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The present Newsletter (the tenth) concludes Volume One. It includes papers from the A.G.M. held in the Royal Scottish Museum, Edinburgh, in March 1980. Again our thanks are due to David Heppell for arranging its production.

It had been intended to produce an Index to Volume One as part of this issue, but due to the large number of contributions it has been decided to distribute the Index and List of Members separately at a later date.

Members are reminded that the next PORCUPINE field meeting is to be held in the Channel Islands for the period 22nd to 29th September 1980. Would anyone wishing further information please see Newsletter No.9, page 164, or contact Roger Brehaut, La Canurie, Collings Road, St Peter Port, Guernsey, Channel Islands.

The dates for the 1981 A.G.M. are Saturday-Sunday 21st-22nd February. The venue will be the Marine Biological Laboratory, Plymouth, and the theme is "Ecological Results from Underwater Photography". Details will be circulated later but preliminary enquiries should be sent to Dr Eve Southward.

The next issue of the Newsletter, i.e. Volume Two Number One, may be produced in offset litho, depending upon costs, and should appear at the end of this year. Any contribution should be sent to the Hon. Editor of PORCUPINE, Fred R. Woodward, Natural History Department, Art Gallery and Museum, Kelvingrove, Glasgow, G3 8AG, or to the Hon. Secretary of PORCUPINE, Dr Shelagh M. Smith, Royal Scottish Museum, Chambers Street, Edinburgh, EH1 1JF.

FRED R. WOODWARD
Hon. Editor

KERRERA NUDIBRANCH EXPEDITION : 12-26 MAY 1979

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The primary objective of the expedition to Kerrera, an island just off Oban, was to investigate the opisthobranch molluscan fauna in this neglected part of the Scottish West coast. The use of facilities belonging to the Dunstaffnage Marine Laboratory (SMBA), including the R.V. Calanus and diving tenders, was generously offered to the expedition and considerably enhanced the effectiveness of the collecting programme. The team of nine divers were able to sample 27 offshore localities. A total of 110 sublittoral collections produced a cumulative bottom time in excess of 45 hours. Dr S.M. Smith conducted concurrent shore studies and gathered data from offshore dredge samples. The shore fauna (as a whole, not just Mollusca) was considered disappointing when compared with most Scottish shores worked by SMS even allowing for poor tides, but there is insufficient data from the Firth of Lorne as a whole to suggest a reason for this.

The results are tabulated below. The sites have been arranged sequentially from those experiencing no appreciable wave action and only slight currents (sites 1-7) to those exposed to waves and ocean swells as well as fast tidal currents (sites 30-34). In an attempt to simplify the data several sites have been grouped as detailed below because the substrate and general environment were considered to be similar.

A total of 52 opisthobranch species were recorded. The most important information gathered relates to Adalaria loveni (Alder and Hancock, 1862) which had not previously been found around the shores of the United Kingdom. A solitary record from Bantry Bay over a century ago was the only previous specimen taken from south of the Norwegian coast. The thirteen specimens from Kerrera, observed spawning and feeding on Securiflustra securifrons (Pallas), are valuable material from which a modern redescription of anatomical features can be derived. Apart from Adalaria loveni, there were few unexpected opisthobranch records although there are no previous published records of Tritonia lineata Alder and Hancock, 1848 from western Scotland.

It is worthwhile comparing the Kerrera collections to other records from nearby localities. To the list of 40 nudibranchs found during this survey must be added Archidoris pseudoargus, Favorinus blianus and Onchidoris muricata found by members of the expedition during 1977. The total of 43 nudibranchs thus recorded represent 61% of the 71 species known from western Scotland as a whole, However personal collections by one of us (GHB) and Bernard Picton of the Ulster Museum from Torran Rocks (south of the Isle of Mull) and the Sound of Mull included many species not found around Kerrera;

Aeolidia papillosa	Hero formosa
Antiopella cristata	Jorunna tomentosa
Coryphella verrucosa	Lomanotus marmoratus
Cuthona amoena	Lomanotus genei
Discodoris planata	Polycera quadrilineata
Doto tuberculata	Polycera faeroensis
Facelina coronata	
Goniodoris castanea	(Colpodaspis pusilla)

It can be stated therefore that 80% (57 species) of the known western Scottish nudibranch fauna has been verified during the last three years from this southern region.

At this stage it is not possible to say whether this high percentage is due to the richness of the sublittoral in this region or due to lack of comparative data from elsewhere, but it is likely that most parts of the west of Scotland are equally well endowed with nudibranchs.

While the molluscan collections recorded in the following distribution table have been examined by taxonomic specialists (Dr S.M. Smith and Dr G.H. Brown), the other groups require expert verification. A voucher collection of sponges and hydroids was preserved and is held by G.H. Brown at Bristol University. Smaller decapods were identified by Dr G. Smaldon, Royal Scottish Museum. Voucher collections of shelled Mollusca and some other species are held by SMS and the Royal Scottish Museum (Reg.nos. RSM NH 1979.036, 1979.078).

The initials of each collector are given against the locations of particular sites and refer to the participants in the survey:

HA - Miss Holly Arnold	PJH - Mr Peter Hunnam
BB - Mr Barry Brooks	MM - Mrs Marietta Maddrell
GDB - Mr George Brown	SS - Miss Sally Stockdale
GHB - Dr Gregory Brown	SMS - Dr Shelagh Smith
DD - Mr David Doubleday	LW - Mr Lawson Wood

The expedition was also able to confirm records of three cnidarians worthy of note. These are Protanthia simplex, Epizooanthus couchi and Swiftia pallida, all of which are the subject of a certain amount of distributional uncertainty.

DESCRIPTION OF COLLECTING AREAS

Site 1

Little Horseshoe Bay 56°23.2'N, 05°32.1'W. SMS

An extremely sheltered, shallow bay supporting Arenicola marina, Cerastoderma edule and Mytilus edulis which typically thrive in calm, shallow inlets. Ascophyllum nodosum (with occasional colonies of Clava multicornis) was also abundant on rocks. No opisthobranchs recorded.

Sites 2-5

2. Ardantrive Bay 56°25.15'N, 05°29.6'W. MM, DD, PJH, LW, GDB, SMS
3. Mount Pleasant Pt 56°24.1'N, 05°29.8'W. GHB, PJH
4. Heather Island Cliff 56°24.45'N, 05°30.0'W. BB, PJH, GDB, GHB, MM, DD, LW
5. Heather Island Sound 56°24.5'N, 05°30.1'W. SMS

All four sites are extremely sheltered from any wave action. The muddy sea bed of Ardantrive Bay proved suitable for the sea pens, Virgularia mirabilis and Pennaria phosphorea usually found in deep water away from surface-water turbulence. Several calyptoblastic hydroids were attached to benthic debris in the bay while there was a varied polychaete fauna. Harder substrates were a feature of the sites further south in the sound although silting was extensive. A few sponges were able to tolerate the silted conditions when alleviated by vertical cliff-faces plunging to below 30 metres. These vertical drops were however dominated by large ascidians, particularly Ciona intestinalis, Ascidiella aspersa and Ascidia mentula. The fan worm, Sabella pavonina was abundant between the ascidians at Heather Island but Alcyonium digitatum seemed to be excluded except from beneath overhangs where colonies grew large. Clumps of ascidians could be removed with little effort reinforcing the observation that these areas never experience violent water movement. The opisthobranchs found were mostly those either feeding on algae in shallow water or on epiphytic hydroids (such as Obelia) and epiphytic polyzoa (such as Electra). Dredging showed that the middle part of the sound had a bottom composed of mud and sufficient rubble to encourage algal growth and a hard bottom molluscan fauna.

Sites 6-9

6. Carraig na Maraig 56°23.2'N, 05°31.45'W. PJH, GHB, SS, GDB, BB, HA
7. Little Horseshoe Shoal 56°23.2'N, 05°31.75'W. GHB, GDB, SS
8. Cutter Rock 56°22.65'N, 05°32.45'W. BB, DD, MM
9. E. coast of Rubha Seanach 56°22.25'N, 05°33.25'W. PJH, GHB

All four sites are sheltered to a considerable extent although some penetration of storm waves into the mouth of the sound from the south and south-west was observed. There were few large sponges at any of the sites but Nemertesia spp were common at Carraig na Maraig together with small patches of Alcyonium glomeratum and Tubularia larynx suggesting some current action. Tubularia larynx was also thriving on a short buoy chain marking the Little Horseshoe Shoal. Small cliffs in the area were again dominated by the large ascidians so prevalent further north in the sound. The substrate east of Rubha Seanach comprised pebbles, cobbles and shell debris attached to which were red algae and some hydroids but little other colonising animal life was seen. This may indicate severe disruption of the sea bed during winter storms. Cerianthus lloydi and many echinoderms such as Antedon, Asterias, Echinus and Ophiothrix thrived under these conditions down to about 20 metres depth. In deeper water Virgularia beds were encountered at Carraig na Maraig and Cutter Rock.

The opisthobranchs from these sites were few but included three species feeding on the sparse patches of Tubularia, a single Tritonia plebeia on a rare colony of Alcyonium digitatum and several of the polyzoan predators (Acanthodoris pilosa and Adalaria proxima). The ubiquitous Cadlina laevis was present but as usual unassociated with any obvious diet sponge.

Sites 10-11

10. Ardmore Bay 56°22.6'N, 05°34.5'W. GHB
11. Port a Chaisteal 56°22.8'N, 05°33.4'W. SMS

Ardmore Bay and Port a Chaisteal are fully exposed to south-westerly gales and this was reflected by the rather barren pebbles and cobbles of which the shallow sea-bed is composed. There were no cliffs or outcrops amongst the cobble-plain to provide sublittoral shelter so that the fauna was very uniform and uninspiring. However SMS obtained the most diverse molluscan fauna of any shore site. The exposure and the irregularity of the topography indicated that this would be so. There was considerable variety of microhabitat.

Sites 12-14

12. Beacon and W. side of N. entrance to Sound of Kerrera 56°25.5'N, 05°29.3'W. BB, MM, DD, LW, SMS
13. Maiden Island (S. and E.) 56°26.8'N, 05°29.6'W. GHB, BB, MM, DD, PJH
14. E. side of N. entrance to Sound of Kerrera 56°25.6'N, 05°29.1'W. GHB, SS, GDB, MM

The large number of samples taken in this area was justified by the wide variety of habitats. A varied shore and sublittoral community, based on rock, is reflected by the large list of species especially from the west side of the channel. On the east side of the channel there was a sharp slope, again interrupted by bedrock colonised predominantly by several hydroid species but dropping eventually to a large Virgularia and Pennaria bed. Another dense bed of these sea pens lay in the lee of Maiden Island while a vertical cliff face descended to below 20 metres at the south of the island. A total of 24 opisthobranchs from these sites reflects the increased diversity compared to sites described above. The shore was enhanced by the presence of a small lagoon (at Rudha Chruidh) and an area of pebbly gravel at ELWST which supported many species of algae including Codium sp from which two specimens of Placida dendritica were obtained.

Sites 15-21

15. Rubha Bhearnaig (shore) 56°25.5'N, 05°30.2'W. SMS
16. Rubha Bhearnaig (sublit.) " " PJH, GHB, BB, MM, DD.
17. Rubh'Ard an Duine 56°25.1'N, 05°30.7'W. GHB, BB, DD
18. N. of Eilean nan Gamhna 56°25.2'N, 05°32.5'W. PJH, MM
19. Sgeir Dhonn 56°25.3'N, 05°31.3'W. DD, MM, BB, GDB
20. W. of Maiden Island 56°25.8'N, 05°29.6'W GHB, SS, GDB
21. W. of Rubha na Lice 56°24.4'N, 05°34.4'W. SMS

Much of the west coast of Kerrera was similar in that the shore sloped gradually to 20 metres or more. Beneath the kelp zone, the boulder strewn slope was a favourable habitat for polyzoans, sertulariid hydroids, Alcyonium digitatum, a large variety of echinoderms and several crabs, particularly Cancer pagurus. At greater depth, softer sediments replaced the boulders and pebbles as indicated in the tables by the records of various sedentary polychaetes, anemones and Virgularia.

Adalaria loveni (Alder and Hancock, 1854) was recorded from four of the west coast sites and represented the densest concentration of this rare species encountered during the survey, Several specimens were feeding on Securiflustra securifrons (Pallas) but shallower collections were taken from Electra pilosa growing epiphytically on kelp stipes. The setulariid hydroids were supporting several species of Cuthona as well as Dendronotus frondosus and Coryphella gracilis.

Sites 22-23

22. Ard na Cuile 56°22.5'N, 05°32.1'W. PJH, GHB
23. Rubh 'an Fheurain 56°22.8'N, 05°32.4'W. GDB, DD

Both these sites were noticeably less silted than elsewhere in the Sound of Kerrera. As well as the sponges Polymastia mammilaris and P. boletiformis, the anemones Sagartia elegans, Epizooanthus sp. and Protanthia simplex were obtained at these sites together with Alcyonium glomeratum. However apart from Ancula cristata and Coryphella pedata there were few opisthobranchs which were not also recorded further north in the sound.

Sites 24-28

24. Sgeir Rathaid (N.) 56°24.9'N, 05°29.1'W. LW, GDB, GHB, DD, PJH, BB
25. Sgeir Rathaid (S.) 56°24.8'N, 05°29.15'W. MM, HA
26. Channel marker, Rubha Tolmach 56°24.25'N, 05°30.2'W. BB, DD, GDB
27. W. of Ferry Rocks 56°24.15'N, 05°30.4'W. PJH, BB
28. Marker, Ferry Rocks 56°24'N, 05°30.6'W. GDB

These five sites were based upon channel marker buoys, the chains to which were excellent substrates for Tubularia larynx and the many nudibranchs which prey upon this hydroid. Two of the chains were infested by millions of caprellids. The fauna around the base of the chains was more typical of the sound with a large number of hydroid colonies, the occasional patch of Alcyonium, a wide variety of echinoderms and many large ascidians.

Site 29

Dunollie Sound 56°25.35'N, 05°29.1'W. GHB, PJH

Although there were some patches of the ascidians Ascidia mentula and Ascidiella aspersa so prevalent in Kerrera Sound, the sea bed here was dominated by hydroids, particularly Hydrallmania falcata, Sertularia spp., Nemertesia spp., and Halecium muricatum. This was the only site within the sound at which Clavelina lepadiformis was encountered.

Sites 30-33

30. Bach Island (E. & W.) 56°22.85'N, 05°36.1'W. BB, DD, MM
56°22.85'N, 05°35.5'W. PJH, GHB
31. Dubh Sgeir 56°22'N, 05°37.4(-6)'W. GDB, HA, SS, MM, DD, GHB, PJH
32. Dubh Sgeir (W.) 56°22.1'N, 05°37.6'W. SMS
33. Dubh Sgeir (E.) 56°21.9'N, 05°36.5'W. SMS

These sites were perhaps best distinguished from others around Kerrera by the relatively large number of sponge species. Tubularia indivisa was present in abundance as well as polyzoans such as Bugula, Cellaria and Securiflustra. A wide variety of echinoderms including Porania pulvillus and Anseropoda placenta were obvious members of a complex and attractive community. The opisthobranch fauna was however disappointing and lacked many of the polycerid species one usually associates with exposed, rock-based communities. The available food species would support many more nudibranch species. The dredge hauls (32, 33) were made in 50m and 100m respectively, much deeper than the dives. Both sites appeared to be dominated by Ophiothrix fragilis and ascidians. The shallower one, rock and clean gravel, contained a number of uncommon species including Velutina plicatilis and Teretia anceps, while the deeper one included a female Neptunea antiqua and her new-laid eggs.

Site 34

Lady's Rock 56°26.9'N, 05°37'W. GDB, PJH, HA, SS, MM, BB, DD, GHB

This was undoubtedly the most spectacular site sampled during the survey. Areas of the bottom were dominated by Alcyonium digitatum and Tubularia indivisa. At certain points Alcyonium covered more of the sea bed than Tubularia while in other areas the dominance was reversed. Metridium senile grew in large patches. Various sponges competed successfully but there were few ascidians or polyzoans.

Apart from Mollusca, of which 163 species were found (520 data points), there were recorded:

Porifera - 14 species (46 data points); Cnidaria - 30 (173); Platyhelminthes - 1 (1); Nemertina - 1 (1); Arthropoda, chiefly Decapoda - 25 (95); Polychaeta - 13 (55); Sipunculoidea - 1 (4); Brachiopoda - 2 (4); Polyzoa - 5 (42); Echinodermata - 22(163); Ascidiacea - 11 (71); a few fish and algae.

Station List

1.	Little Horseshoe Bay	56°23.2'N 05°32.1'W
2.	Ardantrive Bay	56°25.15'N 05°29.6'W
3.	Mount Pleasant Point	56°24.1'N 05°29.8'W
4.	Heather Island Cliff	56°24.45'N 05°30.0'W
5.	Heather Island Sound	56°24.5'N 05°30.1'W
6.	Carraig na Maraig	56°23.2'N 05°31.45'W
7.	Little Horseshoe Shoal	56°23.2'N 05°31.75'W
8.	Cutter Rock	56°22.65'N 05°32.45'W
9.	E. Coast of Rubha Seanach	56°22.65'N 05°33.25'W
10.	Ardmore Bay	56°22.6'N 05°34.5'W
11.	Port a Chaisteal	56°22.8'N 05°33.4'W
12.	Beacon and W. side of N. entrance to Sound of Kerrera	56°25.5'N 05°29.3'W
13.	Maiden Island (S. and E.)	56°26.8'N 05°29.6'W
14.	E. side of N. entrance to Sound of Kerrera	56°25.6'N 05°29.1'W
15.	Rubha Bhearnaig (shore)	56°25.5'N 05°30.2'W
16.	Rubha Bhearnaig (sublit)	56°25.5'N 05°30.2'W
17.	Rubh'Ard an Duine	56°25.1'N 05°30.7'W
18.	N. of Eilean nan Gamhna	56°25.2'N 05°32.5'W
19.	Sgeir Dhonn	56°25.3'N 05°31.3'W
20.	W. side of Maiden Island	56°25.8'N 05°29.6'W
21.	W. of Rubha na Lice	56°24.4'N 05°34.4'W
22.	Ard na Cuile	56°22.5'N 05°32.1'W
23.	Rubh 'an Fheurain	56°22.8'N 05°32.4'W
24.	Sgeir Rathaid (N.)	56°24.9'N 05°29.1'W
25.	Sgeir Rathaid (S.)	56°24.8'N 05°29.15'W
26.	Channel marker, Rubha Tolmach	56°24.25'N 05°30.2'W
27.	W. of Ferry Rocks	56°24.15'N 05°30.4'W
28.	Marker, Ferry Rocks	56°24.0'N 05°30.6'W
29.	Dunollie Sound	56°25.35'N 05°29.1'W
30.	Bach Island (E.)	56°22.85'N 05°36.1'W
	" " (W.)	56°22.85'N 05°35.5'W
31.	Dubh Sgeir	56°22.0'N 05°37.4'W
32.	W. of Dubh Sgeir	56°22.1'N 05°37.6'W
33.	E. of Dubh Sgeir	56°21.9'N 05°36.5'W
34.	Lady's Rock	56°26.9'N 05°37'W

List of species recorded

With the exceptions of nudibranchs and Mollusca found by SMS the data chiefly concerns larger epifaunal species. Numbers in brackets denote site numbers. For more detailed information contact GHB or SMS.

PORIFERA

Pachymatisma johnstoni	(3,4,30,31,34)
Cliona celata	(30)

PORIFERA(contd)

Haliclona oculata	(20,34)
Axinella polypoides	(31,34)
Axinella infundibuliformis	(3,6,30,32,34)
Dysidea fragilis	(30)
Polymastia mamillaris	(22,31,34)
Polymastia boletiformis	(22,23,30,31,34)
Suberities domuncula	(3,7,13,24,28,29,30,33)
Halichondria panicea	(11,12,20,28)
Myxilla incrustans	(12)
Scypha compressa	(12,22,30,31,34)
Scypha ciliata	(29,31,34)
?Halicliona sp	(27)

CNIDARIA

Tubularia larynx	(2,6,7,24,25,26,28)
Tubularia indivisa	(30,31,32,34)
Eudendrium arbuscula	(30,31,34)
Clava multicornis	(1,11,12,15)
Hydractinia echinata	(2,14)
Hydrallmania falcata	(13,29)
Sertularia compressa	(12,15,18,20)
Sertularia argentea	(2,7,12,13)
Halecium halecium	(18,29)
Abietinaria abietina	(13,18,24,25,29)
Obelia geniculata	(2,3,4,6,7,8,12,22,23,24,25,26,27,28,34)
Nemertesia ramosa	(2,4,6,13,14,16,17,18,28,33)
Nemertesia antennina	(2,3,6,11,12,17,18,20,24,26,27,28,29,30,33)
Actinia equina	(11,12,15)
Anemonia sulcata	(1,11,12)
Protanthia simplex	(22)
Tealia coriacea	(2,4,8,10,12,22,23,30,31,34)
Metridium senile	(2,26,28,29,30,34)
Cerianthus lloydi	(2,6,7,8,9,11,12,17,18,19,20,23,27)
Sagartia elegans	(23,30,31)
Adamsia palliata	(24,32,33)
Actinothoe sphyrodeta	(22,30,31,34)
Corynactis viridis	(34)
Caryophyllia smithi	(4,6,7,12,17,18,20,22,23,29,30,31,32,33,34)
Epizooanthus couchi	(22)
Alcyonium digitatum	(2,4,8,17,18,19,22,23,24,25,26,28,29,30,31,34)
Alcyonium glomeratum	(6,22,23,32,33)
Swiftia pallida	(31,32,33)
Virgularia mirabilis	(2,6,8,14,18,19,23)
Pennaria phosphorea	(2,14)

PLATYHELMINTHES

Oligocladius sanguinolentus	(12)

NEMERTINA

Lineus sp	(12)

DECAPODA

Pandalina brevirostris	(5)
Pontophilus bispinosus	(5)
Pontophilus spinosus	(33)
Thoralus cranchi	(5)
Galathea strigosa	(2,6,7,8,12,16,19,23,26,29,33,34)
Inachus dorsettensis	(25,27)
Macropodia rostrata	(3,6,8,9,14,20,28,33,34)
Ebalia cranchi	(5)
Ebalia sp	(33)

DECAPODA (contd)

Cancer pagurus	(2,3,4,6,9,11,12,13,17,18,20,25,29,30,31,34)
Carcinus maenas	(1,2.11,12)
Porcellana platycheles	(11,12)
Porcellana longicornis	(11,12,15)
Eupagurus bernhardus	(2,6,8,9,14,24,31,33)
Eupagurus prideauxi	(33)
Hyas araneus	(2,3,9,12,23,24,32)
Macropipus depurator	(6,8,14,17,27)
Goneplax rhomboides	(19)

Other ARTHROPODA

Balanus balanus	(12)
Balanus balanoides	(1,11,12,15)
Balanus ?hameri	(33)
Idotea chelipes	(1,11,12,15)
Ligia oceanica	(11,12)
Gammarus spp	(1,11,12,15)
Caprellida sp	(26,27,32)

POLYCHAETA

Aphrodita aculeata	(32,33)
Lepidonotus sp	(11,12)
Harmothoe sp	(2,12)
Halosydna gelatinosa	(12)
Eulalia viridis	(12)
Arenicola marina	(1,2,12,14,15,19,23)
Eupolymnia nebulosa	(12,33)
Lanice conchilega	(2,4,8,9,12,14,15,18,19,20,23,24)
Hydroides norvegica	(32,33)
Pomatoceros triqueter	(2,12,13,17,19)
Myxicola infundibuliformis	(6,8,20,27)
Sabella pavonina	(2,6,7,10,12,13,18,25,26,31,34)
Spirorbis sp	(1,11,12,15)

SIPUNCULOIDEA

Phascolion strombi	(2,5,32,33)

BRACHIOPODA

Crania anomala	(32,33)
Terebratulina caputserpentis	(32,33)

POLYZOA

Alcyonidium gelatinosum	(3,4,8,17,20,24,32,34)
Membranipora membranacea	(12)
Securiflustra securifrons	(16,17,18,20,22,28,31,32,34)
Bugula plumosa	(28,30,31,34)
Electra pilosa	(2,3,4,7,8,9,12,13,14,16,17,19,22,23,24,25, 26,28,30,31)

MOLLUSCA

Lepidopleurus asellus	(2,5,21,33)
Lepidochitona cinereus	(1,11,12)
Tonicella marmorea	(12)
Tonicella rubra	(5,11)
Acanthochitona crinitus	(12)
Acmaea virginea	(1,2,11,12)
Acmaea testudinalis	(11,12)
Patella aspera	(11,12)
Patella vulgata	(1,2,11,12,15)
Helcion pellucidum	(1,11,12,13,14,30,34)

<u>MOLLUSCA</u> (contd)

Margarites helicinus	(11)
Calliostoma zizyphinum	(3,10,11,12,13,14,19,20,28,29,32,34)
Jujubinus clelandi	(5,32)
Jujubinus montagui	(5)
Gibbula cineraria	(1,2,3,5,6,10,11,12,13,14,15,17,18,19,23,34)
Gibbula magus	(3,5)
Gibbula tumida	(21,33)
Gibbula umbilicalis	(1,11,12,15)
Lacuna pallidula	(1,11,12,15)
Lacuna vincta	(1,11,12,15)
Littorina littorea	(1,11,12,15)
Littorina neglecta	(1,11,12,15)
Littorina nigrolineata	(1,11,12,15)
Littorina rudis	(1,11,12,15)
Littorina littoralis	(1,11,12,15)
Littorina mariae	(1,11,12,15)
Littorina neritoides	(11,12,15)
Rissoa inconspicua	(12)
Rissoa albella	(11,12)
Rissoa parva agg	(1,11,12)
Cingula cingillus	(12)
Onoba aculeus	(1,11,12)
Onoba semicostata	(11,12)
Alvania beanii	(5)
Rissoella diaphana	(11,12)
Rissoella globularis	(12)
Omalogyra atomus	(11,12)
Skeneopsis planorbis	(11,12)
Turritella communis	(2,3,5,8,14,33)
Aporrhais pespelecani	(2,5,8,18,21,27)
Capulus ungaricus	(33)
Lamellaria latens	(11)
Lamellaria perspicua	(11,12)
Velutina plicatilis	(32)
Velutina velutina	(32)
Trivia arctica	(11)
Trivia monacha	(2,17)
Lunatia alderi	
Trophonopsis barvicensis	(5)
Nucella lapillus	(1,11,12,15)
Neptunea antiqua	(7,17,33)
Buccinum undatum	(1,2,3,6,9,10,11,12,17,18,19,23,24,27,29,32)
Hinia incrassata	(32,33)
Cytharella coarctata	(5)
Teretia anceps	(32)
Leucophytia bidentata	(12)
Odostomia eulimoides	(2,3,6)
Odostomia rissoides	(12,15)
Odostomia turrita	(11)
Odostomia unidentata	(6)
Turbonilla elegantissima	(29)
Turbonilla rufescens	(12)
Diaphana minuta	(5)
Elysia viridis	(2,9,12,16)
Placida dendritica	(2,12)
Limapontia capitata	(11,12)
Limapontia senestra	(12)
Aplysia punctata	(10,18,20,23,26,29,30,31,34)
Aegires punctilucens	location not noted
Acanthodoris pilosa	(8,17,20,23,31)
Adalaria loveni	(16,17,18,20,28,34)
Adalaria proxima	(4,8,17,19,29,31)

MOLLUSCA (contd)

Onchidoris luteocincta	(31,34)
Onchidoris bilamellata	(12,22,23,24)
Goniodoris nodosa	(2,3,4,13,16,17,18,20,29,31,34)
Ancula cristata	(22)
Limacia clavigera	(17)
Cadlina laevis	(3,4,7,11,12,13,14,15,29)
Armina loveni	(13,18)
Tritonia lineata	(30)
Tritonia plebeia	(8,30,31,34)
Tritonia hombergii	(30,31,34)
Doto pinnatifida	(14,16,18)
Doto fragilis	(13)
Doto cuspidata	(18,19)
Doto coronata	(14,19)
Doto eireana	(13,16)
Doto sp I	(14)
Doto sp II	(17)
Dendronotus frondosus	(4,8,9,12,13,14,16,17,19,24,25,26,27,28,29, 30,31,32,34)
Coryphella gracilis	(6,9,13,14,18,19,20,22,23,24,25,26,28,29, 30,31,34)
Coryphella lineata	(9,12,14,24,25,26,27,28,30,31,34)
Coryphella pellucida	(13,14,29,30)
Coryphella pedata	(22,23,31,34)
Cuthona nana	(18)
Cuthona foliata	(17,18)
Cuthona caerulea	(17)
Cuthona viridia	(14)
Cuthona rubescens	(17,23,34)
Cuthona aurantia	(24,26,34)
Cuthona pustulata	(31)
Cuthona concinna	(14)
Tergipes tergipes	(2,3,6,8,13,16,17,18,22,23,25,26,28,29)
Eubranchus exiguus	(8,13,22,23,25,26,28,29)
Eubranchus pallidus	(6,18)
Eubranchus tricolor	(11,16,19,22,23,24,28,29,30)
Eubranchus farrani	(28,30,34)
Facelina bostoniensis	(11,12,22,24,29)
Dentalium entalis	(32,33)
Nucula nitidosa	(5)
Nucula nucleus	(2,5,32,33)
Nucula sulcata	(5)
Nuculana minuta	(5,21,33)
Mytilus edulis	(1,2,11,12,15,24,25,26)
Crenella decussata	(12)
Musculus discors	(11,12)
Modiolarca tumida	(2,6,7,32)
Modiolus modiolus	(11,12,26,27,28,29,33)
Palliolum simile	(13)
Pseudamussium septemradiatum	(32,33)
Chlamys distorta	(33)
Chlamys nivea	(17,19)
Aequipecten opercularis	(2,3,5,17,20,24,27,28,32,33)
Pecten maximus	(2,3,6,7,8,9,10,19,20,27,29)
*Anomia ephippium	(3,13,17)
Pododesmus patelliformis	(2,11,12,32,33)
Pododesmus squamula	(1,5,11,12,33)
Limaria hians	(24)
Myrtea spinifera	(2,21,32,33)
Lucinoma borealis	(13)

*Not seen by SMS, possible confusion with Pododesmus patelliformis

MOLLUSCA (contd)

Thyasira flexuosa	(5,13)
Lasaea rubra	(1,11,12,15)
Mysella bidentata	(12)
Turtonia minuta	(11)
Astarte sulcata	(5,32,33)
Tridonta elliptica	(2,5)
Parvicardium ovale	(5,32)
Parvicardium scabrum	(5)
Cerastoderma edule	(1,12,15)
Spisula subtruncata	(1)
Ensis siliqua	(12)
Tellina fabula	(15)
Tellina tenuis	(15)
Macoma balthica	(1,12,15)
Scrobicularia plana	(1,15)
Abra alba	(2,13)
Abra nitida	(5,32)
Arctica islandica	(13)
Circomphalus casina	(34)
Gouldia minima	(32,33)
Dosinia exoleta	(12)
Venerupis senegalensis	(12)
Chamelea gallina	(1,13,15)
Timoclea ovata	(32,33)
Mya arenaria	(1)
Mya truncata	(12,13)
Corbula gibba	(2,5,21)
Hiatella arctica	(5,11,12)
Thracia convexa	(2)
Thracia phaseolina	(13)
Pandora pinna	(5,32)
Rossia macrosoma	(14,23)
Sepiola atlantica	(2,6,8)

ECHINODERMATA

Antedon bifida	(2,3,4,6,12,13,17,18,19,22,23,24,25,27, 29,30,31,33,34)
Cucumaria lefevrii	(20,24,26,34)
Cucumaria lactea	(12,32,33)
Thyone fusus	(32,33)
Asterias rubens	(2,3,4,6,7,9,10,11,12,13,14,17,18,19,20, 22,23,24,25,26,27,29,30,31,33,34)
Marthasterias glacialis	(4,10,11,12,30,34)
Leptasterias mulleri	(12,13)
Crossaster paposus	(2,3,4,6,8,9,12,17,20,22,23,24,27,28,30,31,34)
Solaster endeca	(3,6,8,18,20,22,28,29,30,34)
Astropecten irregularis	(23)
Porania pulvillus	(6,31)
Anseropoda placenta	(31,33)
Henricia oculata	(3,12,23,33)
Ophiura albida	(8,18,20,23)
Ophiura texturata	(33)
Ophiothrix fragilis	(2,7,8,9,10,11,12,14,18,20,28,29,30,32,33,34)
Ophiocomina nigra	(8,9,10,12,17,18,19,20,24,28,29,32)
Acronida brachiata	(2)
Amphipholis squamata	(10,11,12,33)
Psammechinus miliaris	(9,10,11,12,18)
Echinus esculentus	(3,6,9,10,11,12,14,17,18,19,22,23,24,27,28, 29,30,31,33,34)
Echinocyamus pusillus	(32,33)

ASCIDIACEA

Ciona intestinalis	(2,4,8,13,14,19,20,24,25,26,27,29,33)
Ascidiella aspersa	(2,3,4,5,7,13,24,26,28,29,32,33)
Ascidiella scabra	(3,7)
Ascidia mentula	(2,3,4,5,6,7,8,14,17,20,24,25,26,27,28,29, 32,33,34)
Corella parallelogramma	(3)
Polycarpa rustica	(33)
Botryllus schlosseri	(2,3,4,11,14,20,24,25,26,27,31,33,34)
Botrylloides leachi	(3,24,27,31,34)
Dendrodoa grossularia	(33)
Clavelina lapadiformis	(29,30,31)
Diazona violacea	(6)

PISCES

Lophus piscatorius	(6)
Callionymus lyra	(8)
Pholis gunnellus	(2,8,24)
Spinachia spinachia	(12)
Lepidogaster gouani	(14,20)
Cyclopterus lumpus	(25)
Aspitrigla cuculus	(26)

ALGAE (selected)

Codium sp	(2,12)
Delesseria sanguinea	(2)
Laminaria hyperborea	(3,4,9,11,12,13,14,17,18,20,22,23,24,26,30, 31,34)
Laminaria saccharina	(2,4,6,9,14,18,19,20,22,23,25,26,27)
Laminaria digitata	(3,25)
Alaria esculenta	(22)
Chorda filum	(2)
Crustose algae	(3,4,9,11,17,18,30,31,34)

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EFFECTS OF A TUBE-BUILDING POLYCHAETE, LANICE CONCHILEGA, ON A TIDAL CHANNEL COMMUNITY

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Dense aggregations of Lanice conchilega were examined at Tentsmuir Beach in north-east Fife. Aggregations occurred in a tidal channel with measured tidal flow velocities as high as 1m/sec. Observations of successful larval settlement within dense clumps, suggest Lanice maintains aggregations of 3-5,000 indiv./m^2 through gregarious settlement and flow-induced secondary resettlement. Investigations of macrofaunal abundances and sediment accumulation indicate that Lanice's tube-building activity mediates physical forces of tidal flow and scour. Fine grained sediment and detrital carbonate is accumulated in Lanice beds. Three species of polychaetes (Eumida sanguinea, Anaitides maculata, Harmothoe lunulata) are more abundant within Lanice beds than in areas with few Lanice. Major seasonal predatory influences are: juvenile plaice and dabs which maintain pools with lower worm settlement, and Eider ducks which intensively disrupt the surface while feeding on Mytilus edulis spat. Stability and refuge appear to be the primary ecological advantages to infauna from Lanice aggregations. It is proposed that the tube-building activity and gregariousness enhance an individual Lanice's ability to feed on detritus transported by bedload movement and in suspension.

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SOME OBSERVATIONS ON BROODING IN THE IMMIGRANT SPIRORBID PILEOLARIA (PILEOLARIA) ROSEPIGMENTA UCHIDA

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INTRODUCTION

Pileolaria rosepigmentata is a sinistrally coiled spirorbid tubeworm which characteristically broods its eggs to an advanced stage.

Brooding in the spirorbids may be within the tube, as in Spirorbis spirorbis or in an opercular brood chamber. The brooding structure differs in dextral and sinistral opercular brooders (Thorp and Segrove 1975; Thorp 1975). In the former the eggs are undoubtedly brooded within the operculum, whereas in the latter, although functionally within the operculum, they are morphologically outside. This difference results in dextral species rupturing the operculum to release the motile larvae, a new brood chamber having to develop for each brood, whereas in sinistral species the possession of a dilatable opercular pore enables the same chamber to be used for several successive broods.

Pileolaria rosepigmentata was first recorded from Japan in 1971 (Uchida 1971) and was recorded from Portsmouth Harbour in 1975 (Knight-Jones et al 1975). Its characteristic features were described in the latter paper.

In July of this year adult Pileolaria rosepigmentata were identified on the walls of a wet-laboratory seawater tank at the Marine Laboratory. On 2nd July 25 animals were carefully removed and placed individually into separate compartments of a repli-dish, each compartment containing 5 ml filtered seawater with added crystamycin to reduce bacterial contamination.

The animals were maintained in a temperature of $13.0 \pm 3.0^{\circ}C$, the seawater changed daily, and careful records made of their brooding activity. In this manner more than 80 complete brood cycles have been observed, and a sequence of events has been determined.

BROODING

The eggs, when first deposited in the brood chamber, are usually a dark chestnut-brown colour and a brood consists of up to 30 eggs (cf. Gray 1978 Mean No.21.03). I have no reason to doubt that fertilisation takes place in the ventral ciliated groove following release from the ova-producing, anterior-abdominal segments (zur Loye 1908; Gee and Williams 1962), and prior to their entry into the brood chamber. Spirorbids are hermaphrodite and male and female gametes mature simultaneously in the same animal (Bergan 1953; Gee and Williams 1962). Apart from filtration to remove fine suspended solids, the water was not treated in any way to preclude the introduction of sperm at each water change.

In the majority of broods (86.75%) development was normal and motile larvae were released after 20-21 days (Table I) - their place being taken in the same brood chamber by a new batch of eggs.

The first major event in development, after the onset of segmentation, is the appearance of paired red eyes and an irridescent ciliated prototroch after 12 days (Table II). This is followed by the appearance of a single white patch - the larval attachment gland - two days later, and after a further six days the fully developed, motile larvae are released through a dilatable opercular pore.

These laboratory observations differ from those of Gray (1978) who reported from field observations a lunar cycle of brooding, with larval release at the spring tides. It could well be that the abnormal conditions presented to my experimental animals, isolation in almost complete darkness, caused a prolongation of the brood period to 20-21 days, they will not have experienced a tidal regime in the laboratory tanks before isolation but would have had a diurnal light regime. Perhaps more simply it could be a temperature effect.

Gray recorded mean brood times of 13.29 $\pm$ 7.64 days at a mean temperature of 18.2°C in July and August and 16.24 $\pm$ 9.36 days at a mean temperature of 14.8°C in September and October. Minimum temperatures are generally acknowledged to be of considerable importance in breeding and a daily temperature range of 11-16°C could well have resulted in an increase of the brood period to 20.63 $\pm$ 0.1805 days. Further carefully controlled temperature studies in a definite light/dark regime could resolve this.

LARVAL RELEASE

Prior to larval release the parent animal becomes more active, forsaking its normally secretive behaviour and performing rotational movements with its operculum and branchial filaments extended. Careful observation reveals that the larvae within the brood chamber are also active, rotating within their egg membranes, presumably to rupture them. The larvae emerge singly at first, at approximately one minute intervals, but within 5-10 minutes, as the pore widens and the brood number diminishes, two and three larvae may escape simultaneously. The adult, unless disturbed, may remain with its branchial crown extended for the whole period of larval emission (10-35 minutes). It is only in the later stages that the pore can be readily distinguished.

Once free of the pore the larvae remain in close association with the branchial filaments for at least 75 seconds, the larvae not being readily dislodged even when the animal withdraws violently into its tube. The larva has a free life as brief as 1.25 hours if a suitable substratum is available, although this may be considerably prolonged.

Close observation of the parent reveals that, when the need arises, it can play an active role in larval release, particularly in those cases where complications arise with the egg membranes. These membranes form a loose mass after the embryos have freed themselves, and are normally voided during or immediately following the completion of larval release. In some cases, however, the membrane mass, plus any undeveloped eggs, block the pore and interrupt larval release. At this time the adult has been observed to lay some of the branchial pinnules across the pore and create a current of water to draw the membrane mass out from the opercular brood chamber; larval emission is then resumed.

THE OPERCULAR PORE

The opercular pore dilates to enable two, and frequently three, larvae to escape simultaneously. On completion of larval release the pore closes in the manner of an eliptical iris diaphragm, in most cases being closed to a pinpoint within 20-25 minutes. At the same time the brood chamber becomes deflated basally, where it is not supported by calcification. The normal contour is regained within one hour and the pore is now represented by a small, flattened, volcano-like pimple.

What happens to the pore between this stage and the entry of a new brood remains unclear as the active parent of release resumes a secretive life within its tube, particularly at the time of transfer.

The closure is a puzzle; why close if the new brood is to enter that way? Available evidence, however, suggests that eggs enter from the outside and common sense suggests that it is via the pore.

i) In other species eggs are liberated from the anterior abdominal segments into the ventral ciliated groove (Thorp 1961; Gee and Williams 1962). I see no reason why this should not be the case in <u>Pileolaria</u>.

ii) In 11 brood transfers (13.25% of 83) from one to 10 newly-laid eggs were voided into the surrounding water at the time of transfer.

iii) Other workers, chiefly Potswald (1968) with Pileolaria moerchi have shown that transfer from abdomen to brood chamber can only very rarely take place when the animal is removed from its tube. P. moerchi has a very ample thoracic cloak which if applied to the substratum could mimic the tube.

The structure of the brood chamber I would suggest precludes an internal transfer, even if there was sufficient coelomic continuity between the abdominal segments and the peduncle (Thorp 1975).

Precisely how transfer to the brood chamber is effected remains obscure but I would proffer the following hypothesis.

On reflation of the basal part of the chamber the pore region appears to become slightly concave and in some cases the pore opens slightly. I would suggest that the pore does open for the entry of eggs but perhaps not to the extent that it does for release. Transfer must take place with the animal retracted within its tube. The ripe ova, having been released into the ventral ciliated groove via segmental pores (? nephridiopores), are conducted forwards in the faecal rejection current, and collected within the retracted branchial crown, acting like a basket. With the operculum jammed into the tube, longitudinal contractions of the whole animal could compress the "branchial basket" and force the ova to squeeze in through a small concave pore. The eggs are very elastic at this stage and can literally "flow" through a restricted space as seen in release from the abdominal segments (Thorp 1961).

OPERCULAR REPLACEMENT

Several broods, although transferred successfully to the brood chamber, subsequently aborted at an early stage. Gee and Williams (1962) suggested that increased brood abortion in Spirorbis spirorbis was a consequence of self-fertilisation, while Daly and Golding (1977) put forward the view that it was the result of decreasing viability of stored sperm in the spermatheca.

When a small number of eggs abort, the remainder develop normally and are released with little difficulty, the yolk mass and egg membranes being voided at release. In most cases the ciliary currents set up by the active larvae within the brood chamber combined with the current of the branchial crown are sufficient to waft out the debris.

When a high proportion of the brood has aborted, normally more than 50%, clearance may become impossible and the brood chamber useless for further brooding. In these cases a new opercular brood chamber is developed from the peduncle and the useless organ, with its aborted brood, cast off.

It would appear that there must be a close control (? hormonal) of the whole brooding process and opercular replacement for, when necessary, opercular replacement takes place in time for a brood of eggs to be transferred to the new brood chamber in the correct time sequence.

Much remains to be elucidated - the present processes must be related to field observations and the sequence of events compared with indigenous species to gauge the performance of this species as an immigrant.

We already know from Gray (1978) that P. rosepigmentata attains maturity faster than the majority of indigenous intertidal spirorbids, that it has a greater longevity (> 2 years as against 12-16 months), and a brood size of 21.03 (cf. Janua (J.) pagenstecheri 8.43 and J. (D) braziliensis 12.63).

TABLE I

Broad emission dates in <u>Pileolaria (P.) rosepigmentata</u>

Specimen Number		Brood Number I	BD	II	BD	III	BD	IV	BD	V	BD	VI
1		14/7	(21)	4/8	(20)	24/8	(20)	13/9	(19)	2/10		
2		11/7	(22)	2/8	(21)	23/8	(21)	13/9	(21)	4/10		
3		6/7	(19)	25/7								
4		6/7	(11)	17/7	(19)	5/8	(19)	24/8				
5		6/7	(18)	24/7	(20)	13/8	(21)	3/9	(21)	24/9		
7		11/7	(20-21)	30-31/7	(19-20)	19/8	(19)	7/9	(21)	28/9		
8		6/7	(21)	27/7	(19)	15/8	(20)	4/9	(21)	25/9	(21)	16/10
9		15/7	(21)	5/8	(19)	24/8	(19-20)	12-13/9	(21-22)	4/10		
10		20/7	(21)	10/8	(19-20)	29-30/8	(19-20)	18/9	(19)	7/10		
13		11/7	(20)	31/7	(20)	20/8	(19-20)	8-9/9	(20-21)	29/9		
14	JM*	20/7	(19-21)	8-10/8	(19-21)	29/8	(20)	18/9				
15		13/7	(20)	2/8	(22)	24/8	(19-20)	2-13/9	(21-22)	4/10		
16		21/7	(20)	10/8	(25)	4/9	(21)	24/9	(20)	14/10		
17		13/7	(22)	25/7	(21)	15/8	(20)	4/9	(24)	28/9		
18		13/7	(20)	2/8	(20)	22/8	(20)	11/9	(22)	3/10		
19		3/7	(21)	24/7								
20		11/7	(22)	2/8	(20)	22/8	(21)	12/9	(20)	2/10		
21		3/7	(21)	24/7	(21)	4/8	(20)	3/9	(23)	26/9	(20)	16/10
22		6-7/7	(28-30)	4-5/8	(18-19)	23/8	(20)	12/9	(20)	2/10		
23		21/7	-	(41)	-	31/8	(26)	26/9	(19)	15/10		
24		21/7	-	(41)	-	31/8						
25		3/7	(21)	24/7	(20)	13/8	(20)	2/9	(22)	24/9	(22)	16/10

1. BD Figures in brackets show brood period in days.

2. JM* Juvenile animal at start of observations. Following completion of opercular replacement (12-16 July) egg brood transferred to operculum 20 July.

TABLE II

Duration of development stages (days) in Pileolaria (P.) rosepigmentata

	TB	L-E	L-AG	AG-R
Mean ($\bar{X}$)	20.63	12.09	14.22	6.29
Number	80	46	46	57
Standard Deviation	1.6143	1.1480	1.0937	1.0422

TB - total brooding time;

L-E transfer of eggs to brood chamber to appearance of eyes and ciliated prototroch;

L-AG transfer of eggs to brood chamber to appearance of larval attachment gland;

AG-R appearance of attachment gland to release of larvae.

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Patella EXCLUSION EXPERIMENTS ON THE ISLE OF MAN

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Previous experimental removal of *Patella*, and observations following large-scale kills caused by oil pollution and treatment have shown the importance of *Patella* in regulating algal growth on moderately-exposed and exposed rocky shores (see Southward and Southward, 1978, for review). As a preliminary experiment, I removed *Patella* during March 1977 from a 2m strip down a *Balanus* covered shore in a similar manner to the classical experiments of the 1940's. Diatoms rapidly grew, followed by green algae and after 4 - 5 months by *Fucus* sporelings which eventually formed a thick sward down the shore. Little growth occurred in adjacent control areas.

The influence of season on the sequences of algal colonization of barnacle covered exclusion areas was examined by smaller scale, more tightly controlled experiments, using 1" high wire fences fixed to the rock. The pattern of algal colonization varied markedly with the season in which the exclusion was set up. In autumn diatoms were followed directly by *Fucus* sporelings; in winter and spring diatoms were followed by green algae and afterwards by *Fucus* sporelings; in late summer *Fucus* recruited directly. Little algal growth occurred in the adjacent controls. The initial stages of algal colonization did not seem necessary for the subsequent recruitment of *Fucus* sporelings.

A second series of experiments, also set up at various times of the year, tested the influence of *Balanus* cover on algal colonization. Barnacles were scraped from half of an exclusion area, with suitable controls set up alongside each part of the exclusion. In the experiment started in October, *Fucus* directly colonized the barnacle covered half of the exclusion. In contrast, diatoms followed by green algae (mainly *Enteromorpha intestinalis*), and eventually only a few *Fucus* sporelings, colonized the scraped half. In the experiments set up in February and April, *Ulothrix*, a small green filamentous alga, immediately colonized the scraped half, followed by *Blidingia* (a larger green alga) and then *Fucus*. *Blidingia* directly colonized the unscraped half followed rapidly by *Fucus* in both instances. There is some indication that preliminary stages are necessary before *Fucus* recruitment to bare rock can occur. However, *Enteromorpha intestinalis* seems able to delay establishment of *Fucus* sporelings for some time. There was almost no algal growth in all the controls.

The results have interesting implications for the concept of succession in the intertidal. In addition, barnacles seem to facilitate "escapes" of *Fucus* from *Patella* grazing which contribute to the patchiness observed on rocky shores.

For more detail see:

Southward, A.J. and E.C. Southward, 1978. Recolonization of rocky shores in Cornwall after use of toxic dispersants to clean up the "Torry Canyon" spill. *J.Fish Res.Bd.Canada* 35,682-706.

Hawkins, S.J., 1979. "Field studies on Manx rocky shore communities". Ph.D. Thesis, University of Liverpool.

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JOINT MEETING OF THE MALACOLOGICAL SOCIETY OF LONDON AND THE UNDERWATER ASSOCIATION HELD IN MANCHESTER ON THE 17th NOVEMBER 1979

The meeting was well attended by 80 delegates from the U.K., Ireland and Norway and the papers presented were all of a very high quality. Dr Greg Brown started the morning session with an account of his six years' work on zoogeography of nudibranchs in the North Atlantic and demonstrated that morphological specialisation becomes increasingly prevalent in those species predominating in the more southerly provinces of the region. Dr Roger Hughes then followed with a report on the research project by Dr Bob Eilner on energy maximisation in the diet of shore crabs feeding on mussels. After this he voiced some interesting thoughts on the way crab predation may have shaped the evolution of mollusc shell morphology. Partitioning of resources, particularly food, has for some time been considered to be a major factor in maintaining stability amongst the diverse predatory gastropod fauna of coral reefs. Dr John Taylor presented several pieces of his own evidence in support of this theory but sounded a cautionary note, stressing the disrupting effects of predation on these communities. The first session of the meeting was wound up by Dr J. Messenger who described the form of chromatophores, iridophores and leucophores in the skin of Octopus. Chromatophores are under muscular control and effect changes in the brightness of skin colour. Circumstantial evidence suggests that Octopus is colour blind and unable to match skin colour to background hues voluntarily. The iridophores and leucophores are apparently a passive layer in the skin enabling the animal to match the colour of ambient light by reflection of incident wavelengths.

The afternoon session was devoted to the biology of scallops and was opened with an introductory paper by the chairman, Sir Maurice Yonge, on the monomyarian condition. Dr Peter Gabbot went on to demonstrate that from biochemical considerations the theoretical distance that a queen scallop could swim, before exhaustion of energy reserves, is about 4.4m which is remarkably close to observed distances. Still on the subject of swimming Mr Colin Chapman gave a paper on the responses of Chlamys to fishing gear and Dr Llyr Gruffydd described the swimming response of scallops to water currents. It appears likely that scallop larvae spawned in coastal inlets such as fjords are carried out to sea in surface water currents. Subsequently swimming activity of settled juveniles, stimulated by increase in current speed on the flood tide, results in their being carried back into the fjord. Accounts of population genetics of Chlamys in British waters and population dynamics of Pecten in French waters were given by Dr Andy Beaumont and Dr Nigel Mathers and a programme of scallop spat collection using Japanese methods around the Isle of Man was described by Dr Andrew Brand.

In terms of production the Japanese are world leaders in the field of scallop culture and the report by Dr Ron Ventilla of his recent visit to Japan was one of the most memorable papers of the day. The techniques used by the Japanese are unsophisticated but employed on a vast scale. Spat of Placopecten yassoensis are collected in large numbers (20000-80000 per collector bag) and grown in lantern and pocket nets or attached to ropes by monofilament nylon ties passed through a hole drilled in the 'ear' of the shell. In some areas culture is carried on at such high densities that competition for food by scallops has caused the time to reach commercial size to increase from 18 months to 24 or 30 months and faeces and pseudofaeces settlement on the seabed is considerable.

The final paper of the day was given by Dr A. Taylor who described his research on growth and reproduction of Chlamys in the Clyde at Millport.

PAUL RODHOUSE

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THE EFFECT OF PREDATION BY THE LESSER WEEVER ON JUVENILE PLAICE RECRUITING TO A NURSERY AREA

P. Walker, Fisheries Laboratory, Lowestoft

During a four day period in June 1976 the O group plaice population of Tees Bay, Co. Cleveland was estimated at 3,730 (95%CL 1387 and 8523). The number of plaice of this age group taken by the lesser weever in the same period was estimated to be 417,000 (95%CL 43,000 and 3,200,000). It was felt that in Tees Bay, weever predation could be an important part of the 30-60% monthly mortality reported at this stage of the plaice's life history.

A research vessel cruise in 1979 to study the numbers of plaice settling in this nursery area and the losses due to weever predation was thwarted by poor plaice recruitment. The September mean plaice population, estimated at 6,800, was the lowest in the last seven years.

The basic items of weever diet in 1976 and 1979 were found to be fish, mysids, shrimps and amphipods.

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PREDATION ON THE PROSOBRANCH HYDROBIA ULVAE BY THE OPISTHOBRANCH RETUSA OBTUSA

Mike Elliott, F.R.P.B., Estuary Laboratory, Port Edgar,
South Queensferry, Edinburgh.

As part of a study aimed at quantifying the role of intertidal macrofauna in the Forth Estuary (Elliott, 1979), the predation on the prosobranch Hydrobia ulvae (Pennant) by the shelled opisthobranch Retusa obtusa (Montagu) was studied. The former is one of the more common estuarine intertidal species and the latter is one of the five species of Retusa found in N. European waters. The two varieties of R. obtusa (a typical form with a tapering spire and a flat-topped variety pertenuis) were both found in the estuary.

Hurst (1965) found that R. obtusa does not have a proboscis, buccal mass or radula, probably feeds by suction and therefore has a large crop and gizzard with internal plates. During the months September to February Retusae (in the size range 3.7 to 4.8mm) were found with Hydrobids in their pharynxs, i.e. the prey had been taken prior to sampling and not digested sufficiently to be withdrawn into the shell. In some cases the terminal whorl of the Hydrobid had been eroded within the pharynx. The size range of Hydrobids found in this way was from 1.4 to 2.3mm and increased with a progression through the year; all were in the 0+ cohort. This data suggests a larger prey and predator size than those given by Smith (1967). The data suggest that adult Retusa did not take Hydrobids larger than the 0+ cohort and that young Retusae utilised spat, foraminiferans, etc.

The population dynamics of both species showed that R. obtusa had a life cycle synchronised to that of its prey, i.e. at the time when the predator was large enough to feed on Hydrobiae there was the maximum number of appropriate size prey available. R. obtusa reproduced during the period October to February, i.e. the period during which predation on H. ulvae occurred.

The estimation of the production by these species showed, by the use of correlation matrices and multiple regression analysis, that the most important relationship was the R. obtusa biomass supported by the production of H. ulvae. A large Retusa biomass resulted from the presence of 0+ group H. ulvae on which the adults feed and other smaller prey items that could be utilised by small Retusae.

The ecological efficiency, as the ratio of food intakes between these two species, was an order of magnitude lower than that for systems where a prey species almost totally supports one predator; this reinforces the suggestion that H. ulvae was not the sole prey of R. obtusa.

Dr A.J. Berry at Stirling University, using laboratory experiments, is currently following up many of the ideas expressed above which were based entirely on the analysis of field data.

In addition, although H. ulvae is widely distributed within the estuary, R. obtusa has been found to have a restricted distribution, both intertidally and sublittorally, attributable to its direct development and a restricted salinity tolerance as well as the species' prey availability and possible substrate preferences.

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Hurst, A., 1965. Studies on the structure and function of the feeding apparatus of Philine aperta with a comparative consideration of some other opisthobranchs. Malacologia 2 (3), 281-347.

Smith, S.T., 1967. The evolution and life history of Retusa obtusa (Montagu) (Gastropoda, Opisthobranchia). Can.J.Zool. 45, 397-405.

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A "PORCUPINE" NOTEBOOK PRESENTED TO THE ROYAL SCOTTISH MUSEUM, EDINBURGH

David Heppell
Royal Scottish Museum, Edinburgh

In May this year the Royal Scottish Museum received, by kind donation from Sir Maurice Yonge, a notebook bearing the label "H.M.S. Porcupine. 1870. Dredgings". On examination the notebook was found to be that kept by Gwyn Jeffreys during the first leg of the 1870 "Porcupine" Expedition, from 4 July when the cruise set out from England until 6 August when Jeffreys left the expedition at Gibraltar.

On a subsequent visit to the British Museum (Natural History) I was able to compare it with other "Porcupine" notebooks kept in the Mollusca Section with the collection of E.R. Sykes. They have three "Porcupine" notebooks as follows:

1. 1869 expedition. In handwriting of J.G. Jeffreys. Contains station data such as date, latitude, longitude, depth, nature of bottom and the temperatures recorded at successive depths at each station;
2. 1870 expedition. In another handwriting, possibly that of W.B. Carpenter. Contains data on the soundings taken by the 1870 expedition, similar to the above;
3. 1870 expedition. In handwriting of J.G. Jeffreys, cover identical to the notebook in the Royal Scottish Museum. Contains data on latitude, longitude, depth, etc, and on the sea conditions on each day.

The RSM notebook is laid out similarly to no.3 but the latitude and longitude positions have not been filled in. It is the only one of the notebooks to include preliminary lists of the species taken in the dredgins at each station. Most of the species listed are Mollusca, indicated as either "v." (living) or "m." (shells only), but echinoderms, crustaceans, coelenterates and sponges are also noted. A number of later additions and corrections have been made in red ink. It seems likely that Jeffreys would have kept a similar notebook for the 1869 expedition, but its whereabouts is unknown.

Sir Maurice Yonge recollected that the notebook had been in his possession for about 40 to 50 years, having been bought in Wheldon & Wesley's shop then in Berwick Street, London. Its earlier history is conjectural. My first thought was that it must have come on the market when J.T. Marshall died in 1922, as he had shared with Jeffreys the task of sorting the "Porcupine" dredgings. In fact, Marshall sold up his house and shell collections in 1903 and the "Porcupine" material that had been in his possession was purchased by Sykes. The associated manuscripts and notebooks, however, seem to have passed to the British Museum with Jeffreys' portion of the "Porcupine" material after his death in 1885.

Sykes certainly saw the present notebook in 1903 as he quotes from two pages of it in the first of his supplemental notes on the "Porcupine" Mollusca (Proc. malac. Soc. Lond. 6: 23-24) and thanks Mr Smith for placing the Jeffreys manuscripts at his disposal. As Sir Maurice Yonge had bought the notebook before the last war it could not have been in Sykes' possession on his death in 1954, in which year the residual shells from the "Porcupine" expeditions were donated to the BM(NH). It must provisionally be assumed that the notebook was among the possessions of E.A. Smith when he died in 1916. It must have come eventually into the hands of Wheldon & Wesley with the dispersal of Smith's library.

The Royal Scottish Museum is grateful to Sir Maurice Yonge for this interesting gift, especially as a considerable number of specimens from the "Porcupine" expeditions are housed in the Mollusca collections there. Perhaps some day the corresponding notebook for the 1869 expedition will be discovered among the archives of some other library or museum.

BOOK REVIEW

John W. Murray, 1979. British nearshore Foraminiferids. Synopses of the British Fauna (New Series) No.16. Linnean Society of London. pp68. £2.80.

This book gives a clear exposition of 63 species of British estuarine and nearshore foraminiferids. Designed for those who have no prior knowledge of the group, it covers general features of morphology, biology and ecology, the collection of samples, their preservation and preparation. A glossary of terms, the order of classification and a key to genera are given. Descriptions of species are short, line drawings clear, and a flattering lack of difficulty was found in identifying species described in the book. It was, however, disconcerting to conclude that from samples of littoral algae taken for investigation of other animals, about 10% of the foraminiferid forms (especially, it must be admitted, found as dead tests) could not be identified. To this ignorant reviewer they appeared so different as to be different taxa not included in this book. That said, the book is welcomed for its useful and encouraging introduction to a group which forms an important part of many ecosystems but which is all too often ignored.

Shelagh M. Smith

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The Conchological Society of Great Britain and Ireland have published in February 1980 as the first of an occasional series of Special Publications "Marine Mollusca described by John Gwyn Jeffreys with the location of the type material", by Anders Warén. This comprises 60 pages and 8 plates, including a portrait of Jeffreys.

In his Introduction Warén admits that the impetus to compile this work was brought on by years of frustration in attempting to understand Jeffreys' species, a sentiment which will surely be echoed by anyone who has worked on the marine Mollusca of the NE Atlantic and Mediterranean. The author, after several months' study of the Jeffreys material in the collections of the U.S. National Museum, Washington and the British Museum (Natural History), London has made a survey of all the species of marine molluscs described by Jeffreys. His aim is to facilitate future study of the species and to obviate mistakes in designations of type specimens. Wisely he has not attempted to undertake taxonomic revisions except in those cases where he himself is preparing a revision of the group. In general, only undoubted holotypes or lectotypes are figured in order not to limit the taxonomic freedom of subsequent workers.

The list of species, with accompanying data on type locality, number and nature of types, museum registration numbers, and remarks, is arranged alphabetically within a systematic arrangement of families. Warén also includes a list of generic names introduced by Jeffreys, a short biography, a very extensive bibliography, a list of authors of which there is type material in the Jeffreys collection, and a very useful list of expeditions, the Mollusca of which were worked up by Jeffreys, in most cases with full station lists.

A number of lectotypes are designated (all listed in the Abstract), three neotypes are established and, in general, Warén has endeavoured to indicate whether any particular specific name is valid or invalid. As the author has not been able to read every word of Jeffreys' 200 papers there must inevitably be a few omissions, but the work is authoritative and Warén is to be complimented on the thoroughness with which he has accomplished his aim of making more accessible the finest collection of Palaearctic marine molluscs ever assembled by one man.

David Heppell