

A full account of the work will be published elsewhere. It was done at the Marine Biological Laboratory, Plymouth, and I thank the Director and staff for facilities and help. I also thank the Council of the Royal Society for a grant from the Browne Fund, part of which was used for this investigation.

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### *Acanthocottus lilljeborgi* (Collett) in British Seas

THE Norway bullhead, *Acanthocottus lilljeborgi* (Collett, 1875), is a marine cottid (Teleostei-Scleroparei) endemic to the European boreal region. It closely resembles *A. bubalis* (Euphr.) (= *Cottus bubalis* Euphr.) in general appearance, wide attachment of branchiostegous membrane to isthmus, number and arrangement of opercular spines, and possession of a small barbel at each corner of the mouth, but is readily distinguished from *A. bubalis* by the presence of a second longitudinal row of ossicles, dorsal and parallel to that along the lateral line, a difference in pelvic fin formula (12 instead of 13) and smaller maximum size (60 mm. against 170 mm.)<sup>1</sup>. The distribution and development of *A. lilljeborgi* have been reviewed by Bruun<sup>2,3</sup>. Demersal juveniles and adults of this small fish are not often taken, and most records refer to pelagic postlarvæ. Outside British seas, the species is known from the south and west coasts of Iceland, the Faeroes, Rockall Bank, Great Fisher Bank, the Norwegian coast to 65° N., and the Skagerrak and Kattegat.

Past British records are very few, and bottom living older stages have been recorded only from the Clyde sea area, where small numbers have been found at depths of 10–47 fathoms (18–87m.)<sup>4,5</sup>. The only definite British record of postlarvæ is given by Bal<sup>6</sup>, who obtained them off Port Erin, Isle of Man, in May, 1939. However, postlarvæ from the west coast of Ireland (Tory Island and Donegal Bay in the north, Valentia Island in the south) and the east coast of Scotland (St. Andrews Bay and neighbourhood)<sup>7,8</sup>, all originally identified as *Oncocottus quadricornis* (L.) (= *Cottus quadricornis* (L.)), have been assigned to *A. lilljeborgi* by Bruun.

In the Irish Sea, within the past eighteen months, demersal examples of *A. lilljeborgi* have been taken by scallop-dredge in depths from 15–28 fathoms (28–51 m.) off the south end of the Isle of Man. Standard lengths ranged from 30 to 44 mm. The bottom deposit at the places of capture is coarse, being mainly composed of dead shells and stones, except in one locality where there is a characteristic *Modiolus* epifauna<sup>9</sup>. The relatively wide distribution of the species over this coarse ground, and the evidence of breeding in the region (occurrence of postlarvæ<sup>6</sup> and similarity of some of the demersal specimens to the mature male described by Bruun<sup>2</sup>) suggest that *A. lilljeborgi* is an established inhabitant of the Irish Sea.

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### Defensive Acid-Secretion in Some Marine Gastropods

IT has been known for many years<sup>1</sup> that the opisthobranchiate gastropod *Pleurobranchus membranaceus* (Montagu) is able to produce acid secretions if roughly handled, and the obvious inference is that these secretions deter would-be predators (especially carnivorous fish). More recently, this inference was given a scientific basis in experiments with pleurobranchids and marine fish in the Port Erin Aquarium<sup>2</sup>. During the past few months an attempt has been made to ascertain whether acids were secreted by gastropods other than *P. membranaceus*, and the purpose of this communication is to present some preliminary findings.

It has been found that acid fluids of approximately pH 1 can be secreted by the mantle and foot of: *Berthella plumula* (Montagu) (Opisthobranchia: Pleurobranchidae), *Lamellaria perspicua* (L.) (Prosobranchia: Lamellariidae) and *Velutina velutina* (Müller) (Prosobranchia: Lamellariidae). The pH estimations were made with Johnson's and B.D.H. pH papers. The acid secretion is produced only after rather violent treatment of the area of skin to be tested.

In experiments with hungry fishes (including cod: *Gadus morhua* (L.), pollack: *Pollachius pollachius* (L.), shanny: *Blenius pholis* (L.), father lasher: *Cottus bubalis* Euphrasen and plaice: *Pleuronectes platessa* (L.)), these gastropods were invariably rejected as food. Rejection frequently occurred only after the gastropod had been in the fish's mouth for some seconds. Of the truth of the inference that it is the acid secreted by the gastropods which is responsible for their rejection there can be little doubt, since Bateson<sup>3</sup> found food soaked in a dilute acid for a few seconds to be repellent to a variety of fishes.

One of the most remarkable features of these tests is that the gastropod seldom shows any sign of damage, even though the treatment it appears to receive from the hungry fish is violent in the extreme. It is also worthy of note that the ability to secrete an acid seems to have evolved quite separately at least twice, for the Pleurobranchidae and the Lamellariidae, although superficially exhibiting many parallels, are in the opinion of modern malacologists not at all closely related.

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