

New records of the giant squid *Architeuthis dux* in the southern Indian Ocean

Yves Cherel

Centre d'Etudes Biologiques de Chizé, UPR 1934 du Centre National de la Recherche Scientifique,
BP 14, F-79360 Villiers-en-Bois, France. E-mail: cherel@cebc.cnrs.fr

Only one specimen of *Architeuthis dux* was previously reported from the southern Indian Ocean. The present work adds ten new records of giant squid in the area. Two remains of fresh specimens have been collected from La Réunion Island (21°S) and Amsterdam Island (38°S) in tropical and subtropical waters, respectively. Eight other squid were identified from beaks found in stomach contents of sleeper sharks caught in Kerguelen waters (47 to 48°S) located in the southern Polar Frontal Zone. These new data together with published and unpublished information on the food of seabirds and marine mammals indicate that giant squid have a wide distribution throughout the southern Indian Ocean.

Most records of the giant squid (*Architeuthis dux* Steenstrup, 1857) come from some localities in the North Atlantic (Newfoundland, northern Europe), South Atlantic (South Africa), New Zealand and the North Pacific (Japan). It is thought to be a cosmopolitan species or a complex of species, but, in many parts of the world ocean, either no or a few specimens have been recorded (Clarke, 1966; Roper & Boss, 1982). In the Indian Ocean, except the occurrence of specimens in the diet of sperm whales caught off eastern South Africa and western Australia (Clarke, 1980), only one giant squid was found stranded on the small oceanic island of Saint Paul in 1874, the so-called *A. sanctipauli* Velain, 1875 (Species dubium; Förch, 1998).

In this note, we report two new observations of specimens at sea and the occurrence of beaks of giant squid in the diet of deep-sea sharks from different water masses of the southern Indian Ocean. Giant squid were identified from the morphology of their chitinous lower and upper beaks. Beaks of *A. dux* have a typical shape, the chitin is thin and lightly coloured, and often the wings and lateral walls curl up (Clarke, 1986). Lower beaks might be confused with those of *Thysanoteuthis rhombus* Troschel, 1857, but *Architeuthis* beaks grow to and darken at a larger size (Clarke, 1986). Lower rostrum length (LRL) was measured with a vernier caliper, and dorsal mantle length (ML) was estimated using the allometric equation from Roeleveld (2000).

On 18 April 1998, a big chunk of flesh of a large cephalopod including the base of the arms, head and the upper part of the mantle was seen floating at the sea surface about ten miles from Saint Paul, La Réunion Island (21°00'S 55°45'E). The fisherman reported that the colour of the skin changed quickly over time indicating that some chromatophores were still active and that the specimen was freshly dead. Only the buccal mass was collected. Beaks are typically those of *Architeuthis dux*, but the tip of the rostrum of the lower beak was broken, thus precluding an accurate measurement of its size. The LRL is likely to be in the range 17.0 to 17.5 mm, thus

corresponding to an estimated 174 to 193 cm-ML. Fishermen reported that other remains of big squid were observed and that sperm whales *Physeter macrocephalus* Linnaeus, 1758 occurred in the area at that time. This finding is, to our knowledge, the first observation of a giant squid in that part of the southern Indian Ocean, i.e. in tropical waters surrounding La Réunion Island and Mauritius.

On 15 December 2000, a large mantle was observed floating at the sea surface in the vicinity of Amsterdam Island (37°50'S 77°33'E). Head and gladius of the specimen were lacking. Yellow-nosed albatross *Diomedea chlororhynchus* Gmelin, 1789 were feeding on the corpse that was pulled on deck of the French trawler 'Austral'. Fishermen reported that two other specimens of large squid were observed in the previous weeks. The two funnel-locking cartilages and one nuchal cartilage were collected on-board and kept frozen. The nuchal cartilage is large and similar to that illustrated in Compagno-Roeleveld & Lipinski (1991); its shape is unremarkable, typically teuthoid. The funnel cartilages are identical to the description and photography of those from *Architeuthis dux* from elsewhere (Compagno-Roeleveld & Lipinski, 1991; Förch, 1998). While many cephalopod families have a straight funnel-locking apparatus, both the size (146 and 148 mm) and shape of the funnel cartilages indicate they belong to a specimen of giant squid. No other *Architeuthis dux* was previously reported from Amsterdam Island, but one giant squid was washed ashore on the closely related Saint Paul Island (38°43'S 77°32'E) in 1874 (Clarke, 1966).

During an investigation on the feeding ecology of deep-sea sharks at Kerguelen Islands, many cephalopod beaks were found in stomach contents of the gigantic sleeper shark (Genus *Somniosus* Le Sueur, 1818) (Cherel & Duhamel, unpublished data). Sharks were taken as by-catches of the trawl fishery targeting the Patagonian toothfish *Dissostichus eleginoides* Smitt, 1898 in slope waters surrounding the archipelago. Fourteen beaks of *Architeuthis dux* were positively identified, including six upper and eight lower beaks belonging to eight different

Table 1. *Details of Architeuthis dux beaks found in stomach contents of sleeper sharks in Kerguelen waters.*

Date	Location	Trawling depths (m)	Beaks (N)		Measured LRL (mm)	Estimated ML (cm)*
			Upper	Lower		
13 November 1998	47°14'S 69°23'E	630–710	1	1	15.51	128
16 February 1999	48°11'S 71°15'E	550–870	1	1	16.33	152
22 March 2000	47°10'S 69°23'E	490–620	1	1	11.78	60
24 April 2000	48°26'S 70°58'E	680–755	0	1	11.33	54
10 May 2000	47°25'S 69°14'E	420	1	1	broken	–
08 October 2001	47°19'S 69°11'E	600	2	2	18.13	220
					broken	–
21 November 2001	48°06'S 71°18'E	453–575	0	1	10.43	45

*, Using allometric equation from Roeleveld (2000). LRL, lower rostrum length; ML, mantle length.

squid found in the stomach of seven sharks. The LRL ranges from 10.4 to 18.1 mm and estimated mantle length from 45 to 220 cm (Table 1). All beaks were accumulated items, with no flesh attached. The presence of beaks in the shark stomach is the first evidence of *Architeuthis dux* in the area.

Accumulated beaks of giant squid are rare prey items of albatross during the chick-rearing period (review in Cherel & Klages, 1998). A few of those beaks were recently identified in food samples of grey-headed albatross *Diomedea chrysostoma* Foster, 1785 (four lower and three upper beaks) and yellow-nosed albatross (one upper beak) breeding at Kerguelen Islands in 1994 (Cherel et al., 2002, and unpublished data). In the same way, eight and four lower beaks were found in the diet of wandering albatross *Diomedea exulans* Linnaeus, 1758 from Crozet Islands in 1992 and 1994, respectively (Cherel & Weimerskirch, unpublished data). Most of the lower beaks were small and damaged, thus precluding any measurement, but the LRL of five beaks from food samples of wandering albatross were 4.1, 7.1, 9.1, 13.9 and 14.4 mm thus corresponding to estimated dorsal mantle length of 12, 23, 35, 92 and 102 cm, respectively. Beaks of *Architeuthis dux* were not found in the diet of smaller procellariiforms, penguins and sea mammals, except in that of the sperm whale. In oceanic waters of the central southern Indian Ocean, giant squid account for 2% and 3% of the number of cephalopod prey of sperm whales in the Crozet and Kerguelen areas, respectively (Mikhalev et al., 1981).

The present work indicates the presence of *Architeuthis* squid in various water masses of the southern Indian Ocean, including the tropical (La Réunion), subtropical (Amsterdam) and Polar Frontal (Kerguelen) Zones. This is in agreement with the general view that giant squid are broadly distributed from 80°N in the eastern North Atlantic to the Subtropical Front at about 40°S and in the Atlantic, Indian and Pacific Oceans (Clarke, 1986). The diet of sharks moreover expands their distribution further

south (to about 50°S) in colder waters of the Indian Ocean.

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