mainly near Plettenberg Bay. The main target species for the squid jigging industry is chokker squid (*Loligo vulgaris reynaudii*) (Peter Sims, pers. comm.).

East coast fishermen operate in an area inhabited by Cape fur seals. At the time of this study, c. 140 000 Cape fur seals² (8.5% of the total population) inhabited 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.). Considering that some of the species eaten by Cape fur seals are of commercial importance (chapter 9), it is inevitable that seals and fisheries will come into conflict when fishing.

Some squid jig/line fishermen complain that seals: consume large quantities of commercially important species which would otherwise be available to the industry; take squid/fish from lines; break lines and tackle; and disperse schools from under the boat. Subsequently, many of these fishermen have a strong antipathy towards seals, and feel that the seal population should be reduced.

Many fishermen deliberately kill (shoot) seals to reduce their perceived impact. The effects of this on the local seal population are unknown, but unlike the west coast population, that on the Eastern Cape coast is not increasing.

Research examining operational interactions between seals and the line fish sector has been conducted on the west and south coast of southern Africa (Rand, 1959; Shaughnessy, 1985; Anon, 1987; Wickens, 1989; Meÿer *et al.*, 1992; Wickens *et al.*, 1992; Wickens, 1994); however, there is no comprehensive information for the Eastern Cape coast.

This study documents an evaluation of operational interactions between the squid jigging/line fishing industry and Cape fur seals, in waters off the Eastern Cape coast of Southern Africa. Information was obtained from questionnaire surveys, with limited independent observation aboard commercial chokker squid vessels ($n = 31$ days).

METHODS

In 1995 questionnaires (100 in total) were distributed to skippers of squid jig and line fish vessels, in the Eastern Cape coast of South Africa (Plettenberg Bay to Port Alfred) to obtain an indication of the nature and extent of seal-fisheries interactions.

Questions focused on five key areas: (i) fishing operations (target species; main fishing locations; fishing depth; number of fishing trips per year; duration of trip; number of lines operated); (ii) seal attendance; (iii) depredation and damage to equipment (catch losses; gear damage; operational disturbance); (iv) seal mortality (methods used to remove seals from the area; deliberate shooting of seals); and (v) general attitude of fisherman towards seals.

Fifty seven replies were received, 48 of which are presented in this study. Thirty three of the 48 replies were from skippers of commercial squid jig vessels, some of whom also held a permit to target teleost fish. The remainder were from skippers of commercial and semi-commercial line fish vessels.

Information on seal-fisheries interactions within the squid jig industry was also collected by an independent observer (Willie de Wet). These direct observations were used to substantiate responses in the questionnaire surveys. Independent observations were conducted in 1995, between June and November, over a 31 day period. Observations were made from four commercial squid jig vessels (*Dereck*, *Peregrine*, *Queen Cat* and the *King Cat*). These vessels were 15–20 m in length. Crew size was c. 25.

¹ This data was extracted from the National Marine Linefish System (NMLS) based on data provided by the permit holders on a monthly basis.

² Inferred from pup counts for 1993.

For the purpose of this study, responses from the squid jig skippers and line fish skippers are presented separately. Means are always followed by the standard error. The number of skippers that responded to each question, *n*, is given round brackets.

RESULTS

Handline jigging for chokker squid (questionnaire)

Fishing operations

Skippers participating in questionnaires operated between Cape Agulhas Point (grid 535) and Mbashe Point (grid 671), with fishing effort concentrated between Plettenberg Bay and Cape St Francis (grids 516–520), and between Cape Recife and Great Fish Point (grids 625, 628, 632, 636, 640, 644) (*n* = 33 skippers) (Appendix 11(b).2). Several skippers operating in this region also fished as far west as Cape Agulhas Point.

Fishing depth ranged from 0–150 m, with mean³ depth at *c.* 45 m. The mean³ number of lines per vessel was *c.* 35 (range 4–75 lines). The mean³ number of fishing trips was *c.* 75 (range 10–300 trips). The mean³ duration of fishing trips was *c.* 14 hrs (range 4–28 hrs).

Seal attendance

How many seals are usually observed in the vicinity of lines while fishing?

The mean number of seals usually observed in the vicinity of lines while fishing was 3.1 ± 0.3 ; range 1–7 (*n* = 33 skippers) (Table 11(b).1).

Are seals more abundant in certain fishing locations?

Table 11(b).1 *Number of seals usually observed in the vicinity of lines while fishing (n = 33 skippers)*

No. of seals	Count	Percent
1	1	3.0
2	12	36.4
3	12	36.4
4	5	15.2
7	3	9.1
	33	

Eighty three percent of skippers reported that seals were more abundant in certain fishing locations (*n* = 30 skippers).

Seals were reported to be more abundant from Elands Point to Bird Island/Cannon Rocks (especially in grids 532–534, 625 and 636). Other ‘seal hot spots’ included Plettenberg Bay to Keurboom; Natures Valley, Eerste Rivier, Oubos to Aasvoël Punt; and Jeffreys Bay.

Selected comments from skippers included:
 ...“seals are normally found in the deeper fishing areas”...
 ...“numbers vary due to changes in fish concentrations”...

Are seals a greater problem at certain months of the year?

Fifty eight percent of skippers reported that seal-fisheries problems increased at certain months of the year (*n* = 24 skippers).

Of the 14 skippers whom reported that seals were more of a problem at certain months of the year, 78% reported that seal-fisheries problems increased between April and August (Table 11(b).2).

Selected comments from skippers included:
 ...“seals are a problem especially when fishing under lights at night during the winter months when groups of 5–10 seals are often encountered in the deeper water from 40–90 m”...

Table 11(b).2 *Months of the year in which seals are a greater problem to the squid jig fishery (n = 14 skippers)*

Season	Month	Count	Percent
Summer	12	3	6.7
	1	2	4.4
	2	1	2.2
Autumn	3	0	0
	4	5	11.1
	5	8	17.8
Winter	6	11	24.4
	7	6	13.3
	8	5	11.1
Spring	9	1	2.2
	10	1	2.2
	11	2	4.4
		45	

Depredation and damage to equipment

Do seals interfere with your fishing operations?

Thirteen percent of skippers reported that seals sometimes interfered with their fishing operations, however they caused little disruption or damage; 34% reported that seals frequently interfered, however they consider seals to be a minor problem; and 53% reported that seals frequently interfered, and they consider seals to be a major problem (*n* = 32 skippers).

³ Squid jig fisherman either stated a range (minimum value to maximum value), or gave an estimated mean. Therefore, an overall mean was calculated using the minimum and the maximum values, as well as the estimated mean.

What are the adverse effects of interactions with seals on the squid jig fishery?

Skippers reported that seals scatter schools of squid, take squid from lines as they are being hauled to the surface, and break lines/tackle ($n = 33$ skippers) (Table 11(b).3).

Table 11(b).3 Adverse effects of interactions with seals on the squid jig fishery ($n = 33$ skippers)

Seal-fisheries interactions	Count	Percent
Scatter schools of squid	3	9.1
Take squid from lines	3	9.1
Break lines/tackle	4	12.1
Scatter schools of squid & take squid from line	5	15.2
Scatter schools of squid & break lines/tackle	2	6.6
Break lines/tackle & take squid from lines	5	15.2
Scatter schools of squid & take squid from lines & break lines/tackle	11	33.3
	33	

How often do seals break your lines?

About half of the skippers reported that seals often break lines, while half reported that seals seldom break lines ($n = 29$ skippers) (Table 11(b).4).

Table 11(b).4 Line breakage attributed to interaction with seals ($n = 29$ skippers)

Seals break fishing lines	Count	Percent
Never	0	0
Seldom	13	44.8
Often	15	51.7
Always	1	3.5
	29	

How often do seals cause the squid to scatter?

Eighty two percent of skippers reported that seals often/always cause squid schools to scatter during fishing operations ($n = 28$ skippers) (Table 11(b).5).

Selected comments from skippers included:
 ...*"Seals scatter schools of squid, mainly at night when they disrupt bait fish which the squid feed on"...*
 ...*"They make the schools of squid sound, thereby slowing down the catch rate considerably until the seals leave the area or are shot"...*

Table 11(b).5 How often do seals cause squid schools to scatter ($n = 28$ skippers)

How often seals scatter squid schools	Count	Percent
Never	1	3.6
Seldom	4	14.3
Often	15	53.6
Always	8	28.6
	28	

How many squid on average would you loose per trip in comparison with your total catch ?

Seventy eight percent of skippers reported that seals took 5% to < 20% of the total catch from their lines ($n = 27$) (Table 11(b).6).

Selected comments from skippers included:..."
 ...*Seals take squid from the line "0% to < 5% at day time and 5% to < 10% at night. They can be totally disruptive in schools at night"...*
 ...*"Not sure. The problem is not the number taken from lines but the loss of fish/squid under the boat"...*
 ...*"Sometimes seals take squid from lines, bite it dead but do not eat it. It's like a game - it comes back to do it over and over"...*

Table 11(b).6 Percentage of the total catch lost due to seals taking squid from the lines ($n = 27$ skippers)

Percent of total catch lost to seals	Count	Percent
< 5%	0	0
5% to < 10%	13	48.2
10 % to < 20%	6	22.2
20% to < 50%	5	18.5
> 50%	3	11.1
	27	

What is the economic impact of seals taking squid from lines?

Sixty seven percent of skippers reported that seals taking squid from lines caused considerable economic loss to their fishing operations ($n = 30$ skippers).

Seal mortality or injury

Do you attempt to remove the seals from your area?

Sixty percent of skippers (18) endeavour to remove seals from the area during fishing operations ($n = 30$ skippers). However, this figure is larger considering that 25 fishermen listed actual methods used to remove seals from their fishing operations (see below).

Selected comments from skippers included:
 ...*"At times seals can be very disruptive. On occasions they cause serious loss of catch and tackle. This occurs mostly in winter and at night under lights. Its only under those conditions that action is taken against seals"...*
 ...*"I try to avoid shooting seals in fear of fouling squid breeding grounds with carcasses which might attract sharks"...*

How do you prevent seals from interfering with fishing operations?

The main method employed to discourage seals from interfering with fishing operations was to use a shot

gun, i.e., shoot near the seal to frighten it and/or shoot to kill (Table 11(b).7). Other methods reported by skippers included: "gaffing the seals"; "using knives"; "throwing objects at them to chase them away"; "throwing sinkers"; "catching them" and "waiting for some other idiot to shoot them usually by shot gun". Rifles and clubs were used by several fishermen.

Table 11(b).7 *Methods used to prevent seals from interfering with fishing operations (n = 27 skippers)*

Method used to deter seals	Count	Percent used
Rifle	2	7.4
Shot gun	13	48.1
Club	3	11.1
Other methods	6	22.2
Shot gun & other methods	1	3.7
Do not intervene ¹	2	7.4
	27	

¹ Move away to another location or stop fishing until the seals move on to another vessel.

How many seals do you shoot per year?

The mean number of seals shot per year was 45.8 ± 24.9 (range 0–480, $n = 20$ skippers). The minimum and maximum number of seals shot per year were 2.4 ± 1.4 (range 0–10) and 11.9 ± 6.5 (range 2–50), respectively ($n = 7$ skippers).

Thirteen skippers provided estimates of the number of seals that they shot each year (Table 11(b).8).

Table 11(b).8 *Mean number of seals shot by fishermen (n = 13 skippers)*

Fishing grid no. ¹	No. seals shot per year
–	0–3
636–637, 640, 644	0–5
516–518, 519	0–10
632, 636, 640	1–2
–	2–3
518–520	5
516, 519–520, 625, 628, 636, 640, 644	4–10
516–644	10–50
616, 518–520, 532–534, 622, 625, 628–629, 632, 636, 640, 644–645	100
516–517, 519, 520	100
516	100 ²
516	130 ²
516	480 ²
	c. 900–1000

¹ Main fishing locations of individual skippers.

² Plettenberg Bay (hake and squid jig fishermen).

Attitude of fishermen towards seals

What is the general feeling of the local fishing community towards seals?

Forty three percent of skippers reported that seals were too numerous and should be managed to prevent negative interactions with the fishing community ($n = 31$ skippers) (Table 11(b).9).

Table 11(b).9 *General attitude of local squid jig fishermen towards seals (n = 31 skippers)*

Attitude of fishermen towards seals	Count	Percent
A	6	13.6
B	11	25.0
C	8	18.2
D	19	43.2
	44*	

A, seals do not significantly interfere with fishing operations. B, seals are a major problem to the squid jig fishery. Seals take squid from lines and damage gear. C, seals compete with the local fisheries because they feed on commercially important species, thus reduce the potential catch of fishermen. D, seals are too numerous and should be managed to prevent negative interactions with the fishing community.

* Several fishermen gave more than one answer.

Selected negative comments from skippers included:

...*"Fishermen generally hate seals and thus shoot them with shotguns"...*

...*"They are a menace in the ocean and should be culled"...*

...*"The seals overpopulation is a MAN created problem thus should be remedied by MAN"...*

...*"The scientists are very concerned to protect the fishing resource by introducing size limits, closed seasons etc. They will achieve their goal a lot more successfully by reducing the seal population urgently"...*

...*"The presence of so many fishing vessels has upset the balance of nature. Not only the fittest survive - all survive by scavenging near boats. The seal population should be culled A.S.P. as their numbers are increasing on the east coast as well"...*

Selected positive comments from skippers included:

...*"We as fishermen do not want to interfere with seals as they find fish/squid very often for us. But they often scatter big schools of fish/squid. The general feeling for seals is not to hurt them but to try and chase them. A gun shot in the air does chase them very often"...*

...*"Seals can be a menace at times, however they can also help one in locating a school of squid. The only reason I may shoot the odd seal is when they are really destroying everything and the crew are upset and are about to jig them and kill them in a barbaric way"...*

...*"Sometimes we look for seals to find squid"...*

...*"Don't kill the seals because they help us with our living on the waters"...*

...*"They don't interfere in any significant way but are mercilessly shot on sight by the majority of deck boat skippers. Seals should be protected in these parts"....*

Handline jigging for chokker squid (independent observer)

Information collected on 'fishery data sheets' by an independent observer aboard commercial squid jig vessels has been summarised in Table 11(b).10.

Fishing operations

Mean fishing depth was 42.7 ± 2.7 m (range 22–70 m); the number of lines ranged from 23–31; and the duration of fishing trips was 5–8 days ($n = 5$ trips).

Seal attendance

During the 31 days at sea, seals were sighted near the vessel on 36 separate occasions. The mean number of seals near the vessel was 1.3 ± 0.1 (range 1–4).

Depredation and damage to equipment

When seals were near the vessel, seal-fisheries interactions were observed 47% of the time, i.e., seals were observed feeding on squid near the lines.

When feeding on squid, seals were observed taking squid directly from lines on four separate occasions. Although it was difficult to determine the number of squid taken from lines, estimated losses were: (i) 1–2 squid, (ii) 8 squid, (iii) > 1 squid and (iv) 1–2 squid, respectively.

Seals broke lines/tackle on three separate occasions. On the first occasion eight lines were broken. On the second and third occasion one line was broken.

Seals caused squid to disperse⁴ totally from the area once, when 4 seals were around the vessel.

Table 11(b).10 Summary of interactions that occur between seals and squid jig fishermen on the Eastern Cape coast of South Africa: independent observation aboard commercial vessels over a 31 day period

Date	Local time (hrs)	Fishing location	Fishing depth (m)	No. seals at lines	Seal-fisheries interaction					Shooting of seals	
					A	B	C	D	E		
22 Jun 95	2112	33°56'S 25°44'E	38.6	2		+	+			shot gun	
22 Jun 95	0300	33°56'S 25°44'E	38.6	1		+	+	+		shot gun	
24 Jun 95	2041	33°56'S 25°44'E	43.7	1		+				shot gun	
24 Jun 95	0245	33°56'S 25°44'E	43.7	1		+	+	+		shot gun	
23 Jul 95	2300	33°56'S 25°44'E	70.0	1	+						
24 Jul 95	1045	34°02'S 25°05'E	46.0	1	+						
24 Jul 95	2000	34°09'S 25°03'E	62.0	1		+					
25 Jul 95	1131	34°12'S 24°56'E	62.0	1	+						
25 Jul 95	1300	34°12'S 24°56'E	62.0	2	+						
25 Jul 95	1400	34°12'S 24°56'E	62.0	1	+						
26 Jul 95	1130	34°12'S 24°56'E	66.0	1	+						
28 Jul 95	1945	34°09'S 24°59'E	56.6	1	+						
28 Aug 95	0900	Maitland	66.0	1		+				shot gun	
28 Aug 95	1730	Maitland	66.0	1	+					shot gun	
29 Aug 95	0745	Maitland	66.0	1	+						
29 Aug 95	1130	–	52.0	1	+						
30 Aug 95	2030	34°05'S 25°01'E	54.0	1	+					shot gun	
30 Aug 95	2108	34°05'S 25°01'E	54.0	1	+					shot gun	
31 Aug 95	0915	–	54.0	1		+					
19 Oct 95	0800	33°44'S 26°03'E	31.1	1		?					
19 Oct 95	0915	33°44'S 26°03'E	32.9	1	+						
19 Oct 95	1705	33°44'S 26°03'E	32.0	1	+					shot gun	
20 Oct 95	0613	33°44'S 26°03'E	31.1	1		+				shot gun	
20 Oct 95	0630	33°44'S 26°03'E	31.1	1	+						
20 Oct 95	0711	33°44'S 26°03'E	31.1	1	+						
20 Oct 95	0720	33°44'S 26°03'E	31.1	1		+	+	+		shot gun	
20 Oct 95	1200	33°44'S 26°03'E	31.1	1	+					rifle*	
20 Oct 95	1710	33°44'S 26°03'E	31.1	1	+					rifle*	
20 Oct 95	2130	33°44'S 26°03'E	29.3	1		+				shot gun	
22 Oct 95	1001	33°59'S 25°13'E	22.6	5		+				shot gun	
22 Oct 95	1709	33°59'S 25°13'E	22.6	2		+				shot gun	
24 Oct 95	1009	34°00'S 25°17'E	23.8	1		+				shot gun	
24 Oct 95	1408	34°00'S 25°17'E	23.8	1	+						
2 Nov 95	1800–	34°01'S 25°15'E	24.1	4		+			+	shot gun	
3 Nov 95	1540	33°59'S 25°13'E	21.9	1		+					
	1900										
3 Nov 95	1735	33°59'S 25°13'E	21.9	1		+				shot gun	
					1–5	19	16–17	4	3	1	19

Start and end date of each of the 5 trips: (i) 21 Jun 95–25 Jun 95; (ii) 23 Jul 95–29 Jul 95; (iii) 27 Aug 95–1 Sep 95; (iv) 18 Oct 95–25 Oct 95; and (v) 30 Oct 95–4 Nov 95.

A, no interaction or no obvious interaction with fishing operations; B, feeding on squid at vessel; C, take fish from lines; D, break line and tackle; E, seals cause schools to totally disperse from area.

* Rifle obtained from neighbouring vessel.

⁴ Furthermore, on October 22, 1995 at Beachview, dolphins caused squid to totally disperse from the area on three occasions, i.e., no signs of squid on the echo.

Table 11(b). 11 Main specie of line fish targeted off the Eastern Cape coast (n = 15 skippers)

	Common name	Scientific name	Count	Percent
1	Stock fish (hake),	<i>Merluccius capensis</i> & <i>M. paradoxus</i>	12	27.3
2	Carpenter (silverfish)	<i>Argyrozona argyrozona</i>	8	18.2
3	True kob (kabeljou)	<i>Argyrosomus hololepidotus</i>	7	15.9
4	Geelbek	<i>Atractoscion aequidens</i>	4	9.1
5	Yellow-fin tuna (& tuna ¹)	<i>Thunnus albacares</i>	3	6.8
6	Santer	<i>Cheimerius nufar</i>	2	4.6
7	Dageraad	<i>Chrysoblephus cristiceps</i>	2	4.6
8	Roman	<i>Chrysoblephus laticeps</i>	1	2.3
9	Panga	<i>Pterogymnus lanarius</i>	1	2.3
10	Elf (shad)	<i>Pomatomus saltatrix</i>	1	2.3
11	Kingklip	<i>Genypterus capensis</i>	1	2.3
12	Dikbek (barred thick-lip)	<i>Hemigymnus</i> sp	1	2.3
13	Reds ²		1	2.3
			44	

¹ Presumably yellow-fin tuna, striped bellied benito, big eye and blue fin tuna.

² Presumably carpenter, santer, panga and roman.

One semi-commercial fisherman also reported salmon in grids 632–633.

Seal mortality or injury

When seals were near the vessel, fishermen shot seals 53% of the time to safeguard their catches. Seals were usually shot with a shot gun. A rifle was used on two occasions.

Line fishing for teleost fish (questionnaire)

Fishing operations

Main target species and corresponding fishing locations

Skippers participating in questionnaires reported that 12 fish species were important to their fishing operations, particularly hake, carpenter and kob (n = 15 skippers) (Table 11(b).11). Fishing effort was concentrated between Cape Recife and Bird Island (grids 625–630 and 632–634), and between Knysna Heads and Elands Point (grids 515–518 and 529–531) (Appendix 11(b).3).

Fishing depth ranged from 14–115 m, with mean⁵ depth at c. 80 m. The number of lines per vessel ranged from 1–16 lines). The mean⁵ number of fishing trips was c. 80 (range 15–250 trips). The mean⁵ duration of fishing trips was c. 10 hrs (range 5–12 hrs).

Seal attendance

How many seals are usually observed in the vicinity of lines while fishing?

The mean number of seals usually observed in the vicinity of lines while fishing was 3.1 ± 0.3 ; range 2–6 (Table 11(b).12).

Table 11(b).12 Number of seals usually observed in the vicinity of lines while fishing (n = 15 skippers)

No. of seals	Count	Percent
2	6	40.0
3	4	26.7
4	4	26.7
6	1	6.7
		15

Are seals more abundant in certain fishing locations?

Forty three percent of skippers reported that seals were more abundant in certain fishing locations (n = 14 skippers).

Six skippers listed areas where seals were more abundant (Table 11(b).13).

Table 11(b). 13 Fishing locations where seals are more abundant (n = 6 skippers)

Fishing location	Count	Percent
515	1	7.7
516	1	7.7
529	1	7.7
530	1	7.7
625	3	23.1
626	2	15.4
629	2	15.4
630	1	7.7
633	1	7.7
		13

Selected comments from skippers included:
...“Seal distribution varied occurring to fluctuation in fish concentrations”...

...“Seals were generally more common in stock fish grounds”...

⁵ Line fisherman either stated a range (minimum value to maximum value), or gave an estimated mean. Therefore, an overall mean was calculated using the minimum and the maximum values, as well as the estimated mean.

Depredation and damage to equipment

Do seals interfere with your fishing operations?

Seven percent of skippers reported that seals did not interfere with their fishing operations; 20% reported that seals sometimes interfered, however they caused little disruption or damage; 40% reported that seals frequently interfered, however they consider seals to be a minor problem; and 33% reported that seals frequently interfered, and they consider seals to be a major problem ($n = 15$ skippers).

What are the adverse effects of interactions with seals on the line fish sector?

Skippers reported that seals in this region scatter schools of fish, take fish from lines as they are being hauled to the surface, and break lines/tackle ($n = 15$ skippers) (Table 11(b).14).

Table 11(b).14 *Adverse effects of interactions with seals on the hook and line fishery ($n = 15$ skippers)*

Seal-fisheries interactions	Count	Percent
Scatter schools of fish	1	6.7
Take fish from lines	6	40.0
Break lines/tackle	1	6.7
Scatter schools of fish & take fish from line	1	6.7
Break lines/tackle & take fish from lines	6	40.0
	15	

How often do seals break your lines?

Ninety one percent of skippers reported that seals seldom break fishing lines ($n = 11$ skippers) (Table 11(b).15).

Table 11(b).15 *Line breakage attributed to interaction with seals ($n = 11$ skippers)*

Seals beak fishing lines	Count	Percent
Never	0	0
Seldom	10	90.9
Often	1	9.1
Always	0	0
	11	

How often do seals cause the fish to scatter?

Sixty percent of skippers reported that seals never, or seldom cause, fish schools to scatter during fishing operations ($n = 10$ skippers) (Table 11(b).16).

Table 11(b).16 *How often do seals cause fish schools to scatter ($n = 10$ skippers)*

Seals scatter fish schools	Count	Percent
Never	2	20.0
Seldom	4	40.0
Often	4	40.0
Always	0	0.0
	10	

How many fish on average would you loose per trip in comparison with your total catch?

Eighty percent of skippers reported that seals take < 10% of the total catch from lines ($n = 10$ skippers) (Table 11(b).17).

Selected comments from skippers included:
 ...*"It depends on the size of the seal. If a very large seal with a hairy neck (large adult male) is around the boat, then he will take all of the catch and completely stop you from fishing"...*
 ...*"About 20% to 30% of times they really become pests, mainly taking soft fish, e.g., hake and carpenter from your line"...*
 ...*"Anything from 1 fish to total catch. The crew become despondent and will not fish. Moving a few miles does help but time is cost"...*

Table 11(b).17 *Percentage of the total catch lost due to seals taking fish from the lines ($n = 10$ skippers)*

Percent of total catch lost to seals	Count	Percent
< 5%	5	50
5% to <10%	3	30
10 % to <20%	2	20
20% to < 50%	0	0
> 50%	0	0
	10	

What is the economic impact of seals taking fish from lines?

Sixty four percent of skippers reported that seals taking fish from lines caused little economic loss to their fishing operations ($n = 11$ skippers).

Seal mortality or injury

Do you attempt to remove the seals from your area?

Fifty three percent of skippers (8) reported that they do attempt to remove seals from the area ($n = 15$ skippers). However, this figure is larger considering that 11 fishermen listed actual methods used to remove seals from their fishing operations (see below).

How do you prevent seals from interfering with fishing operations?

The main method employed to discourage seals from interfering with fishing operations was to use a shot gun, i.e., shoot near the seal to frighten it and/or shoot to kill (Table 11(b).18). Other methods reported by fishermen included: "feeding the seals with mackerel"; "throwing stones"; "throwing sinkers attached to a line"; "shooting the seals with a catapult"; "loud noises"; "starting of engines"; "banging gaffs on the water surface" and "hooking seals". A club was used by one fishermen. Rifles were not used.

Table 11(b).18 *Methods used to prevent seals from interfering with fishing operations (n = 14 skippers)*

Method used to deter seals	Count	Percent
Rifle	0	0.0
Shot gun	4	28.6
Club	1	7.1
Other methods	3	21.4
Do not intervene ¹	6	42.9
	14	

¹ Move away to another location or stop fishing until the seals move onto another vessel.

How many seals do you shoot per year?

The mean number of seals shot per year was 50.7 ± 34.9 (range 0–480, n = 14 skippers). The minimum and maximum number of seals shot per year ranged from 50–250 (n = 1 skipper).

Four skippers provided estimates of the number of seals that they shot each year (Table 11(b).19).

Table 11(b).19 *Mean number of seals shot by fishermen (n = 4 skippers)*

Fishing grid no. ¹	No. seals shot per year
515–518, 529–532	50–250
516	100 ²
516	130 ²
516	480 ²
	c. 760–960

¹ Main fishing locations of individual skippers.

² Plettenberg Bay (hake and squid jig fishermen).

General attitude of fishermen towards seals

What is the general feeling of the local fishing community towards seals?

Forty percent of skippers reported that seals are too numerous and should be managed to prevent negative interactions with the fishing community (n = 13 skippers) (Table 11(b).20).

Table 11(b).20 *General attitude of line-fishermen towards seals (n = 13 skippers)*

Attitude of fishermen towards seals	Count	Percent
A	4	26.7
B	6	40.0
C	2	13.3
D	3	20.0
	15*	

A, seals do not significantly interfere with fishing operations. B, seals are a major problem to the line-fishing industry. Seals take fish from lines and damage gear. C, seals compete with the local fisheries because they feed on commercially important species, thus reduce the potential catch of fishermen. D, seals are too numerous and should be managed to prevent negative interactions with the fishing community.

* Two skippers gave 2 responses.

Selected comments from skippers included:

... "Seals are basically a major problem...they are incredibly destructive...deepwater longliners suffer badly"...

... "Local fishermen generally complain about seals, but when you inquire, you find very few have actually lost fish/lines to seals. They are bothersome at times but can be scared off by loud noises and banging gaffs on the water surface when they are not deep down"...

DISCUSSION

In waters off the Eastern Cape coast, interactions between the jig and line fishing industry, and Cape fur seals, can result in revenue losses to fishermen and mortality/injury to seals.

Seal attendance

Skippers reported that seals were nearly always present while fishing, and the average number of seals near lines was 3 (range 1–7) (present study). Independent observation aboard squid jig vessels suggested that this number was slightly lower, i.e., an average of 1.3; range 1–4 (present study). In comparison, independent observations on the west/south coast, suggest that an average of 1.5 seals (Mejer *et al.*, 1992) or 2 seals (Wickens, 1994) are usually observed around handline vessels while fishing.

There was no obvious localised region of seal-fisheries interaction. However, many of the line fishermen reported that seals were usually more common in deeper waters, especially off the main headlands (Mossel Bay; Knysna Heads to Plettenberg Bay; and Cape Recife), and south-east of Bird Island. Squid jig fishermen also reported observing more seals near Plettenberg Bay, Cape Recife and the Bird Island area, and reported observing more seals in deeper waters between Elands Point and Cape St Francis.

Seal-fisheries interactions occurred at day and at night. East coast line fishermen are generally active during the day, and the squid jig fishermen are active at day and night. Squid jig fishermen reported that seals were particularly destructive at night when fishing under lights, especially in winter.

Although interaction with seals occur throughout the year, some fishermen report that interactions increase in April to August (especially in June), when the majority of seals are feeding at sea. Most squid is landed from June to December, which may partially explain the high incidence of interaction reported in the winter months. Seals come ashore in large numbers to give birth and mate in November and December, and to moult in January to March (Rand, 1967, David & Rand, 1986). From November to December, and possibly January to March, the majority of seals presumably feed less, and/or feed closer to breeding colonies, reducing interaction with fishermen on the main fishing grounds (Mejyer *et al.*, 1992).

Depredation and damage to equipment

Questionnaire surveys suggested that squid jig fishermen, and longliners targeting hake (Plettenberg Bay area), experienced greater conflict with seals than did other line fishermen. The majority of squid jig fishermen reported that seals often/always caused squid schools to scatter, whereas most line fishermen reported that seals never/seldom caused fish schools to scatter. Seals breaking lines was considered to be a problem on about half of the squid jig vessels, whereas most line fishermen reported that seals seldom broke lines. Taking fish from lines was of considerable economic loss to the majority of squid fishermen, but was of little economic loss to the majority of line fishermen.

Independent observation aboard squid jig vessels indicated that seals seldom broke lines/tackle, and seldom caused squid schools to disperse from the area (present study). When interaction was observed, seals were generally feeding near the lines, occasionally taking squid directly from the lines. The maximum number of squid taken directly from lines by a single seal was eight; and the maximum number of lines broken by a single seal was eight. These two examples indicate that seals can cause considerable disruption at times, resulting in financial loss to fishermen in terms of loss of tackle (e.g., nylon line, dollies, hooks, swivels and sinkers), lost fishing time, and loss of potential catch.

In comparison, independent observations on the west/south coast indicated that losses of fish and tackle to seals are of a relatively minor nature relative to the value of the handline fishery (Mejyer *et al.*, 1992; Wickens, 1994); and seals occasionally scatter schools of fish, e.g., seals were thought to cause snoek schools to sound five times during 103 days of fishing (Mejyer *et al.*, 1992); no cases of seals scattering fish schools were reported by Wickens (1994).

Deliberate killing (shooting) of seals

On the Eastern Cape coast, a minority of fishermen are responsible for killing large numbers of seals each year to safeguard catches. Seventeen skippers reported that they deliberately kill seals, i.e., four line fishermen kill a total of c. 760–960 seals per year; and 13 squid jig fishermen kill a total of c. 900–1000 per year. Three of these fishermen have a licence to fish for squid and hake, therefore seal mortality for the 14 fishermen was c. 810–1210 seals. Considering that there were 234–243 squid jig/403–438 line fishing vessels operating between Port Alfred and Mossel Bay between 1992 and 1995 (Chris Wilke, pers. comm.), overall mortality will be considerably higher.

Independent observation aboard squid jig vessels indicate that seals are often shot to safeguard catches, i.e., an average of 0.6 seals shot per day over the 31 day period. When one or more seals were observed near lines, action was taken to safeguard catches 53% of the time, i.e., 19 out of 36 observed cases. A shot gun was usually used to shoot seals, although a rifle was used on two occasions. On the west/south coast, independent observations also confirm that seals are deliberately shot by line fishermen, however the magnitude of the problem has not been quantified (Wickens, 1994).

Although deliberate killing of seals without a permit is illegal, it is almost impossible for Fisheries Control Officers to enforce this law across the entire region (see section 3b of the Seabirds and Seal Protection Act 46 of 1973). Until effective methods of deterring seals from fishing operations are developed, unfortunately the deliberate killing (shooting) of seals will continue. Therefore it must be done humanely. Although a variety of methods have been used to deter seals from fishing operations (including explosive firecrackers, electric pulses, air guns and sounds of killer whales), none have proven successful for all fisheries (Wickens *et al.*, 1992).

When shooting seals at sea, fishermen usually use a 12 bore shotgun. Rifles and pistols are less commonly used. Shooting in the air usually does not deter seals when feeding, therefore many fishermen shoot near or at the seal. At sea, it is not always possible to achieve a clean head shot because: the vessel is moving; seal movement is erratic; and the seals may be below the water surface. Therefore, many seals are shot in the stomach or back, and die a slow, painful death.

Examination of seals stranded along the Eastern Cape coast between January 1992 and December 1995 ($n = 47$ seals collected by Stewardson), indicated that 9 seals (19%) had been shot, presumably by fishermen (Appendix 11(b).4). These animals were all adult males with a mean standard body length of 171.6 ± 7.6 cm, range 145–216 cm. Only two seals had been shot in the head. The remainder were shot in the stomach, neck or between the shoulders.

Marksmanship, distance from the seal, and the type of projectile used, influence the likelihood of achieving a fatal wound. When using shot guns at sea, many fishermen are probably using small shot to ensure that at least some pellets hit the seal. Although a hit may frighten seals from the area, small shot is likely to cause injury and suffering. If seals must be shot (e.g., removing rogue bulls from the area), larger pellets travelling at least 1200 feet per second, preferably calibre .222 inches, should be used. Larger pellets penetrate deeper into the animal inflicting a fatal wound.

When using 303 rifles at sea, some fishermen may use sporting projectiles (soft point) to inflict a fatal wound. However, when shooting through water, this type of bullet will break up, and therefore injure (rather than kill) the animal. The use of military projectiles (full metal jackets) should be used to achieve a fatal wound. A .22 rifle is not powerful enough to kill an adult seal humanely, and therefore should not be used.

Other methods used to deter seals

Other methods used by fishermen to discourage seals from interfering in fishing operations included: firing a shot near the seal to frighten it; using clubs; gaffing/hooking the seal; using knives; throwing objects (e.g., sinkers, stones); using a catapult; feeding the seal with mackerel; catching the seal; loud noises; starting of engines; banging gaffs on the water surface; waiting for some other fishermen to shoot the seal; and moving to another area (present study).

On the west/south coast, handline fishermen also discourage seals from interfering in fishing operations by: using a catapult (to shoot stones or lead); gaffing the seal; and moving to another area (Wickens, 1994). In addition fishermen harpoon seals; move slowly past another boat in hope that the seal would follow that boat; and lift their lines temporarily so that the seals move to another boat (Wickens, 1994).

The use of gaffs, knives, harpoons and stones can cause severe injury to seals. At least some of the injured seals would subsequently die.

General attitude of fishermen towards seals

Although many fishermen in the Eastern Cape harbour a strong antipathy towards seals, less than 50% of skippers thought that seals should be managed (culled) to prevent negative interactions with the fishing community.

The hake longliners at Plettenberg Bay appealed for immediate action, stating that culling (or localised removal of specific animals) would help resolve the seal problem in their area.

CONCLUSION

On the Eastern Cape coast, seals break lines/tackle, take fish from the lines, cause fish schools to scatter, and reduce potential catch by feeding on fish schools near the lines. These interactions causes some financial loss to fishermen. Some fishermen deliberately kill seals in order to reduce their perceived impact. More than 1 000 are shot in this area each year. Therefore interactions are detrimental to both parties. Although individual fishermen may experience considerable disruption to their operations at times, in terms of the value of the industry as a whole, such losses are negligible .

In order to reduce the losses incurred by fisheries, and prevent shooting of seals, research is needed to develop effective non-lethal methods of deterring seals from fishing operations. Considering that 1 or 2 seals can cause losses for fishermen, culling is unlikely to reduce the magnitude of losses appreciably (Wickens, 1994). Localised removal of specific animals may be a short term solution in some areas; however, long term solutions are required. Non-lethal methods of deterring seals from operations would alleviate problems to both parties, e.g., deterrents to repel seals from fishing gear and/or conditioning seals to avoid fishing areas. The market could subsidise such research by increasing the price of fish. The closure of certain areas to fishermen should also be considered. Large numbers of seals are being shot in this area, therefore ongoing monitoring of the seal population is required.

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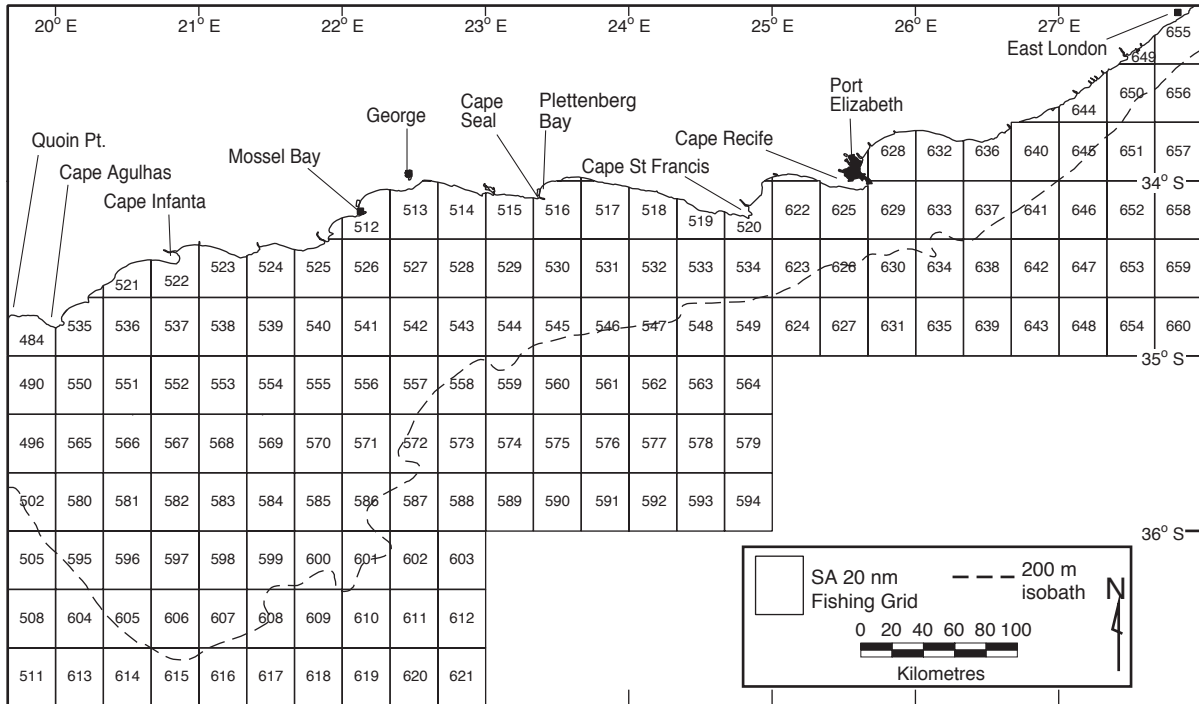
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Appendix 11(b).1 Demersal grid chart of the south and east coasts of South Africa



Appendix 11(b).2 Main fishing locations and the number of skippers operating in each location (n = 33 squid jig skippers)

Fishing location ¹	Count	Percent	Fishing	Count	Percent	Fishing	Count	Percent
512*	2	0.7	533	4	1.4	623	2	0.7
513*	3	1.1	534	4	1.4	625	13	4.7
514*	3	1.1	535*	4	1.4	626	2	0.7
515	4	1.4	536*	3	1.1	628	13	4.7
516	13	4.7	537*	2	0.7	629	9	3.2
517	8	2.9	538*	2	0.7	632	12	4.3
518	12	4.3	539*	2	0.7	633	2	0.7
519	15	5.4	540*	2	0.7	636	15	5.4
520	15	5.4	541*	2	0.7	637	4	1.5
521*	2	0.7	542*	2	0.7	640	18	6.5
522*	2	0.7	543*	1	0.4	641	3	1.1
523*	2	0.7	544	1	0.4	644	14	5.0
524*	2	0.7	550*	2	0.7	645	5	1.8
525*	4	1.4	551*	1	0.4	649	1	0.4
526*	2	0.7	552*	1	0.4	650	3	1.1
527*	1	0.4	565*	1	0.4	655	3	1.1
528*	2	0.7	566*	1	0.4	661	1	0.4
529	3	1.1	567*	1	0.4	665	1	0.4
530	3	1.1	580*	1	0.4	666	1	0.4
531	3	1.1	595*	1	0.4	671	1	0.4
532	4	1.4	622	12	4.3			
105	37.8		50	18.1		123	44.5	

¹ Fishing locations were recorded as a grid number (see Appendix 11(b).1).

* Several of the Eastern Cape skippers also fished as far west as Cape Agulhas Point

Appendix 11(b).3 Main fishing locations for the 12 species of line fish listed in Table 1(b).11. Fishing grid number followed by the number of skippers operating in each location (n = 15 skippers).

		Line fish species																				
1	2	3	4	5	6	7	8	9	10	11	12											
515	1	626	1	625	2	625	1	626	1	625	1	628	1	625	1	628	1	529	1	626	1	
516	4	629	2	626	1	626	1	627	3	628	1	632	2	626	1			530	1			
517	1	630	1	627	1	627	1	628	1	632	1			627	1			531	1			
518	1	632	1	628	3	628	2	629	1					628	1							
625	4	633	2	629	1	629	2	630	1					629	1							
626	2	NR	2	632	1	633	1															
627	1			633	1	NR	1															
628	2			NR	1																	
629	2			NR																		
630	2																					
633	1																					
634	1																					
NR	2																					
Total	24	9	11	9	7	3	3	1	5	1	3	1										

¹ Fishing locations were recorded as a grid number (see Appendix 11(b).1).

NR, grid numbers not recorded for that species.

Species codes: 1. stock fish (hake); 2.carpenter (silverfish); 3. true kob (kabeljou); 4. geelbek; 5. tuna; 6. santer; 7. dageraad; 8. roman; 9. panga; 10. elf (shad); 11. kingklip; and 12. dikbek (barred thick-lip).

Appendix 11(b). 4 Cape fur seals deliberately killed by fishermen along the Eastern Cape coast January 1992 to December 1995

Accession no.	Date	Approximate location	Sex	Length (SBL cm)	Weight (kg)	Cause of death
PEM1877	2 Apr 1992	Lauries Park, PE 34°02'S, 25°23'E	M	185	68	Bullet wound between the shoulders
PEM1882	6 May 1992	King's Beach, PE 33°58'S, 25°39'E	M	180	124	Bullet wound to the stomach (rifle)
PEM2018	25 Jan 1993	Bird Island 33°51'S, 26°17'E	M	155	–	Two bullet wounds to the shoulder and neck
PEM2045	30 May 1993	Schoenmakerskop 34°02'S, 25°32'E	M	145	–	Bullet wound to the stomach
PEM2050	8 Jun 1993	Plettenberg Bay 34°07'S, 23°25'E	M	165	–	Bullet wound ¹
PEM2134	28 Dec 1993	Noordhoek 34°02'S, 25°39'E	M	216	–	Bullet wound to the stomach
PEM2143	28 Jan 1994	Seaview 34°01'S, 25°17'E	M	189	114	Two bullet wounds to the head
PEM2198	Jul 1994 ³	Plettenberg Bay 34°03'S, 23°24'E	M	105	28	Blow to the head ² (severe hemorrhage extending from the nasal to the mid orbit)
PEM2203 ⁴	18 Jul 1994	PE Harbour 33°58'S, 25°37'E	M	240	134	Stoned and gaffed
PEM2406	25 Jul 1995	Swartkops River	M	154	72	Bullet wound to the shoulder and lungs (one shot gun pellet retrieved)
PEM2411	24 Aug 1995	Plettenberg Bay	M	155	85	Bullet wound to lower jaw; punctured eye; pellet scars on fore flippers (shot gun pellet retrieved)

¹ Examined by Cape Nature Conservation Ranger (confirmation of bullet wound).

² Possible interaction with a vessel, but more likely to have been hit with a stone or club.

³ Autopsy performed 6 Jul 1994; dead animal stored in freezer at Plettenberg Bay.

⁴ Fishermen observed throwing stones at the seal; gaff wound to the lower lip and pellet; and severe lacerations over the eye (eye pushed downward into the socket).