

ENTANGLEMENT OF SOUTHERN ELEPHANT SEALS IN SQUID FISHING GEAR

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Although southern elephant seals, *Mirounga leonina*, prey upon fish and squid species that are targeted by large commercial operations that overlap with their foraging range (Daneri and Carlini 2002, van den Hoff *et al.* 2002, Bradshaw *et al.* 2003 and references therein), direct interactions with fisheries have not been widely reported. Most of the available evidence concerns interaction with fisheries targeting toothfish, *Dissostichus spp.* (Slip 1995, McMahon *et al.* 2000, van den Hoff *et al.* 2002, Hindell *et al.* 2003). We report on the entanglement of southern elephant seals from coastal Patagonia, Argentina, in squid fishing gear (Fig. 1). To our knowledge, this is the first description of a direct interaction of a squid commercial fishery with southern elephant seals.

The only large breeding colony of elephant seals in continental South America occurs at Península Valdés (42°04'S, 63°45'W; Le Boeuf and Laws 1994). This population, which currently contains about 50,000 animals, has been closely monitored since the early 1980s (*e.g.*, Campagna and Lewis 1992; Lewis *et al.* 1998, 2004). Seals haul out along in 200 km of coastline, but about 60% of them breed along a 50-km stretch. A 10-km study site in the high-density area has been surveyed biweekly during the breeding season (September and October) and bimonthly throughout the year

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Figure 1. Entangled southern elephant seals from Península Valdés. (a) Adult female with two wounds, (b) juvenile with about 10 jigs still attached to the monofilament line, (c) scar marks in an adult female, (d) squid fishing gear: monofilament line and jigs, (e) recently molted immature male with a deep scar, (f) subadult with a large scar deep in the neck.

for a decade. About 2,500 females and 200 adult and large subadult males reproduce in the study site; a similar number, mostly juveniles, adult females, and subadult males, molt from November to February (Lewis *et al.* 2004 and unpublished data).

Starting around 1995, seals of both sexes and different age categories were recorded entangled in fishing gear (Fig. 1). Each year, three to five animals were seen in the study site with fresh wounds around the neck, caused by monofilament lines. A few additional animals had scars from old wounds (*e.g.*, Fig. 1e). In 10 yr (1995–2005), at least thirty-five animals were seen either with recent wounds or scars around the neck. Five more were reported entangled during surveys beyond the study site. Entangled seals occurred during both the breeding season (adult females) and the molt (juveniles, adult females, and subadult males).

The entangling line was cut away in eighteen seals (6 adult females, 1 subadult male, 11 juveniles of both sexes and ages estimated at 2–3 yr). In all cases, the material removed was a monofilament line, 1.3–1.5 mm thick (Fig. 1d) typically tied in a circle with a human-tied knot. In two juveniles, the line had jigs attached (colored lures armed with a crown of hooks; Fig. 1b, d). Jigs are typical gear of the squid fisheries. The circular shape of monofilament resembles the lines used to tie weights

to the jiggers.² Monofilament line was the only material found in entangled Valdés seals since the mid-1990s. In the early 1990s at least five animals were seen entangled with plastic packing bands.

Coinciding with the record of entangled seals in monofilament line, a large, commercial fishery, targeting Argentine squid, *Illex argentinus*, developed on the Patagonian shelf and slope (Rosenberg *et al.* 1990, Waluda *et al.* 2002). This fishery targets an international fleet that consists of both jigging light vessels and trawlers (Brunetti 1988, Basson *et al.* 1996, Haimovici *et al.* 1998, Arkhipkin 2000, Rodhouse *et al.* 2001, Waluda *et al.* 2002). Seals from Valdés, particularly adult males, juveniles, and postbreeding adult females, satellite tracked during the pelagic phase of their annual cycle overlap in their at-sea distribution with the squid fishery (Campagna *et al.* 1995, 1998, 1999, and unpublished data). As seals travel to areas where boats operate, it is possible that they encounter vessels or debris thrown overboard.

Entanglement affects many species, causes mortality, and impacts populations in several pinnipeds (*e.g.*, Fowler 1987). The problem may even increase the risk of extinction of populations already endangered, such as the Hawaiian monk seal, *Monachus schauinslandi* (Henderson 2001). Northern elephant seals, *M. angustirostris*, have been observed entangled in marine debris such as monofilament lines, nets, packing bands, ropes, and several other type of marine debris (Stewart and Yochem 1985, Hanni and Pyle 2000). In the same area covered by this report, South American sea lions, *Otaria flavescens*, are often observed entangled in packing bands and fishing nets (Campagna, unpublished observations).

Entanglement rates vary per area and species, and range, particularly for otariids, from 0.1% to 7.9% of the surveyed populations (*e.g.*, Harcourt *et al.* 1994, Page *et al.* 2004, and references therein). The rate of entanglement for the Valdés seals seems comparatively low at first appearance. Estimates based on three to five new entangled seals sighted per breeding season in the study site yields a rate as low as 0.001% (3/2,700 reproductive seals). However, this rough rate is undoubtedly low as it does not consider entangled animals alive from previous seasons and concentrates on a period when juveniles, the most affected age category, are not present.

Beyond the effects at the population level, entanglement may be lethal for affected individuals. Even those animals that are rescued may have a lower survival or reproductive rate due to the longer term effects of the entangling material (Hanni and Pyle 2000). Only five of the eighteen rescued Valdés seals were resighted in subsequent years, thus suggesting that survival is depressed. A female with two monofilaments loops around removed from around its neck (Fig. 1a) returned to give birth successfully at least twice. Scars due to entanglement are often larger than those inflicted by males during most fights and affect vulnerable parts of the body with thinner skin compared to the chest of an adult male. Old scars may turn into chronic wounds that often bleed and get infected, with debilitating consequences. Judging from the depth of the wounds, entangled seals could live a few years with a line cutting the skin and muscles of the neck. The wounds limit the movement of the neck and rest of the body and could impair the diving ability of a seal.

² Personal communication from Miguel Pariggi, May, 2006.

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