The Conchological Society of Great Britain and Ireland

(*Founded 1876*)

Papers for Students No. 11

COLLECTING BRITISH MARINE MOLLUSCS

by

Stella M. Turk, F.Z.S.

Introduction.

British marine shells are generally more attractive than those of the land and freshwaters: perhaps because they appeal to the aesthetic sense a greater number of people show some interest in them but a small proportion have the scientific approach characteristic of those who study non-marine molluscs. As there is much of importance to learn about the distribution and ways of life of most of our marine species and there are too few people to record and report, it is worth stressing here that the aesthetic enjoyment in shells need not be sacrificed when the scientific attitude is developed.

Where to look for marine molluscs.

The answer is almost everywhere around our coasts. The following notes, lists and chart are designed as rough and ready guides to places favoured by the various species of molluscs for food and shelter. Inevitably in studying living marine molluscs one will become familiar with the groups of animals that serve as the prey or hosts of many species and discover where the latter live. Divers have opportunities not only for seeing many species absent between tide-marks but for observing them in their natural environment, not left high and dry by the tide. Just as the student of terrestrial molluscs looks under stones, amongst moss and on branches, leaves and stems, so the world of the shore and shallow water needs minute investigation, with a keen eye for camouflage. Looking at the illustrations of as many species as possible, especially of the sea slugs which frequently mimic their prey, will help train the eyes. Watch and note may also be kept for egg capsules and spawn both on and off shore. The observer's own

notes and records of the molluscs found can be usefully kept in a loose-leaf file or card index, allowing one or more pages or cards per species.

The species of British marine molluscs, as listed by Winckworth.

Throughout this paper the numbers and sequence used by Winckworth (1932 & 1951) for each species are employed, mostly on their own. Any system has its anomolies and this is no exception. In recent years some of the names he lists have proved to be synonyms, some have been placed in different genera or families, others have been found to include more than one species whilst quite a few new species have been added to the British list and consequently bear no numbers. Naturally the aim of any systematic list is to show the true relationships of members of the group but inevitably research reveals, and will continue to reveal, new facts about such relationships, so altering previous arrangements. It follows that the sequence of numbering in Winckworth's list is not acceptable in the light of present knowledge - the pyramidellids (G.125-165), for instance, no longer being considered prosobranchs but opisthobranchs. Nevertheless this list still forms a pragmatic working basis for exchanging information on the present level if one is made aware of its limitations. Some idea of the proposed changes can be seen in the first parts of the 'Revised list of British Mollusca' by Bowden and Heppell (1966 & 1968).

Where possible the position of additional species within the Winckworth scheme is indicated by giving the number of the preceding one followed by an 'a', 'b' or 'c' as appropriate (See Appendix 1). Some synonyms have been shown in brackets, the bracketed number being preceded by ? if the synonomy is tentative.

Q = British status is in question
S = Sarnian (Channel Isles only)
U = food category not certain

SOLENOGASTRES (=APLACOPHORA) S.1-5. These small shell-less molluscs live on soft substrates, feeding on Protozoa and hydroids.

LORICATA (=POLYPLACOPHORA) Lo.1-12. All British chitons browse on algae growing on hard substrates: they vary in size from 5-40 mm.

GASTROPODA G.1-376. Gastropods have such a wide variety of feeding habits and these form so useful a guide to where they may be found that an attempt has been made to analyse these so as to present them in chart form (see Appendix 2). A further analysis of the parasitic and carnivorous types of gastropod shows the hosts and prey at phylum level, as listed below. It is suggested that students might compile more detailed notes for their own use. These notes could be kept advantageously by interleaving the list of marine molluscs by

Winckworth (1932) and entering information beside each species. Where more precise detail is not available or is not deemed necessary for the particular purpose, the chart will provide a quick method of entry, the top column letters being juxtaposed by the side column numbers as appropriate e.g. Patella spp. G.7-9 can neatly be described as A1, feeders on plant matter on a hard substrate, whilst G.257-262, so called 'sea butterflies' are B6, pelagic ciliary feeders. A general indication of geographical distribution such as is used by the species would add still further to the value of such notes. As a means of setting the size scale when searching particular habitats and microhabitats it is invaluable to have some idea of the size of various groups e.g. the rissoids (G.51-74) of which the smallest is 1.25 mm. and the largest 7 mm. There are many practical difficulties involved in any categorisations of this sort. Firstly consistent definitions of types of habitat and feeding habit are virtually impossible i.e. one crab carapace on a muddy shore can provide a hard substrate for some coelenterate to settle, supporting in turn a browsing slug. Similarly deep silt may occur in the cracks and crevices of rock. Furthermore there is no absolute distinction between 'carnivore' and 'parasite' although the general rule of size relationship acts as a rough guide: thus Swennen (1959) points out that the smaller species of sea slug on large prey could be considered ectoparasites. Secondly there are the variations associated with geographical distribution and with changes through time of the environment or the animals themselves. Molluscs found off-shore in th colder parts of their British range may occur within tide-marks in the South-west, whilst individuals are always liable to extend their feeding, ecological or geographical limits either by natural variation and selection or as a result of changes in their surroundings. One has only to add to these difficulties the incomplete knowledge that we have of the present ecological preferences of many species, and the problem of gathering together effectively what is known, for the impossibility of 'strait-jacketing' animals into sharply defined categories to become more obvious.

PHYLA OF PREY AND HOSTS OF BRITISH MARINE CARNIVOROUS GASTROPODS, INCLUDING BROWSERS, PARASITES AND SCAVENGERS

PROTOZOA: FORAMINIFERA 243; 247.
PORIFERA (sponges) 2-4; 6; 91-92; 94; 98; 309-310; 312-315; 317.
COELENTERATA (hydroids, sea-anemones, etc.) 100-104c; 137; 156; 163; 180; 182; 185; 277-280; U289; 319-321; 326 (327-328) -333; 335a-335b; 336; 338-352; 356 (U355 U359 U360); 357-358; 361-364; 367 (366) -368; 370-371.
ANNELIDA: POLYCHAETA (marine bristle worms) 131; 137; 140; 142; 147; 157; 190; 204; 245-246.
ARTHROPODA: CRUSTACEA 190; 192; 204; 294; 362.
MOLLUSCA: SCAPHOPODA (tusk shells) 245.
MOLLUSCA: GASTROPODA 190; 204; 239; 245-246; 263-266.
MOLLUSCA: LAMELLIBRANCHIA (bivalves) 125; 145; 149-150; 173-178; 190-192; 204; 213; 245-246.
BRYOZOA or POLYZOA (sea mats) U281-282; 284; 287-289; 290; 292-293; 295-302; 322-324; 356 (U355 U359 U360).

ECHINODERMATA (sea urchins, starfish, etc.) 111-114; 122; 124; 146.
TUNICATA (sea squirts) 179; 181; 183-184b; 276; 289a; 302-304; U306; 308; 323.
FISHES 363 (fish eggs).
VARIOUS MOBILE PREY 172; 204; 236-238; 246.
CARRION & FAECES 203-204; 207-208.
PRECISE FOOD UNKNOWN 115-121; 123; 124aQ-124b; 126-130; 132-136; 138-139; 141; 143-144; 148; 150-155; 159-160 (158)-162; 164-165; 173; 186-189; 193-202; 205-206; 209-212; 214; 229; 240-242; 244; 248-254; 275-275a; 283; 285-286; 291; 305; 307; 311; 315a-316; 318; 325; 334; 353; 354; 365; 369; 372.

SCAPHOPODA Sc.1-5. Tusk-shells are microcarnivores, living on Foraminifera in sand. They do not exceed 40 mm.

LAMELLIBRANCHIA L.1-181. British bivalves vary from 1.5 mm. (L.74-75 Neolepton spp.) to 300 mm. (L.38 Atrina fragilis, the pinna mussel). Almost all bivalves feed on plants, the majority being filter feeders, straining one-celled algae through their gills, whilst the primitive nut and ark shells (L.1-L.15) collect food with their palps. The only exceptions to the plant feeding habit are the Septibranchia (L.178-181) the 'meat-eating clams' which probably take live creatures as well as carrion. Lamellibranchs burrow in substrates of mud, sand or on fine gravel to various depths, bore tunnels in wood or stone, secrete themselves in existing holes, cracks or crevices, or attach themselves permanently by byssi to stones, other shells, weeds, etc. The various methods employed may be ascertained by reference to Tebble (1966). Special attention should be drawn to the coin shells and their allies (Erycinacea L.69-83) most of which live as commensals: the known associations are as follows:- L.72 with the burrowing prawns Upogebia spp.; L.78 with the sea-urchins Spatangus purpureus and Echinocardium flavescens; L.79 with the urchin Echinocardium cordatum; L.80 with the brittle star Acrocnida brachiata and the sipunculid worm Golfingia; L.83 with sea cucumbers Leptosynapta spp.

CEPHALOPODA C.1-19. Squids, cuttles and octopuses are all capable of very rapid movements, hunting such prey as fishes and crustaceans and mostly living in open water.

How to collect marine molluscs.

No hard and fast rules can be set, collectors often developing the practical approach best suited to their own manual dexterity, ingenuity in designing and carrying suitable equipment and, indeed, their temperaments: some collectors insist on remaining as inconspicuous as possible! Even when seemingly perfect plans are made, the most delicate and rare of sea slugs or minute of gastropods is likely to be found when the collecting bag is perched on the next rock so that the fingers and thumb must suffice. One of the basic needs of a collector is undoubtedly a local tide table so that the best use can be made of those times that the biggest expanse of shore is exposed.

Collecting containers.

Polythene bags and perspex or polythene tubes or jars are ideal, being unbreakable. If these are labelled with numbers beforehand, notebook entries can be based on the numbers, saving the writing of small individual labels on the spot. Soft lead pencil is best for field work since this is unaffected by water or any subsequent preservative.

Tools for picking up small delicate specimens.

Weak stainless steel forceps and small water-colour paint brushes are best for this purpose. The somewhat heavier types of disposable polythene forceps are also useful for marine work, being impervious to sea water.

Tools for collecting bivalves or their hosts in soft substrates.

Full sized garden spades will do the job but great care must be taken not to damage the molluscs or the hosts with which thay may be associated. It is best to approach the task with the dedicated care used by an archaeologist on a 'dig'. Having dug a pit in a likely area (characterised by holes or siphon spurts) gradually enlarge this by scraping away at the sides with a small trowel or one's hands: rubber gloves, worn over woollen ones in cold weather, serve as protection from the more obnoxious mud favoured by such species as L.124 Scobicularia plana. Species which live near the surface of the substrate may be uncovered with a rake, as used by cockle gatherers. Salt is effective for surfacing razor fish which dive rapidly and deeply into the sand: apply a pinch to the entrance of their burrows, grabbing the occupants firmly when they emerge to about half their length after a few minutes. Washing the disturbed mud or sand through a net or nylon sieve may discover many immature examples and small species.

Tools for removing boring bivalves from stone or wood.

A geological hammer and chisel are essential for those in the harder types of rock, great care being exercised so as not to damage the specimens. Strong penknives may be sufficient to extract the wood-boring shipworms but one needs diligence to remove the whole mollusc, complete with the pallets which protect the siphons at the surface of the wood and the tiny valves at the head end, usually many inches distant through twisting and widening tunnels. Turner (1955, pp. 32-35) describes how special laminated collecting boards can be made in which the shipworms are forced to make straight tubes and are therefore easily extracted for systematic studies. An old screw driver is usually sufficient to recover the various species - often immature - that burrow into the thick layers of stony seaweeds (Lithothamnion and Lithophyllum) or in shaly rock. A crow bar is an excellent weapon for turning over large stones, but whether big or small, stones should always be rolled back to the same position, in the interests of conservation.

Tools for obtaining small species from sea-weed fronds and holdfasts.

Polythene coffee strainers scraped against small sea weeds in rock pools often remove many living examples of such species as G.71 Rissoa parva. Alternatively pieces of weed can be removed gently and swirled in a receptacle of suitable size and shape: most shells show up best against a white background, but a transparent container can be placed on a piece of black or white polythene sheet. Laminaria holdfasts cast up or brought in with a grab usually disclose a very rich fauna after a few hours in a bowl of sea water allowed to stale.

Hints for collecting strand line shells.

The quantity, condition and range of species on strand lines depends on wind, season and tide: experience will suggest when visits to local beaches are likely to be productive. Observations, including quadrat counts of numbers and kinds present, can contribute to worthwhile scientific studies, especially when correlated with records of the nearest living colonies of the species - information that might be provided by divers. Counts of the numbers of right and left valves of particular species may reveal some patterns of sorting by currents. Small strand line species can be sorted on white shelf paper (on winter evenings by the fireside!) after the finer grains of sand have been sifted out. Head glasses on bands, which leave both hands free, greatly facilitate this task.

Collecting off-shore.

The scope of collecting and recording can be much extended by non-divers with the help of the following equipment. A plant grapple will hook in weed from deep water for examination, a dredge serves to collect living molluscs and their shells from the surface layers of mud and sand, whilst a tow-net is the only way of gathering pelagic forms such as pteropods (G.257-268) and the planktonic larvae characteristic of the majority of marine molluscs. Lastly baited pots may be set to attract the various scavenging types such as whelks: polythene bottles which could, if necessary, be cut to extract the inmates would probably make quite successful bait containers. Turk and Turk (1958, pp. 26-27) briefly describe how to make a dredge, tow-net, grapple and bait-cage. It is worth making liaisons with those professionally connected with the sea, such as local crab fishers or trawlermen. Examination of the bottom boards of crab boats or crab pots at frequent intervals will reveal hosts of fresh specimens brought up inadvertently as the pots are hauled in. Fish stomachs are an excellent source for prime shells of what are often rare species. After studying the species of fish that normally include molluscs in their diet then locate a good source. Clarke (1955, pp. 20-24) writes that some fishermen gutting their catches at sea may be persuaded to bag all the resultant stomachs and intestines for a nominal price: probably it would be wise to supply a large jar of 5% formalin solution.

Preservation, transport and data.

Data for labels and notebooks.

The scientific value of a shell specimen depends on the amount of detailed data which accompanies it, so it follows that great care must be taken to keep each and every label securely with the correct specimen. The essential data includes:-

When it was collected. Give day and month as well as year if possible. In a mere thirty years most museums will house specimens collected over three centuries - so write 1968, not '68.

Locality where it was collected. Use names that appear on One Inch Ordnance Survey maps, adding the grid reference, which appears on all post-war maps, if possible. Off-shore positions should be given by latitude and longitude.

Habitat. Give a broad description such as estuary, salt-marsh, rocky shore, sandy beach, off-shore gravel beds, etc.

Microhabitat. Detail the more minute aspects of the habitat in as much detail as they are known to you, e.g. on sea lettuce, Ulva lactuca; on sea urchin, Echinus esculentus; under small stone encrusted with Bryozoa; on sponge; in rock crevice; etc.

Position on shore or depth in fathoms off-shore. The following abbreviations are recommended for shore positions: EHWS; MHWS; MHWN; LHWN; MTL; HLWN; MLWN; MLWS; ELWS (E = extreme; H = high; L = low; N = neap; M = mean; S = spring; T = tide; W = water).

Status. It is important to note whether the shell was found empty; cast up with the dead or dying animal in it; or living in situ. Many collections, past and present, do not carry this basic information and hence the live distribution of most of our marine species is far too scanty.

Any other observations on numbers, breedings, etc. Whilst purely subjective estimates such as 'common', 'abundant', 'rare', etc. are of general use, some estimate of actual density of numbers per square metre (or other suitable area) is still more valuable.

Preparation and preservation of specimens.

Whether the shell alone is required or also the animal, the easiest method for most species is to keep them in a container of sea water until they die naturally as the water stales. Keeping them alive as long as possible provides an ideal means of studying the living animals. However the process may be hastened if required by covering the container. Once the animals are dead they can be removed from their shells with forceps, curved wire or pins, the shells then being dried and stored in any way required: sea shells should never be placed in boiling water which is

likely to damage the periostracum of many species, nor should they be varnished. Naturally the animals should be kept in as expanded a condition as possible if further study is to be made of them, and experiment to find the best way of achieving this end continues. Epsom salts (magnesium sulphate) or propylene phenoxetol both cause relaxation, and may be added to form not more than 1% by volume of the total liquid. Results from deep freezing are sometimes perfect: place the active animal in a suitable container of sea water in the deep freeze and, once the water is solid, remove the whole container adding a little formalin or alcohol to its surface before allowing it to de-freeze naturally.

Chitons will normally roll up unless kept flat and this may be done by placing them between small pieces of glass or splints of wood secured with rubber bands. The standard preservatives for molluscs are industrial spirit or formalin but the latter is unsuitable, except for temporary use, if the shell is also to be included since the formic acid will soften it: the recommended strength of formalin is 5%, obtained by adding 1 part of 40% formalin to 19 parts of water, preferably sea water or Tidman's solution. 70% industrial spirit is best for permanent use but care must be taken to prevent evaporation and to safeguard against shrinkage of the tissues: the first is achieved by tightly stoppered containers and the second by graduating the strength of the alcohol through 30% and 50%.

Packing specimens for dispatch by post or rail.

Preserved specimens should be removed from their liquid and packed in polythene bags containing cotton wool saturated with the preserving fluid. Bags of the usual non-leak-proof gauge should then be packed in a tin rather than a wooden or cardboard box. Living molluscs will remain alive for a matter of days if some simple precautions are taken, for experience shows that all but the most delicate shelled or shell-less types are better for being kept merely moist rather than immersed in water. If they are placed in polythene bags and these bags are then put in water-proof tin, there should be sufficient oxygen and moisture for quite a long journey. Soft or fragile species are more suited by a polythene tube or jar containing sufficient water to cover the whole animal. Aluminium screw top jars, obtainable in many sizes and usually given away by chemists, are ideal for dispatching live or preserved molluscs.

The Conchological Society's Marine Census.

This paper, written by the present Marine Recorder, has been prepared with the needs of the Marine Census very much in mind. Even for those students who do not take part in Census recording it is believed that the use of the marine divisions and status categories will form an orderly basis for their own collecting. Although this Census was started over 45 years ago, it was completely revised in the early 1960, the previous 20 Marine Census Areas being replaced by 40 Areas, as shown on the accompanying map (Appendix 3) taken from Heppell (1964). It is therefore understandable that even the commonest species are not yet reported from many Areas and hel can be given by the veriest beginner as well as the professional specialist. The most satisfactory way of submitting records to convey the maximum information is set out on the following prototype recording form (Appendix 4

List of dealers supplying equipment.

P.K. Dutt & Co. Ltd., 1a, Howard Road, Bromley, Kent.
T. Gerrard & Co., Gerrard House, Worthing Road, East Preston, Littlehampton, /Sussex.
Watkins & Doncaster, 11, Park View Road, Welling, Kent.
Southern Watch & Clock Supplies Ltd., 48-56, High Street, Orpington, Kent.
(The last firm supply head glasses on bands, suitable for sorting tiny shells and for dissection.)
Steriseal Ltd., Redditch, Worcestershire. (For disposable polythene forceps.

Reference List.

BOWDEN, J. & HEPPELL, D. 1966 & 1968. A revised list of British Mollusca.
1. Introduction; Nuculacea-Ostreacea. J. Conch., vol.26, pp.99-124.
2. Unionacea-Cardiacea. J. Conch., vol. 26, pp. 237-272.

CLARKE, A.H. 1955. Collecting molluscs from fish. See TUCKER ABBOTT.

FRETTER, V. & GRAHAM, A. 1962. British prosobranch molluscs: their ecology and functional anatomy. Ray Society, London.

HEPPELL, D. 1964. The British Marine Census Areas. J. Conch., vol. 25, pp. 299-303.

SWENNEN, C. 1959. The Netherlands as an environment for Nudibranchia. Supplement to Basteria, vol. 23, pp. 56-59.

TEBBLE, N. 1966. British bivalve seashells: a handbook for identification. British Museum (Natural History).

TUCKER ABBOTT, R. et al. 1955. How to collect Shells. American Malacological Union. (There are two later editions of this useful work which costs only a few shillings.)

TURNER, R.D. 1955. Collecting Shipworms. See TUCKER ABBOTT.

TURK, F.A. & S.M. 1958. The foreshore of Cawsand Bay and District: its Fauna and Flora. Plymouth and District N.U.T.

WINCKWORTH, R. 1932 & 1951. The British marine Mollusca. J. Conch., vol. 19, pp. 211-252. Additions and corrections J.Conch., vol. 23, pp. 131-134.

Useful works not cited above.

BARRETT, J. & YONGE, C.M. 1958. Pocket Guide to the Sea shore. Collins.

FORBES, E. & HANLEY, S. 1849-1853. A history of the British Mollusca and their shells. 4 vols. London.

JEFFREYS, J.G. 1862-1869. British Conchology. 5 vols. London.

PRUVOT-FOL, A. 1954. Mollusques opisthobranches. Faune de France, vol. 58. Paris.

STEP, E. 1901. Shell Life. Warne. A completely revised edition will soon be available.

THOMPSON, T.E. 1964. Grazing and the life cycles of the British nudibranchs. Symp. Brit. Ecol. Soc., no. 4, pp. 275-297. (Food details for two-thirds of the species.)

APPENDIX 1

Marine Species now recognised as British but not in Winckworth (1932 & 1951)

(Some subspecies listed by Winckworth have since received specific status, but these have not been included in the following list. Position of species within the Winckworth scheme is indicated by citing the number of the preceding species followed by a, b or c.)

G.18a Margarites olivacea (Brown, 1849) Thorson, G. 1944. Marine Gastropoda Prosobranchiata. Medd. Grønland, vol. 121 (13), pp. 1-181.

G.34a Skenea millipunctata (Friele, 1866) Chaster, G.W. 1892. Conchologist, 2.

G.46a Hydrobia neglecta Muus, 1963 Muus, B.J. 1963. Proc. malac. Soc. Lond., vol. 35, part 4, p. 131.

G.57a Cingula inflata (Monterosato, 1884) Fretter, V. & Patil, A.M. 1961. Proc. malac. Soc. Lond., vol. 34, part 4, pp. 212-223.

G.124b Ranella olearium L., 1758 (=Gyrina gigantea) Cooke, A.H. 1916. Proc. malac. Soc. Lond., vol. 12, part 1, p. 3.

G.229a Cenodagreutes aethus Smith, 1967 Smith, E. The Veliger, vol. 10 (1),
G.229b C. coccyginus Smith, 1967 As 229a. /pp. 1-4.

G.266a Hedylopsis seucica Odhner, 1937 (included in Winckworth, 1951, but status queried) Spooner, G.M. 1959. Nature, Lond., 183, pp. 1695-6.

G.266b Microhedyle lactea Hertling, 1930 As G.266a.

G.266c Philinoglossa heligolandica Hertling, 1932 As G.266a.

G.289a Polycera elegans Bergh, 1894 Edmunds, M. 1961. Proc. malac. Soc. Lond., vol. 34, part 6, pp. 316-321.

G.344a Pseudovermis schulzi Marcus & Marcus Boaden, P.J.S. 1961. Nature, Lond., 191, p. 512 (or species near to P. schulzi).

L.37a Pycnodonte cochlear (Poli, 1795) Bowden, J. & Heppell, D. 1966. J. Conch., vol. 26, no. 2, p. 108.

L.62a Thyasira equalis (Verrill & Bush, 1898) McIntire, A.D. 1961. J. mar. biol. Ass. U.K., vol. 41, pp. 599-616.

L.62bQ Thyasira gouldii (Philippi, 1845) Bowden, J. & Heppell, D. 1968. J. Conch., vol. 26, no. 4, p. 245.

L.79bQ Tellimya tenella (Loven, 1846) Bowden, J. & Heppell, D. 1968. J. Conch., vol. 26, no. 4, p. 245.

L.103a Mercenaria mercenaria (L., 1758) Heppell, D. 1961. J. Conch., vol. 25, no. 1, pp. 21-34.

L.137a Ensis phaxoides van Urk, 1964 van Urk, R. 1964. Basteria, vol. 28 (1 & 2), pp. 13-44. Tebble, N. (1966) does not mention this species.

L.138a Ensis minor (Chenu, 1843) van Urk, R. 1964. Basteria, vol. 28 (1 & 2 pp. 13-44. Tebble, N. (1966, p. 164) denies that this species is /British.

L.145a Lutraria angustior Philippi, 1844 Holme, N.A. 1960. J. mar. biol. Ass. U.K., vol. 38, pp. 557-568.

C.6a Alloteuthis subulata (Lamarck, 1798) Previously confused with A. media L. Heppell, D. 1963. J. Conch., vd. 25, no. 5, p. 218.

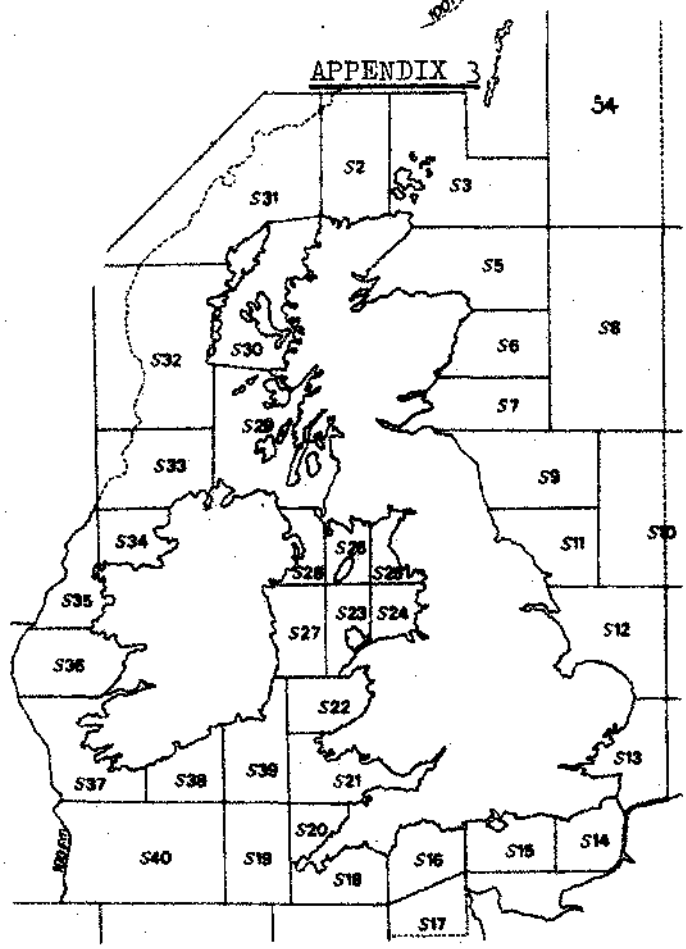
APPENDIX 2

GUIDE TO GENERAL FOOD HABITS AND HABITATS OF BRITISH MARINE GASTROPODS

	A) Feeders on plant matter (algae, algal detritus, diatoms, lichens and vascular plants).	B) Ciliary feeders	C) Feeders on animal matter (hunters, grazing carnivores, parasites and scavengers).	D) Food unknown
1) Hard substrate (rocks, stones, shells, coarse gravel)	5;7-9;12-13;15-17a; 18a;22;25-27;30-31; 36;38;42-43;57a-60; 63-S;78-81;90a;166; 255;373-376	167-169	2-4;6;91;98;103;112;136; 148;159;187-188;190-193; 225-226;229;275-275a	1;5;105;
2) Soft substrate (fine gravel, sand, mud, silt)	14;19;21;46-46a;48-50; 53-57;61;65;76;88-89; 170-171;230-235; 266abc	87	100;102;114-115;137; 165;173-178;194-198; 200-201;207-210;212-215; 217;219-224;227;236-254; 276	96-97;109;152; 154-155;161-162
3) Variously on plants or hard or soft substrates	20;23-24;41;47;64;67; 70;77;80;82(83);90	-	126;141;189;203-204; 206;228	156
4) Usually on living plants	10;18;29;32-33;37; 39-40;45;51-S;69; 71-75;84-86;256-256b; 267-274	-	132	110
5) Usually on or near living animals	-	-	92;94;122;124-125;131 140;142;145-147;149-150; 157;163;179-185;277-320; 322-372	-
6) Pelagic	-	257-262-Q	104-104c;172;263-266;321	-
7) Habitat unknown	28;34-34a;52;62;68; 79-79a	-	101;111;113;116-121;123; 124a;127-130;133-135; 138-139;143-144;151;153; 160(158)-Q;164;186-S; 199;202;205;211;216;218	35;66;93;95;99; 106-108

The precise food of one third of the nudibranchs G.277-372 and many other species listed above under C is not known: see separate list of prey and hosts of carnivorous gastropods.

APPENDIX 3



SUBDIVISION OF THE BRITISH MARINE CENSUS AREA INTO CENSUS AREAS

The following are the names and boundaries of the Census Areas:

1.	SHETLAND	100 fm.; 0°; 59°15 N.; 1°50 W.; 60°0 N.
2.	SUTHERLAND	5°0 W. (Cape Wrath); 100 fm.; 60°0 N.; 3°30 W.
3.	ORKNEY	3°30 W.; 60°0 N.; 1°50 W.; 59°15 N.; 0°; 58°30 N.
4.	VIKING	100 fm.; 2°30 E.; 58°30 N.; 0°.
5.	MORAY FIRTH	58°30 N.; 0°; 57°30 N. (Buchan Ness).
6.	ABERDEEN	57°30 N.; 0°; 56°40 N.
7.	FIRTH OF FORTH	56°40 N.; 0°; 56°0 N.
8.	NORTH SEA	58°30 N.; 2°30 E.; 56°0 N.; 0°.
9.	NORTHUMBERLAND	56°0 N.; 2°30 E.; 20 fm.; 55°0 N.
10.	DOGGER	20 fm.; 2°30 E.
11.	YORKSHIRE	55°0 N.; 20 fm.; 2°30 E.; 54°0 N.
12.	WASH	54°0 N.; 2°30 E.; 52°30 N.
13.	THAMES	52°30 N.; 2°30 E.; northern limit of French intertidal zone; line joining Cap Gris Nez and Dover.

APPENDIX 3 - continued

14.	EAST CHANNEL	Line joining Cap Griz Nez and Dover; northern limit of French intertidal zone; 50°0 N.; 0°.
15.	WIGHT	0°; 50°0 N.; 2°0 W.; (St. Alban's Head).
16.	PORTLAND	2°0 W.; 50 fm. contour north of Hurd Deep; 3°40 W. (Start Point).
17.	CHANNEL ISLES	50 fm. contour north of Hurd Deep; 2°0 W.; 49°0 N.;
18.	WEST CHANNEL	3°40 W.; 50 fm.; 4°0 W.; 49°30 N.; /4°0 W. 5°50 W.; latitude of Cape Cornwall.
19.	SCILLY ISLES	51°0 N.; 5°50 W.; 49°30 N.; 7°15 W.
20.	NORTH CORNWALL	Latitude of Cape Cornwall; 5°50 W.; 51°0 N.
21.	BRISTOL CHANNEL	51°0 N. (Hartland Point); 5°50 W.; 52°0 N.
22.	CARDIGAN BAY	52°0 N.; 5°50 W.; 52°45 N. (Bardsey).
23.	ANGLESEY	52°45 N.; 5°0 W.; 54°0 N.; 4°0 W.
24.	LIVERPOOL BAY	4°0 W.; 54°0 N.
25.	SOLWAY	54°0 N.; 4°0 W.
26.	ISLE OF MAN	4°0 W.; 54°0 N.; 5°0 W.
27.	DUBLIN	54°0 N.; 5°0 N.; 52°45 N.
28.	BELFAST	55°0 N.; 5°0 W.; 54°0 N.
29.	CLYDE & ARGYLL	55°0 N.; 7°25 W. (Malin Head); 50 fm. line joining Ardnamurchan Point and Barra Head.
30.	MINCH	Line joining Ardnamurchan Point and Barra Head; line joining Butt of Lewis and Cape Wrath. (In the Sound Harris, Minch is east of 7°0 W. and south of 57°40 N.
31.	LEWIS	58°0 N.; 100 fm.; 5°0 W.; line joining Butt of Lewis and Cape Wrath.
32.	UIST	Line joining Ardnamurchan Point and Barra Head; 50 fm.; 56°0 N.; 100 fm.; 58°0 N.
33.	NORTH DONEGAL	55°0 N.; 100 fm.; 56°0 N.; 7°25 W.
34.	DONEGAL BAY	10°0 W.; 55°0 N.
35.	MAYO	53°25 N. (Slyne Head); 100 fm.; 55°0 N.; 10°0 W.
36.	GALWAY BAY	52°30 N. (Loop Head); 100 fm.; 53°25 N.
37.	FASTNET	9°0 W. (Galley Head); 51°0 N.; 100 fm.; 52°30 N.
38.	CORK	7°15 W.; 51°0 N.; 9°0 W.
39.	NYMPHE BANK	52°45 N.; 5°50 W.; 51°0 N.; 7°15 W.
40.	SOLE	51°0 N.; 7°15 W.; 49°30 N.; 100 fm.

COASTLINE INCLUDED IN THE CENSUS AREAS

1. Shetland; Fair Isle.

APPENDIX 3 - continued

2. Sutherland, from Cape Wrath; Caithness to Dunnet Bay.
3. Orkney; Caithness, from Dunnet Bay to Noss Head.
4. (Entirely offshore).
5. Caithness, from Noss Head; E. coasts of Sutherland and Ross and Cromarty; N. coast of Inverness; Nairn, Moray, Banff; Aberdeen to Buchan Ness.
6. Aberdeen, from Buchan Ness, Kincardine, Angus, to Lunan Bay.
7. Angus, from Lunan Bay; Perth, Fife, Clackmannan, Stirling, West Lothian, Midlothian; East Lothian, to Dunbar.
8. (Entirely offshore).
9. East Lothian, from Dunbar; Berwick, Northumberland.
10. (Entirely offshore).
11. Durham; Yorkshire, to Bridlington Bay.
12. Yorkshire, from Bridlington Bay; Lincolnshire, Norfolk; Suffolk, to
13. Suffolk, from Lowestoft; Essex; Kent, to Dover. /Lowestoft.
14. Kent, from Dover; Sussex, to Newhaven.
15. Sussex, from Newhaven; Hampshire (including the Isle of Wight); Dorset, to St. Alban's Head.
16. Dorset, from St. Alban's Head; Devon, to Start Point.
17. Channel Isles.
18. Devon, from Start Point; Cornwall, to Cape Cornwall (St. Just).
19. Isles of Scilly.
20. Cornwall, from Cape Cornwall; Devon, to Hartland Point.
21. Devon, from Hartland Point; Somerset, Gloucester, Monmouth, Glamorgan, Carmarthen; Pembroke, to Strumble Head.
22. Pembroke, from Strumble Head; Cardigan, Merioneth; Caernarvon, to Bardsey Island.
23. Caernarvon, from Bardsey Island to Llanfairfechan; Anglesey.
24. Caernarvon, from Llanfairfechan; Denbigh, Flint, Cheshire, Lancashire, to the estuary of the River Lune.
25. Lancashire, from the estuary of the River Lune (including Westmorland); Cumberland, Dumfries; Kirkcudbright, to Abbey Head.
26. Kirkcudbright, from Abbey Head; Wigtown, to Port Logan; Isle of Man.
27. Wicklow, Dublin, Meath; Louth, to Dundalk.
28. Louth, from Dundalk; Down; Antrim, to Carnlough; Wigtown, from Port Logan to Cornwall Point.
29. Antrim, from Carnlough; Londonderry; Donegal, to Malin Head; Wigtown, from Corsewall Point; Ayr, Renfrew, Dunbarton, Bute (including the Isles of Cumbrae and Arran); Argyll, to Ardnamurchan Point (including the Isles of Gigha, Islay, Jura, Oronsay, Colonsay, Mull, Iona, Tiree and Coll).
30. Argyll, from Ardnamurchan Point; Inverness (including the Isles of Muck, Eigg, Rhum, Canna, Skye and Raasay); W. coast of Ross and Cromarty; Sutherland, to Cape Wrath; E. coasts of Barra, South Uist, Benbecula, North Uist, Harris and Lewis.
31. W. coast of Lewis; W. coast of Harris to Scarpay.
32. W. coast of Harris, from Scarpay; W. coasts of North Uist, Benbecula,
33. Donegal, from Malin Head to Aran Is. (Co. Donegal). /South Uist and Barra
34. Donegal, from Aran Is.; Leitrim, Sligo; Mayo, to Erris Head.
35. Mayo, from Erris Head; Galway, to Slyne Head.
36. Galway, from Slyne Head (including the Aran Islands); Clare, to Loop Head
37. Clare, from Loop Head; Limerick, Kerry; Cork, to Galley Head.
38. Cork, from Galley Head; Waterford, to Dunabrattin Head.
39. Waterford, from Dunabrattin Head; Wexford.
40. (Entirely offshore).

APPENDIX 4

PROTOTYPE RECORDING FORM FOR MARINE MOLLUSCS with examples of actual records.

1 Winckworth list no.	2 Identification	3 Locality	4 Census Area / Census Category	5 Nat. Grid Ref. / Date	6 Habitat and micro-habitat	7 Shore zone or depth	8 Collected by Identified by (Checked by)	9 Estimated nos. behaviour or any other observations
G.12	Acmaea tessulata (Müller)	Staffin Isle of Skye	30 A	NG/46 18.7.1966	Under small stone	3 fm.	George Heriot School Sub-Aqua Club. J.H.Duffus (S.M. Turk)	1 specimen seen R V
G.71	Pissoa parva (da Costa)	Torcross, S. Devon	16 A	SX/84 11.10.1965	Rocks. On algae (Plocamium, etc.)		M.R. Block S.M. Turk	Abundant - mostly var. interrupta R
G.294	Onchidoris fusca (Müller)	Fowey, Cornwall	18 A	SX/124515 27.1.1963	Under stone	Shallow water ELWS	G. Way S.M. Turk (D. Heppell)	Large numbers forming a mat and spawning. Temp. near freezing R V
L.43	Chlamys distorta (da Costa)	Barricane, Woolacombe, N. Devon	21 B	1943			L.W. Stratton L.W.S.	Strand line - Several found
L.79	Montacuta ferruginosa (Montagu)	St. Anthony-in-Meneage, Cornwall.	18 A	SW/785255 16.9.1962	On spines of Echinocardium cordatum	ELWS	B.D. Stephens B.D.S. (S.M. Turk)	Echinoderms numerous, mostly with a few specimens. R V
L.148	Mya arenaria (L.)	Kingsbridge Estuary, S. Pool Creek	18 B	SX/74 5.3.1967			G.H. Spooner G.H.S.	Frequent, with Cardium edule, and valves of Scrob. pip.

APPENDIX 4 - continued

To make copies of this form, rule lines as above and simply number the columns. Foolscap paper would provide more space, and recorders should find it useful to keep carbon copies of any lists they submit; such copies are easily made with a ball pen failing a typewriter. Please endeavour to keep different Census Areas separate from one another to facilitate filing. If there are more obs. than will fit in columns, number entry and continue on back of form. The more detail the better, but it is not always possible to complete information under all headings; however, please be sure to indicate the Census category in the second half of column 4 (A = alive; B = empty shells; C = worn shells or empty valves). If in doubt do NOT record as A. R = identification authenticated; V = specimens placed in Voucher Collection. If the specimens cannot be named, please pencil in your own ref. no. on form, and number examples sent to the Recorder accordingly.

First issued: 18th January, 1969.
Reprinted: November, 1976.

"Papers for Students" edited and distributed by:

Mr. A. Norris,
Natural History Department,
City Museum,
Municipal Buildings,
Leeds, LS1 3AA.