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The ectoparasitic barnacle *Anelasma* (Cirripedia, Thoracica, Lepadomorpha) on the shark *Centroscyllium nigrum* (Chondrichthyes, Squalidae) from the Pacific sub-Antarctic

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Abstract

We report the occurrence of the ectoparasitic lepadomorph barnacle *Anelasma* sp. on the deep-sea squaloid shark *Centroscyllium nigrum* from the Pacific sub-Antarctic off southern Chile. *Anelasma* has previously been documented only from the northeast Atlantic on the squaloid shark *Etmopterus spinax*; this new record extends the known range of *Anelasma* into the Pacific Ocean and into the Southern Hemisphere, and documents a new host for this parasitic barnacle.

Introduction

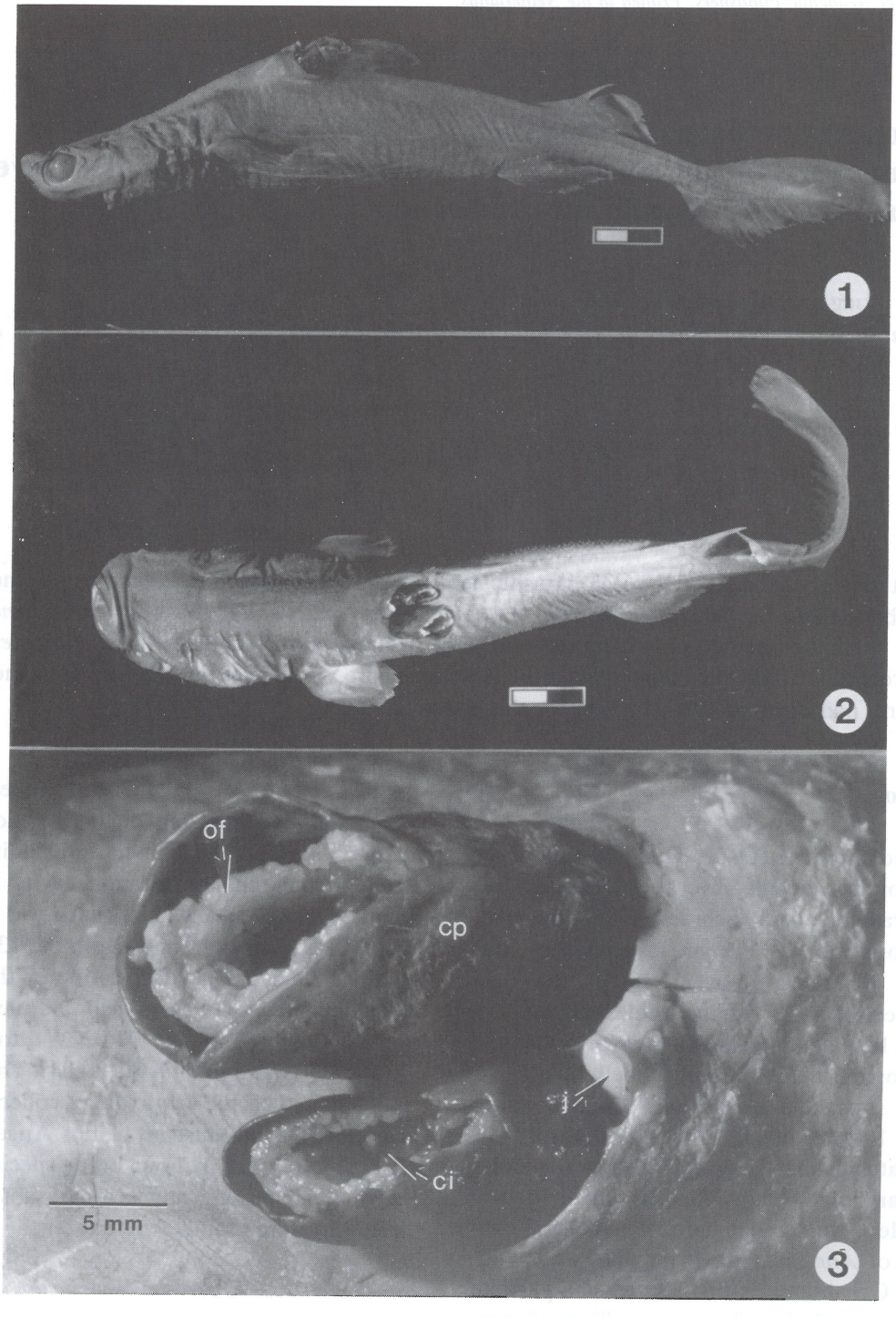
The stalked barnacles (Order Thoracica; suborder Lepadomorpha) include several aberrant epifaunal or parasitic genera (Schram, 1986; Newman, 1987). Most of these live on invertebrates, but *Anelasma squalicola* (Lovén, 1845), the best known species in the family Anelasmatidae Zevina 1980, has been reported in the North Atlantic as an ectoparasite of the velvet belly shark *Etmopterus spinax*, a deepwater squaloid shark (Darwin, 1851; Gruvel, 1905; Hickling, 1963). Unfortunately, the biology, distribution and evolutionary relationships of *Anelasma* are poorly known. Here we present the first published confirmation of *Anelasma* sp. from the Pacific sub-Antarctic Ocean and its first record as a parasite on the combtooth dogfish *Centroscyllium nigrum*.

Materials and methods

The host is a sub-adult male *Centroscyllium nigrum* measuring 256 mm in total length. Two individuals of *Anelasma* sp. are imbedded subdermally just to the left of the first dorsal spine; a much smaller and lighter third individual protrudes from the implantation cavity anterior to the larger individuals. The shark was trawled by the USNS *Eltanin* from a depth of 833 metres on 1 April 1966, in the Pacific side of the Strait of Magellan near Isla Desolación, Chile, from approximately 53°21′ S, 73°02′ W to 53°19′ S, 73°07′ W (USNS *Eltanin* Sta. 1604). The specimen is deposited in the ichthyology collection of the Natural History Museum of Los Angeles County (LACMNH 11157). Four other specimens of *C. nigrum*, all lacking any ectoparasites, were collected from the same general area.

Description and comments (Figs 1–3)

The 2 large *Anelasma* have a purplish-brown, tough, flexible mantle lacking plates. The 2 large individuals are 25 and 17 mm in estimated total length, and 11 and 9 mm in diameter, respectively.



Figs 1–3. 1–2. Lateral and dorsal views of parasitised *Centroscyllium nigrum* (LACMNH 11157), showing location of the *Anelasma* sp. *Scale-bars*: 1 cm. 3. Magnification of the dorsal view of *Anelasma* sp. on the same shark specimen (LACMNH 11157). *Abbreviations*: cp, capitulum; of, ovigerous frena; ci, cirri; j, juvenile specimen.

Just within the mantle, the double ovigerous frena are well developed and covered with orange eggs. The cirri are visible within the capitulum and appear reduced in relation to the body; they have no apparent setae. There is some swelling around the implantation cavity, but the shark's skin shows no sign of secondary infection or abnormal growth. A small and much less developed individual lies anterior to the 2 large speciemens. It is 4 mm in diameter, 10 mm in estimated total length and its capitulum is an opaque whitish-grey colour.

In all observable external morphology, habits and size, specimens match the diagnosis of *Anelasma squalicola* (Darwin, 1851). *A. squalicola*, like the sub-Antarctic specimens, usually occurs in pairs embedded within the sheath of the first dorsal spine of the host. A single *Anelasma* cyprid may settle in the scar left by rupture of the dorsal spine sheath early in the host's life, and subsequently develops a peduncle that penetrates into the dorsal muscles of the host; later, a second or third cyprid may settle into the initial implantation cavity and develop as the first barnacle continues to grow (Hickling, 1963). Secondary and tertiary colonisation occurred in our specimen. Although the adult barnacle may occasionally use its degenerate cirri to capture food, most of its nutrition is obtained from the host via a system of rootlike structures that grow out of the peduncle into the muscle of the host (Hickling, 1963).

Discussion

Aside from *Anelasma squalicola*, Newman & Foster (1987) contend that there may be three other species of *Anelasma*, one each from the Gulf of Mexico, Pacific South America and New Zealand. However, these occurrences should be considered dubious since the authors do not identify them to the specific level, do not describe or figure these barnacles, do not supply more precise locality information, do not identify the hosts, and do not cite published references or institutional catalogue numbers for these specimens. A somewhat earlier review of barnacles from the Gulf of Mexico (Spivey, 1981) makes no mention of *Anelasma* from this area.

Based on the paucity of material available at the present time, we cannot say at this time whether or not these represent a new species of *Anelasma*. *Etmopterus spinax* is the only documented host of *Anelasma squalicola*, but the degree of host specificity of this species is not adequately known. In any case, *Centroscyllium* and *Etmopterus* are sister genera within the subfamily Etmopterinae (Shirai & Nakaya, 1990) and both are deepwater inhabitants of temperate and sub-Polar seas in the Pacific and Atlantic Oceans of both hemispheres (Compagno, 1984). Therefore, *Centroscyllium nigrum* as a host should not seem unusual, even though *Anelasma* has never previously been reported as a parasite for this genus.

On the other hand, this new find is so geographically distant from the known documented range of *Anelasma squalicola* that it may indeed represent a new, isolated species of *Anelasma*, possibly related to or conspecific with one or both species of Southern Hemisphere *Anelasma* mentioned by Newman & Foster (1987). All previous published reports of *A. squalicola* have come from the North Atlantic close to the British Isles (Frost, 1928; Hickling, 1963); none has been noted from the northwest Atlantic (Threlfall, 1969; Margolis & Arthur, 1979; Scott & Scott, 1988) or from the Antarctic (Newman and Ross, 1971). Additionally, we could find no previous records of *A. squalicola* or sharks parasitised by it from anywhere in the Pacific, except for two questionable occurrences of southern Pacific *Anelasma* mentioned by Newman & Foster (1987). The Antarctic region exhibits both a 32:1 ratio of lepadomorph to balanomorph species and a 75% degree of species endemism among barnacles; however, many genera of Antarctic and sub-Antarctic barnacles, now including *Anelasma*, have an amphitemperate distribution, and there are general similarities between the barnacle faunas of Antarctica and the north Atlantic (Newman & Ross, 1971; Newman & Foster, 1987). Further work and additional specimens will be needed to determine the specific designation and the biogeographical and phyletic significance of the sub-Antarctic *Anelasma*.

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