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The first Annual General Meeting and Spring Seminar held in conjunction with the Littorinid Research Group at Manchester Museum on the 24th and 25th February, 1978 proved a resounding success, due to the considerable enthusiasm and involvement of our hosts, to whom we extend our sincere thanks.

The theme of the symposium, "The Species Problem", proved most stimulating, and is particularly relevent at this period in time when the International Commission on Zoological Nomenclature have just issued their draft proposals for the third Code of Zoological Nomenclature. It is suggested members may wish to consult this most important document and forward their views to the Commission at the earliest opportunity.

In the light of the lively discussion at the meeting on the validity of types, it is hoped that members will send in their comments (journalistic secrecy being guaranteed if required) for publication in future newsletters.

On a sadder note, it is with considerable concern that we note the recent Amoco Cadiz disaster in the "English" Channel, and we extend our commiserations to our colleagues at Roscoff.

Finally, members are reminded that contributions comprising reviews, notices of forthcoming events, news of personal and joint research projects, requests for information, etc., should be sent to the Hon. Editor of Porcupine, Mr. F.R. Woodward, South Shields Museum and Art Gallery, Ocean Road, South Shields, Tyne and Wear, NE33 2TA, or to the Hon. Secretary of Porcupine, Dr. Shelagh M. Smith, Royal Scottish Museum, Chambers Street, Edinburgh, EH1 1JF.

F.R. WOODWARD
Hon. Editor.

COMMITTEE NEWS

Minutes of the First Annual General Meeting held at Manchester Museum on Saturday, 25th February, 1978 at 09.30hrs.

John B. Wilson took the chair.

Minutes of the Business Meeting held on 13th February, 1978 were accepted unread.

Items 1, 2 and 3 which will be published in the next number of the Porcupine Newsletter were read (in the case of 2 demonstrated on the blackboard) and accepted with no discussion.

1. Hon. Secretary's Report. Adoption proposed by Elizabeth Platts. Seconded by Bob Earll.

2. Hon. Treasurer's Report. Adoption proposed by Tom Gascoigne. Seconded by Adrian Norris.

3. Hon. Editor's Report. Adoption proposed by Bob Earll. Seconded by Roger Bamber.

The Record's Convenor, having no news, did not give a Report, however, it was hoped that records for which there was no recording scheme would be lodged with him (see any other business).

4. David Heppell gave a brief outline of the progress made by the sub-committee on Recording grids.

David McKay suggested that at the present stage of planning it should be established how many records there are to be processed and quoted a figure of over 10,000 point records for marine molluscs for E. Scotland alone. He suggested that local authorities especially in Scotland should be prodded into setting up regional centres as in England. Eve Southward considered that the greatest achievement of the grid sub-committee was to get B.R.C. to consider point records (not only records grouped by grid square). David McKay suggested that record cards should be one-sided A4 to promote ease of use and storage. Shelagh Smith pointed out that this would avoid errors in photocopying. Bill Fettitt said that recording had been overtaken by events, the present system was cumbersome, computerisation is easier now (he has been asked to submit a report on the N.W. England Collection Research Unit to the grid sub-committee).

5. Election of office-bearers.

All office-bearers were re-elected without dissent by those present.

Election of Council Members.

Council members were elected by the same process.

Trevor Norton's retiral was intimated.

Council Members now are:-

John Cullinane, Bob Earll, John Gordon, Eifion Jones, Adrian Norris, Brendan O'Connor, Alastair Somerville, Eve Southward, Geoff Swinney, John Wilson.

6. The discussion of the format of future meetings generated lively contributions. David Erwin voiced opinions of those who favoured one meeting per year only, this meeting to be a bumper meeting to which many people would be attracted, Frank Evans preferred at least two meetingsper year. He did not wish to see meetings shrink. Elizabeth Platts agreed with this and David McKay considered that one meeting per year inadequate for meeting people. Fred Woodward suggested that we should try and have joint ventures with other Societies. David Heppell pointed out that more people had been willing to travel considerable distances than was originally envisaged. It was hard work organising, especially obtaining speakers - for more than two quality meetings per year. It was also suggested that University vacation times were attractive because the Universities then could provide residential accommodation for evening chats. Elizabeth Platts then formally proposed that a vote should be taken as to whether there should be only one, or more than one, main meeting. Two thirds of those

present were in favour of two or more meetings, at the discretion of the committee. Further contributions suggested that there could be additional mini-meetings and field meetings with other groups. The main meeting(s) should be during vacation, the A.G.M. should be in one place, the others at various places.

7. Any other business.

The Portaferry meeting was intimated.

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Hon. Secretary's Report

Porcupine was inaugurated just over a year ago with the first meeting in Edinburgh the 12th - 13th February, 1977. The success of the first year may be judged in terms of 120 members, three meetings (this Manchester one being the fourth) and four Newsletters. Each Porcupine Newsletter contains proceedings of the previous meeting and the provisional programme of the next, therefore in this report I shall but briefly summarise the year's business.

The first meeting - in Edinburgh took the theme Marine Recording and attracted 74 people, who as one who was present commented "voiced 74 different opinions". I hope that Porcupine will continue as it started and will remain a forum for diversity of expression. The second meeting took place on Tyneside in June at which the main topics were preservation and fixation techniques and marine photography. Field excursions to Whitburn Steel and St. Mary's Island were included, 23 people attended. The third meeting was at Cardiff in October with a theme of parasites and symbionts which attracted 24 people. In addition there was a field week in Orkney at the end of August under the auspices of the Biological Recording in Scotland Committee, amongst others, 9 Porcupine members were there despite difficulties caused by a ferry strike.

Porcupine has other activities, at present rather more behind the scenes, which were started as the result of discussion at the Edinburgh meeting. A sub-committee has considered grids used as bases of marine recording. It is easier to publicise the methods at present in use or proposed than to reconcile systems which are ideally suited to their individual purposes but are not compatible below a sophisticated computerised level which would require a much greater amount of manual processing of a clerical nature not attractive to marine biologists than was originally envisaged.

Publication, in loose leaf form, of a guide to faunal/floral lists and systematic keys is in progress and is financed in part by a grant from the World Wildlife Fund. The first instalment should appear this summer. The only way this publication can be the success the demand for it would predict is for it to be a joint effort by all Porcupine members. Submissions of entries, especially those containing critical comments as well as the bald reference, are urgently and continually required. The publication committee (c/o David Heppell or Shelagh Smith, Royal Scottish Museum, Edinburgh) is not Argus and has not time to perform latterday labours of Hercules and can easily overlook not only the obscure but also the most obvious and useful works not in its own field.

Shelagh Smith

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Further Meetings

Porcupine Meeting in Ireland on Marine Meiofauna

A weekend course June 23rd-25th,. 1978 at the Queen's University, Marine Biology Station, Portaferry, Co. Down.

The course is designed to introduce members to the diverse and intriguing interstitial fauna of sand and shell-gravel and to the general extraction and other techniques used in its study. A wide range of sediment occurs around Portaferry so in addition to the commoner meiofaunal groups such as ciliates, turbellarians, nematodes and copepods it should be possible to demonstrate some of the 'rarer' interstitial coelenterates, archiannelids, gastrotrichs and molluscs. There will also be ample opportunities to investigate larger organisms.

Provisional programme:

Friday, 23rd. Arrive. Evening meal at 18.30 followed by introductory talk by Pat Boaden.

Saturday, 24th. Morning field collection. Pre-lunch talk "Marine Ciliates" by Jim Parker. Post-lunch talk "Soft taxa" by Pat Boaden followed by laboratory session on extraction, identification and other techniques. Evening meal followed by "Nematodes" from Howard Platt.

Sunday, 25th. Optional shore excursion. Laboratory session and demonstration continues. Lunch. Discussion. Departure.

Residential accommodation will be at the Marine Biology Station which is situated on the sea front in Portaferry. Depending on numbers it will probably be necessary to share 2 - 4 per bedroom. The cost, inclusive of meals, will be £10 per head. There is a small hotel adjacent to the Marine Station (enquiries to Portaferry Hotel, The Strand, Portaferry) but participants are encouraged to stay at the Station itself. It should be possible to arrange extra meals, etc., for anyone arriving early or wishing to stay on (although another course is arriving on the Sunday evening).

Preliminary bookings and enquiries by letter or phone by 1st May please. Final arrangement by 1st June.

The Director,
Marine Biology Station,
Portaferry BT22 1PF
NORTHERN IRELAND.

Telephone Portaferry (024772) 230.

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Supplement to the Orkney Field Trip

List of Demospongia identified from the Orkney shores (28th August-1st September 1977)

TETRACTINOMORPHA

HOMOSCLEROPHORIDA

Oscarellidae

Oscarella lobularis (Schmidt)
Birsay, St. Margaret

CERACTINOMORPHA

HALICHONDRIDA

Halichondriidae

Halichondria bowerbanki Burton
Birsay

Halichondria panicea (Pallas)
Holm of Howton, Birsay

Halichondria sp. (cf. *H. diversispiculata* Burton)
Holm of Howton, Birsay

Hymeniacidonidae

Hymeniacidon sanguinea (Grant)
Birsay

POECILOSCLERIDA

Esperiopsidae

Esperiopsis fucorum (Esper)
Birsay

Crellidae

Pytheas rosea (Topsent)
St. Margaret

Hymedesmiidae

Stylostichon plumosum (Montagu)
St. Margaret

HAPLOSCLERIDA

Haliclonidae

Haliclona spp. (at least 2 species)

Notes:- The complete identification of Halichondria sp. would require a comparison with the type specimen, and that of Haliclona spp. a revision of the north-european species of the family.

- Pytheas rosea, found at St. Margaret, presents some little differences with the English Channel specimens: the tornota are smaller (about 190-205 μ) and the cortical acanthostyli have more numerous and shorter spines. Nevertheless, there is no major reason for separating it from the typical P. rosea (Topsent).

Louis Cabioch

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The official version of Dr. Harford Williams discussion at Cardiff was lost in Her Majesty's postal services, consequently only the lecture notes appeared in the last edition of the Newsletter. We apologise for any inconvenience this may have caused Dr. Williams and our readers.

The summary of the discussion is now printed in full below.

Monogeneans and cestodes in marine hosts

By Harford Williams*

The Open University in Wales

An estimate was given of the number of papers published on monogeneans since 1758, known species and those which remained to be discovered and described. In this respect monographs by Sproston 1946 and Hargis et al 1969 had been invaluable. A definition of the monogeneans emphasized that they are with rare exception platyhelminth parasites of the skin and gills of fish, species specific to their hosts, have a single-host life-cycle (with rare but significant exceptions) and locate hosts by means of a short-lived free-swimming larva known as an oncomiracidium.

The talk concentrated on the objectives of recently published papers in testing two interesting hypotheses:

i. Eggs are produced by monogeneans and the the fertilized ovum within these eggs reach the infective ciliated stage when the hosts are most vulnerable to attack i.e. when they are resting, shoaling, congregating for spawning or concentrated in localized feeding grounds.

ii. Tapeworms have evolved from monogeneans.

With the aid of transparencies attention was therefore given to:

i. Egg-production in relation to host behaviour in Protancyrocephalus, Mazocraes and Gastrocotyle.

ii. Destiny of the eggs in Nitzchia, Entobdella and Acanthocotyle.

iii. Incubation period in Acanthocotyle and Dictyocotyle.

iv. Hatching of the oncomiracidium in Leptocotyle, Rajonchocotyle, Squalonchocotyle, Acanthocotyle and Entobdella.

v. Behaviour of the larva in Entobdella and Acanthocotyle.

vi. Invasion of fish hosts by Entobdella.

The application of these observations in relation to evolutionary and fisheries biology was emphasized. For instance it is now possible to predict the behaviour of halibut from the hatching behaviour (at dusk) of the egg of Entobdella hippoglossi.

* Honorary Research Associate, The National Museum of Wales.

The behaviour of Entobdella soleae and three species of Diclidophora is also directly related to the behaviour of the host species.

It was concluded that less than a dozen of well over a 1000 species of monogeneans have been studied in depth. Recently accumulated knowledge on these however does support the view that tapeworms have evolved from monogeneans. The important position of Gyrocotyle in this matter was highlighted.

The talk was based on some original observations and the following references in particular contain many additional sources of information.

Kearn, G.C. (1973)
An endogenous circadian hatching rhythm in the monogenean skin parasite Entobdella soleae, and its relationship to the activity rhythm of the host (Solea solea).
Parasitology, 66, 101-122.

Kearn G.C. (1974)
Nocturnal hatching in the monogenean skin parasite Entobdella hippoglossi from the halibut, Hippoglossus hippoglossus.
Parasitology, 68, 161-172.

Kearn, G.C. (1974)
The effects of fish skin mucus on hatching in the monogenean parasite Entobdella soleae from the skin of the common sole, Solea solea.
Parasitology, 68, 173-188.

Llewellyn, J. (1972)
Behaviour of monogeneans. In Behavioural Aspects of Parasite Transmission.
Zoological Journal of the Linnean Society, 51, Supplement 1, 19-30.

Macdonald, S. (1974)
Host skin mucus as a hatching stimulant in Acanthocotyle lobianchi, a monogenean from the skin of Raja spp.
Parasitology, 68, 331-338.

Macdonald, S. (1975)
Hatching rhythms in three species of Diclidophora (Monogenea) with observations on host behaviour.
Parasitology, 71, 211-228.

Sproston, N.G. (1946)
A synopsis of the monogenetic trematodes.
Zoological Society (London). 25, (4), 185-600.

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The Species Problem: Aspects relating to European marine fauna.

This meeting was held on 24/25th February, 1978 at the Manchester Museum, 45 members and friends being present, representing all parts of the U.K., with particularly strong contingents from Ireland, north and south.

The meeting opened with a short speech of welcome by the Director of the Museum, Mr. A. Warhurst, and the scientific proceedings then got off to a flying start with a paper, from Dr. M. Carter, on the breeding and brooding of the sea-anemone Actinia equina. Dr. Brenda Healy then gave a most illuminating talk on the Enchytraeidae which impressed upon us, inter alia, the great practical difficulties involved in studying this group of minute, wormlike creatures. The morning session ended with an exposition from Mr. C.J. Webb of some species differences in the anatomy of gobies.

After lunch the meeting enjoyed a colour film presented by Mr. D. Erwin, "Down under Down", about the Strangford Lough survey; the film included some fascinating underwater shots of the animal and plant life of the Lough. The film was followed by more beautiful slides illustrating sea-slugs of the genus Doto, while Mr. B. Picton explained the finer points of the group to us. After tea Mr. D. Heppell related the story of the recent stranding of Architeuthis in Scotland and of the investigation to which it gave rise. On Friday evening members and guests met in the Senior Common

Room for informal discussion.

Saturday started with a lively A.G.M. where discussion about the frequency and location of future meetings became at times quite intense, although a consensus was finally arrived at. Dr. N.P. Wilkins then spoke on the use of gel electrophoresis in taxonomy, and explained with great clarity the problems associated with meaningful interpretation of gels. Professor Cain next addressed the meeting on the problem of recognising and explaining away closely related sympatric species, taking as his text the by-now-notorious winkles.

After lunch Miss C. Hannaford-Ellis told us of her recent studies on the winkles and of her elucidation of the "rudis-patula" complex. The last main talk was delivered with much gusto by Mr. R. Bamber who illustrated and explained the current position in pycnogonid nomenclature and taxonomy.

During both afternoons a number of short contributions were given by various members; the active discussion after all the papers indicated that the audience was both receptive and perceptive, and the hubbub during the breaks confirmed the wisdom of allowing plenty of time for individual discussion.

Summaries of the lectures are given below.

Charles (Bill) Pettitt
Manchester Museum.

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Actinia equina L. a problematical species

M. A. Carter and C. H. Thorp

Department of Biological Sciences, Portsmouth Polytechnic.

The species Actinia equina L. as at present constituted contains two varieties mesembryanthemum and fragacea. Mesembryanthemum brood young and probably reproduce parthenogenetically; fragacea do not brood young and probably reproduce sexually. There are therefore problems over both the biological and the taxonomic status of the species.

Chia and Rostron first showed that the sexes of var mesembryanthemum are separate and that males and sexually immature individuals brood young as well as females. They were not able to find any young at an earlier stage than planulae among the broods. They therefore suggested that this was a cross fertilizing species with release of preplanulae which subsequently found their way into other adults to continue development.

We have sampled on upper and middle shore sites (both 10m x 10m) at Bembridge, Isle of Wight. We also found that sexes were separate among the 240 adults tested. The average frequency of sexually mature individuals over a twelve month period was 32.5$\pm$ 4.6% at the upper site and 20.8$\pm$3.7% at the middle site. The average frequency of brooding individuals for the same period was 75.0$\pm$ 4.0% and 75.8$\pm$ 4.0% respectively. Sexual individuals were significantly heavier than non sexual ones at both sites (upper shore sexual individuals, average weight 3.98 gms; non sexual individuals 2.80 gms; mid shore sexual individuals 2.08 gms, non sexual individuals 1.59 gms). Females were heavier than males at both sites but not significantly so. Note the weight differences between sites.

Although these data agree with that obtained by Chia and Rostron we do not agree with their interpretation since, like Cain, we found that parent and brooded progeny column colours were identical. We sampled 360 adults and 2428 young and found that red adults contained red progeny and brown ones brown progeny.

Cain suggested that a high degree of self fertilization would give results such as these. The separateness of the sexes means that phasic hermaphroditism is the only possible mechanism to bring about self fertilization. We found that 16 of the 22 individuals containing planulae among their broods were non sexual. Planulae are

the closest embryonic stage to the egg and therefore to the female state and the observation that planulae are often found in non sexual individuals supports the sex phase change hypothesis.

However, we do not feel that this hypothesis accounts for reproduction of var mesembryanthemum. We have analysed the esterase phenotypes in 11 individuals and their broods by electrophoresis. The major esterase pattern is simple and consists of a double band or a single band which may be fast or slow. We interpret these as being heterozygous, or one of the two homozygotes for a monomeric enzyme. Five of the eleven adults were heterozygous and all their progeny (total 94) were also heterozygous. The homozygous adults produced only homozygous off-spring.

The lack of segregation among the heterozygotes rules out both self fertilization and cross fertilization as reproductive mechanisms in mesembryanthemum unless there is some mechanism whereby a parent selects its brood. We have tested this by flushing broods out of their parents enteron and have been unable to get any of the ten parents tested to take up their own broods when the young were placed on their oral disc.

This leaves either asexual reproduction or parthenogenesis as the most likely reproductive mechanism. Asexual reproduction is known to be very rare in this species and we could find no evidence of it. Parthenogenesis could maintain a high degree of heterozygosity such as we have found. However, simple parthenogensis cannot be the reproductive mechanism here because males are present in the Bembridge population throughout the year. It is possible that the stimulus of gametal contact is required to stimulate parthenogenetic development of mesembryanthemum. We have noted that the structure of the egg is peculiar.

A. equina var fragacea individuals have a more restricted distribution than mesembryanthemum and where they occur they are usually found near the low tide mark or in crevices in the rock. We sampled a population at Wembury, Devon and found that the fragacea were on average heavier than the mesembryanthemum occurring with them. The great majority of the fragacea were sexually mature, the opposite being true of the mesembryanthemum. None of the fragacea brooded young whereas the great majority of the mesembryanthemum were brooding. Fragacea have been observed to release sperm in the Marine Laboratory at Plymouth. These observations suggest that the reproductive strategies of the two forms are quite different and they may be reproductively isolated.

References:

Chia, F-S and Rostron, M.A., J. mar. biol. Ass. U.K., 18, 435-476 (1970)

Cain, A.J., Nature 247, 289-290 (1974)

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A review of the Genus Doto (Mollusca: Opisthobranchia) in the N.E. Atlantic and Mediterranean

B. Picton - Ulster Museum

Introduction

Within the distinctive genus Doto there is a very considerable taxonomic and nomenclatural confusion. Exactly how many real taxa are involved is uncertain but I would guess that fifteen have been properly recognised to date in the areaunder consideration, and further that some species remain to be described. However, there are at least 32 nominal species (i.e. names).

This confused situation has been caused by a number of factors.

1. Workers describing taxa without a full appraisal and understanding of the existing literature.

2. The isolation of workers, both geographically and in time.

3. The description of taxa with very little discussion of facies variability and an apparent lack of understanding of modern species concept.

4. The tendency of earlier workers to erect nominal taxa on very few specimens

5. The tendency of authors to give insufficient indication of the diagnostic characters to be used in separating closely related species.

6. The abundance of poor description, poor illustrations and non-existent or inadequate type material.

These and related problems have led to very real confusion: it is often difficult to unequivocally link a name or names to a taxon.

History

Until 1976 it was a relatively simple matter to identify specimens of Doto from the British Isles. Five species were listed - Doto cuspidata and Doto cinerea, both rare, - Doto pinnatifida and Doto fragilis, well-known and easy to recognise, - Doto coronata common and extremely variable. This was the state of affairs as laid out by Eliot (1910).

Lemche (1976) examined coronata and came to the conclusion that this name was being used for several closely-related species. He described five new species from this aggregate and speculated that what was left as Doto coronata was still an aggregate. In the same work he described a sixth new species which had probably been previously confused with Doto pinnatifida, and raised two of Eliots (op. cit) subspecies to (doubtful) specific rank. Doto cinerea sensu Eliot is not in Lemches opinion Doto cinerea Trinchese and is removed from the British list.

Lemche was not the first person to suspect that there were more species of Doto in the N.E. Atlantic than the British workers recognised. Hesse (1872, 1873) described six new species of Doto from Brittany. Unfortunately his drawings are rather stylized and he made no comparison with previously described species. Both Pruvot-Fol (1931) and Lemche (op. cit.) treated these names as synonyms or nomina dubia. Lemche (pers. comm.) subsequently suggested that he had identified Doto onusta as "the common species taken on Dynamena pumila" but this was never published.

Trinchese (1881) described seven new species and two forms of Doto coronata from Naples. His illustrations are large and clear but only three of these species have been recognised by subsequent workers, Doto rosea and D. cinerea are synonyms. Two other species are possibly conspecific with two of Hesse's species but the presence of these Mediterranean species in Brittany would require confirmation.

Schmekel and Kress(1977) examined the taxonomy of Doto species from Plymouth and Naples. Unfortunately this work was in press when Lemches paper was published and consequently they treat Doto coronata as one species. In the light of Lemches findings their Plymouth coronata consisted of two or three species and their Naples coronata was probably a fourth species. Doto acuta is described as a new species from Naples.

I have listed all the nominal species of Doto, with probably synonymies, in table 2.

The traditional taxonomic approach

I have formed opinions on the merit of some of the characters which have been traditionally used in the taxonomy of this genus. Numbers of cerata and numbers of tubercles on the cerata obviously increase with growth, but the maximum numbers can be cautiously used as taxonomic characters. Odhner (1936) placed far too much emphasis on these meristic characters in his revision of the world Doto spp. Presence or absence of pseudobranchs is an important character, but can only be judged on fully grown cerata. I found a considerable size range in adult Doto dunnei but they always had large, characteristically shaped pseudobranchs.

These are only some of the taxonomic characters which must be used with caution but as this is not the main subject of this paper I do not propose to discuss the use of other characters here.

An Ecological Approach

Since Lemche's 1976 publication I have searched for Doto species at every opportunity. Lemche gives a different hydroid species as the normal food for each of his new species and lays considerable emphasis on this factor. It has been known for a long time that many nudibranchs show great food-specificity and that this was a factor allowing maximum niche-exploitation. (Thompson 1964) I found it difficult to recognise these new species to begin with, most of the characters used could only be seen under a microscope. Therefore I collected by searching for particular hydroids, looking for the conspicuous nudibranch spawn-coils, and then searching for the tiny well-camouflaged animals.

The animals collected in this way invariably fitted Lemche's descriptions, and animals collected on a single hydroid species showed little variation in colour pattern and even less variation in structure. Doto koenneckeri presented some problems as I could not find Thecocarpus myriophyllum which Lemche quotes as the food of this species. This is a deep-water hydroid yet Lemche informed me that it grew abundantly on algae at Kylesalia Creek in Galway. I visited this site in September 1977 and also spoke to Gerd Koennecker who had collected much of Lemche's material. Koennecker suggested that Lemche meant Aglaophenia pluma which was indeed abundant at Kylesalia. My suspicions were confirmed by a photograph from Philippe Bouchet which shows an animal with all the characters of D. koenneckeri feeding on Aglaophenia pluma.

I also found many Doto coronata agg. specimens on a variety of hydroids apart from those listed by Lemche. Miller (1961) gives an even longer list of food-hydroids and I have incorporated all this information into table 3. In several cases there have been clear differences in structure and pigmentation between these other groups of animals and I believe that many of these hydroids support undescribed species of Doto.

Doto coronata ss.

If all these segregates, both described and undescribed, are valid species it is important to determine which one should bear the name coronata. This name was given by Gmelin (1791) to an animal described by Bomme (1769, 1773) from the Netherlands. The animal is figured by Bomme on a hydroid which appears to be a species of Eudendrium, Eudendrium rameum probably. I have never found this hydroid but Schmekel and Kress (op. cit.) give Eudendrium sp. as food for Doto paulinae in the Mediterranean. I think it likely therefore that an investigation of E. rameum in the Atlantic will produce specimens of the true Doto coronata.

Species or varieties?

If we are really dealing with true species in Doto we must consider carefully how and why they form reproductively isolated groups. Species cannot be described simply from any degree of morphological difference but only on grounds or reproductive isolation. Two species may be morphologically identical and yet have well-developed isolating mechanisms preventing interbreeding. These sibling species are quite common in some insect groups, Anopheles is a good example (Mayr 1969).

In the field groups of Doto individuals are usually found on fairly large clumps of hydroids. They appear to only crop the hydroid colony and may remain on one colony for their whole life. Thus at maturity we have small isolated groups which are reproductively isolated from other groups. The critical factor is therefore not whether the adults are selective but whether the veliger larvae are able to select a particular species of hydroid. Thompson (1958) has shown that metamorphosis in nudibranchs is often dependent on the presence of the adult food. I believe that this situation will be found to apply in these Doto species.

Without experimental evidence it is, of course, possible to put forward the

alternative hypothesis that the morphological differences are caused by a different diet. In many of the species the differences, such as presence or absence of body tubercles, shape of spawn, etc., are so great that true species are clearly involved. The species which are only separated by differences of pigmentation and minor structural differences require more careful treatment. Studies of animals collected from the same hydroid in different localities should show how much variation may be expected and allow comparison with animals collected from other hydroids.

Doto fragilis constitutes a special case at the moment as it seems to feed on hydroids belonging to two different families, Haleciidae and Plumulariidae. It would seem quite likely that a species could feed on two closely related hydroids but this is somewhat unexpected. It is of course possible that two or three sibling species are involved here but I have not observed any consistent differences between these animals. Further careful observation and possibly experimentation will be needed to resolve this question.

Conclusion

This account of the taxonomy of the genus Doto has focussed attention on three aspects.

A brief analysis of the history of work on the group has shown how the present state of chronic taxonomic and nomenclatural confusion has arisen. Attention has been drawn to the drawbacks of taxonomic analysis based on purely morphological criteria and an 'ecological' approach to the problem has been suggested.

It seems to me that real progress in sorting out the species of Doto will only be made when workers are thoroughly familiar with modern species concept and its associated technique. An essential prerequisite is to divorce the taxonomic problems from the nomenclatural problems inasmuch as that is possible. Once a sufficient amount of material of the genus, from the N.E. Atlantic and the Mediterranean (and if possible from further afield), is available it should be possible to clearly segregate and distinguish taxa. This is quite a different thing to recognizing phena which is what some previous workers have done. By taxa I mean reproductively isolated units composed of populations - that is to say 'true species'. These should then be described in terms of their facies variability and emphasis placed on diagnostic characters (sadly lacking in early, and some recent, descriptions) and types designated. In the case of nudibranchs I would reiterate my special plea for good coloured photographs as ancillaries to preserved type material. The application of names to the taxa (nomenclature) should properly follow the taxonomic analysis.

The taxonomic work can only proceed satisfactorily when we are certain of which morphological characters are phylogenetically significant. It seems to me that many taxonomic characters used by early workers and some currently in use may not be phylogenetically significant. There are many indications that some groupings are instances of convergence and not relationship. A more thorough understanding of the functional morphology, breeding behaviour and the general biology of the animals would greatly help in sorting out the taxonomy of these fascinating animals.

I have spent much time arguing the case for an ecological approach to the taxonomy of Doto and given very little time to the traditional morphological approach. This emphasis has not been partisan. I am however convinced that study of the feeding preferences of Doto species, that is the association of one species with a particular group of hydroids as a food-source and the association of a closely related species with a different group of hydroids will enable initial recognition of such sibling pairs or sets. If, say, analysis of the food requirements of a 'species' indicates anomalies in that distinctive forms, or simply even isolated populations of apparently identical morphology, feed on different sets of hydroids, then I regard this as a clue to the existence of siblings or a species aggregate and not proof (we might be dealing with a polymorphic species). Proof would require exhaustive study in the traditional way, that is morphological analysis and possibly in some untraditional ways, biochemistry and genetics for instance.

Acknowledgements

I would like to thank Philippe Bouchet of the National Museum D'Histoire Naturelle, Paris, for the slides and information on Doto koenneckeri. My thanks also go to Robert Nash of the Ulster Museum for helpful criticism of my manuscript, and to Mary McTear for her accurate typing of the final copy.

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Doto species in the British Isles 1978

Doto coronata agg (Gmelin)
Doto fragilis (Forbes)
Doto pinnatifida (Montagu)
Doto cuspidata Alder and Hancock
*Doto papillifera Eliot
*Doto nigra Eliot
Doto maculata (Montagu)
Doto tuberculata Lemche
Doto eireana Lemche
Doto koenneckeri Lemche
Doto millbayana Lemche
Doto dunnei Lemche

*Status uncertain (Lemche 1976)

Nominal species of Doto from the N.E. Atlantic and Mediterranean

N.E. Atlantic

D. coronata	(Gmelin)
D. cuspidata	Alder and Hancock
D. dunnei	Lemche
D. eireana	Lemche
D. fragilis	(Forbes)
D. koenneckeri	Lemche
D. maculata	(Montagu)
D. millbayana	Lemche
D. pinnatifida	(Montagu)
D. tuberculata	Lemche
*D. armoricana	Hesse ? = D. pinnatifida ? = D. cuspidata
*D. aurita	Hesse ? = D. aurea
*D. confluens	Hesse
*D. crassicornis	M. Sars ? = D. fragilis
*D. nigra	Eliot
*D. onusta	Hesse
*D. ornata	(Alder and Hancock)
*D. papillifera	Eliot
*D. pinnigera	Hesse ? = D. fragilis
*D. styligera	Hesse ? = D. paulinae

Mediterranean

D. acuta	Schmekel and Kress
D. cinerea	Trinchese
D. coronata	Trinchese 1881 non Gmelin
D. doerga	Marcus (Type locality = Caribbean)
D. floridicola	Simroth (Type locality = Azores)
D. paulinae	Trinchese
D. pontica	Swennen
D. rosea	Trinchese (synonym of D. cinerea)
D. susanae	Fez
*D. aurea	Trinchese
*D. costae	Trinchese
*D. cornaliae	Trinchese
*D. splendida	Trinchese
*D. forbesi	Deshayes (Type locality unknown = (France))

*Not recognised recently.

Table 3

SPECIES OF HYDROIDS EATEN BY DOTO SPP. IN BRITISH ISLES

Tubulariidae	
Tubularia larynx	Doto coronata (M.C.M.)
Corynidae	
Coryne muscoides	Doto coronata (M.C.M.)
Sarsia eximia	Doto coronata (M.C.M.)
Clavidae	
Clava muticornis	Doto coronata (M.C.M.)
Bougainvilliidae	
Bougainvillia ramosa	Doto coronata (M.C.M.)
Garveia nutans	Doto coronata (B.E.P.)
Eudendriidae	
Eudendrium rameum	Doto coronata s.s. (Bomme)
Campanulariidae	
Campanularia verticillata	Doto coronata (M.C.M., B.E.P.)
Obelia geniculata	Doto coronata (B.E.P., M.C.M., H.L.)
Lafoeidae	
Lafoea dumosa	Doto coronata (M.C.M.)
Haleciidae	
Halecium beanie	Doto coronata (M.C.M.)
H. halecinum	Doto fragilis (B.E.P., etc.)
H. muricatum	Doto fragilis (giant form) (B.E.P.)
Sertulariidae	
Diphasia tamarisca	Doto coronata (M.C.M.)
Dynamena pumila	Doto onusta (H.L., B.E.P.)
Sertularella gayi	Doto tuberculata (H.L., B.E.P.)
S. polyzonias ?	Doto coronata (M.C.M.)
Abietinaria abietina	Doto coronata (A.&H., M.C.M., B.E.P.)
Hydrallmania falcata	Doto coronata (A.&H., M.C.M., B.E.P.)
Sertularia argentea	Doto coronata (M.C.M., B.E.P.)
S. operculata	Doto eireana (H.L., B.E.P.)
Plumulariidae	
Kirchenpaueria pinnata	Doto dunnei (H.L., B.E.P.)
Ventromma halecioides	Doto coronata (A.&H.)
Schizotricha catharina	Doto maculata (H.L., B.E.P.)
Plumularia setacea	Doto millbayana (H.L., B.E.P.)
Nemertesia antennina	Doto pinnatifida, Doto fragilis (B.E.P.)
N. ramosa	Doto cuspidata, Doto fragilis (B.E.P.etc.)
Aglaophenia pluma	Doto koenneckeri (B.E.P.*)
A. tubulifera	Doto sp. nov. (B.E.P.)

Different sorts of species; taxonomic and ecological

The problems arising from closely related species in the same area are two-fold - how can they be recognised, and how do they co-exist? Forms that reproduce sexually at least at some period in their lives normally require some sort of recognition-mechanism; they too may get confused, and as mating with the wrong species may produce no progeny at all, there will be strong selection for distinguishing characters. Many secondary sexual characters, of all description, are used for recognition, and these will necessarily be the best characters for identification of the adults. Examples of species-specific characters of the penial armature were given from the winkles Littorina obtusata, mariae, nigrolineata, neglecta and rudis.

Wholly asexually reproducing species are species only by courtesy, but they too, like sexual species and their young, must occupy a definite ecological niche in order to persist. Characters adapting them to their specific mode of life, if any can be found, must then be used to recognise them. Alternatively, since the more alike two species are, the more distinct they must be ecologically to persist, the type of habitat they occur in may be diagnostic or nearly so (one in the Pelvetia zone, the other in the barnacle zone, etc.). It is very unsafe to look for non-adaptive characters on the grounds that they are unlikely to be affected by local adaptation, and therefore indicators of the stock. Such characters as have been carefully investigated (including isozymes) have nearly always been found to be subject to selection.

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Sibling Species in Littorina "saxatilis"

Before 1974 all British rough winkles were thought to be one species, L. saxatilis, and this species was split into various subspecies and varieties, depending on the morphology of the shell. Latterly, it has become apparent that a number of quite distinct species were being mistakenly called by this one name, due to the general similarity of their shells.

The speaker recognised four species in the L. saxatilis species-complex, which were L. rudis, L. nigrolineata, L. neglecta, (all previously described by J. Heller in 1975) and a fourth newly-recognised, oviparous species. Consideration was given to the morphological differences that separate these four species, which principally concerns the morphology of the reproductive system. The extent to which the shell can be of use in identifying each of the four species was also discussed: two of the four species, L. neglecta and L. nigrolineata, have species-specific shell types.

Since the four species are commonly sympatric the question of niche separation arose. There is no evidence to suggest that they are food specialists, hence they must be avoiding competition in some other way, e.g. they might be expected to be zone specialists. However, ecological studies done at Porth Swtan, Anglesey, indicate that the four species are avoiding competition in a more complex fashion.

The adults of L. rudis and the newly-recognised species appear to co-exist in the Pelvetia and Verrucaria zones. However, if the zonation of the populations are examined over the whole year it becomes apparent that the females of the latter species migrate downwards when they become reproductively mature. Furthermore these two species appear to avoid competition in their juvenile stages by occupying quite separate zones.

Adults of L. nigrolineata, which are of a comparable size to these two species and might therefore be expected to compete with them, zone below them in the barnacle belt. The fourth species, L. neglecta, is quite minute, rarely growing to more than 4 mm in shell height, and because of its small size it is presumed that its potential competitors are most likely to be the juveniles of the other species. However, there is a definite banding pattern of zonation of the species in the barnacle belt, and also L. neglecta appears to take advantage of a temporal size zonation by reproducing earlier in the year than its main competitors. This work is being supported by a N.E.R.C. research studentship.

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The Morphological Taxonomy of Nymphon rubrum (Pycnogonida)

During analysis of the Northumberland pycnogonid fauna, some difficulty was experienced in distinguishing between specimens putatively attributable to Nymphon rubrum Hodge, 1865 and N. brevirostre Hodge, 1863 (=N. brevitarse Kroyer, 1844), despite the fact that this area includes the type localities for both "species". Previous workers, notably Losina-Losinsky (1935) and Hedgpeth (1963), have discussed the similarities and confusion of this "species complex", and variously united or distinguished them; it is presently accepted that N. brevirostre is synonymous with N. brevitarse, but N. rubrum "may be distinct". Most recently King and Crapp (1971) established a 'distinction' based on the proportions of body segment II from some British specimens.

The Northumberland individuals, together with specimens from the Norman Collection (B.M.N.H.), giving a total of 102 specimens, were analysed with regard to nine morphological parameters which have been variously used to distinguish the two species.

Body size, body colour (live), leg length to body length ratio, tibia I to femur length ratio, oviger spines and propodal spines were found to offer no significant distinction between even typical forms of either 'species' (see Sars, 1891). Ratios of the proportions of the cephalon, the proportions of body segment II, and the lengths of the tarsus and propodus of the walking leg were analysed and compared to a size parameter (length of coxa II): all three showed normal distributions as a histogram with no significant bimodality, and significant correlation to body size.

It was concluded that these shallower water forms of N. brevitarse show a range of morphological characteristics from the 'brevirostre' form, particularly when young, towards the 'rubrum' form as they grow, with local populations demonstrating differing emphases on one or other form in some cases. 67% of specimens were totally intermediate between the two forms.

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The amphipod genus Siphonoecetes

Studies on amphipods of the genus Siphonoecetes in Irish waters by the writer and Mr. D. McGrath have revealed the presence of two distinct species. The two species differ markedly in pigmentation, a character rarely used in amphipod taxonomy due to rapid fading of pigments in alchohol preserved material. The writer, however, has found pigment patterns to be remarkably constant in corophioidean Amphipoda. The genus Siphonoecetes is highly conservative morphologically and also polythetic, and a study of the two Irish species has revealed differences only in the structure of Gnathopod 2, Uropod 1 and Uropod 3. A study of material in the British Museum (Natural History) has shown that all British and Irish material therein can be attributed to one or other of the two species, although a few specimens (lacking pigmentation due to long periods of preservation) have proved difficult to assign on any single character taken in isolation. The bathymetric distribution of the two species has not yet been fully elucidated, but it would appear that one species occurs in shallow water (0-20m) the other in deeper (80m+) water, although additional data may show an overlap in distribution. The shallow water species builds tubes of agglutinated sand grains while the other is apparently associated with empty tubes of the polychaete Ditrupa or empty scaphopod shells. However, the deeper water species has only been sampled by means of grabs and dredges, and the disturbance caused by this means of collecting frequently results in the animal leaving its habitation so that it is not possible at the moment to ascertain whether this is a consistent difference

in the behaviour of the two species. It should also be pointed out that neither Ditrupa tubes nor scaphopod shells are available in shallow waters and the shallow water species might utilise Ditrupa tubes or scaphopod shells if given the opportunity.

All British and Irish records of Siphonoecetes have been referred to either S. dellavallei or S. colletti. In general records of S. dellavallei emanate from southern localities, those of S. colletti from the northern regions. This would appear to relate to the usage of the literature, northern workers tending to utilise Sars (Crustacea of Norway, Vol. 1) whilst southern workers generally rely on Chevreux and Fage (Faune de France, Vol. 9). Sars describes only two species, S. colletti and S. pallidus the latter being a very distinct deep water species. Chevreux and Fage describe three species including both S. dellavallei and S. colletti. Unfortunately the key couplet which separates these two species in their work is based on an incorrect character which leads to the identification of British material as S. dellavallei a species shown by Myers (1978) to be a Mediterranean endemic.

One of the two Irish species is probably conspecific with S. colletti but it is not possible at this moment to ascertain which, since Axel Boeck's original description is insufficiently refined to distinguish between the two. Sars' figures and description of S. colletti are enigmatic in that they appear to be a mixture of the two species.

The shallow water species is probably conspecific with S. kroyeranus Bate although that species is described as lacking a rostrum. The rostrum may have been overlooked by Bate (as it was by Kroyer in his description of the type species of the genus S. typicus).

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Aspects of the taxonomy of Enchytraeidae (Oligochaeta)

Enchtraeidae occur in all kinds of moist soil, including acid peat, in fresh and brackish water and in marine littoral and sub-littoral deposits to a depth of at least 2,500m. There are 21 world genera but only four are well represented in marine habitats: Enchytraeus, Lumbricillus, Marionina and Grania. About 50 species are recorded from the marine littoral and sub-littoral in Europe. A key to littoral species is given by Tynen and Nurminen (1969).

Criteria for species definition have been established by Nielsen and Christensen (1959, 1961, 1963) who describe 112 European species and review the extensive and often very confusing literature. A further 50 or so species have been published in the last fifteen years and it is certain that many more await description. Identification is based on size, setal shape and number, gut form and diverticula, septal glands, nephridia, brain, origin of pulsating portion of the dorsal vessel, coelomocytes and reproductive organs. The most important diagnostic character is the spermatheca; mature, fertilized specimens are thus usually essential. Characters are best observed in living specimens. Stained mounts or sections have severe limitations and require experience but interference phase microscopy, using whole mounted or unmounted specimens is a promising technique which could make type material more useful.

The species problem in enchytraeids centres around the wide intraspecific variation which is characteristic of many species, especially those with a broad ecological or geographic range. Some variation can be related to ecological factors, some to observed cytological differences (chromosome number, cytotypes) and some to geographic separation. Only in the genus Grania has a trinomial system of nomenclature, long established for the Lumbricidae, been adopted for species in which geographically

separated populations show distinct morphological differences.

Enchytraeid taxonomy is still in an early developing phase. There is a lack of information about the range of variation within recognised species and, consequently, indecision as to the relative weighting of characters for diagnosis. The situation is aggravated by the understandable caution which prevents authors from describing species or variants which are not obviously distinctive. A more daring, communicative attitude would, perhaps, be more appropriate at this stage. The newly formed Committee of Oligochaete Taxonomists plans to issue a newsletter which may help to overcome some of the problems.

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Brenda Healy.

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The application of electrophoresis to problems in taxonomy

Electrophoresis has been used in taxonomy for over a quarter of a century. In the early days of its use the idea arose that species exhibited specific, exclusive electrophoretograms - "species specific patterns". In the last decade, increasingly more powerful electrophoretic and staining procedures have shown that for many proteins a high degree of intraspecific and interspecific variability is common, and the concept of "species-specific patterns" has been abandoned for these proteins. This has not meant that electrophoresis is less valuable in taxonomic studies, but that analyses must extend to a larger number of different enzyme proteins before different taxa can be reliably compared. In general, the greater the systematic difference in the taxa being compared, the greater the difference observed between their enzyme proteins. Populations of a single species are identical with one another at most enzyme loci; sub-species are less similar, sibling species show greater differentiation, and so on. While taxa of any systematic rank can be compared by analysing variability at their enzyme-encoding gene loci, and the more loci analysed the more informative the comparison, it is clear from studies on numerous species that there exists no objective electrophoretic criterion for any specific systematic category. Populations which differ in electrophoretic studies cannot be assigned to different systematic categories, on electrophoretic evidence alone - questions of sympatry, ecological differentiation and reproductive isolation must first be considered. Electrophoresis, then is not an "all-or-none" tool in taxonomy and systematics as earlier ideas of species-specific patterns might have implied. Never the less its value in population genetics, in evolutionary and development biology, in physiology and ecology, and as an aid in many other aspects of biology is unquestioned.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The draft third edition of the International Code of Zoological Nomenclature is now available for comment by zoologists. Copies may be obtained (price £2.50 surface mail, £5.00 air mail) together with copies of the paper explaining the major changes proposed (price 50p) from the Publications Officer, International Trust for Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London SW7 5BD, U.K.

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The Type Method and the 'Species'

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Historical Introduction

Types are of such fundamental importance in both taxonomy and systematics that one would expect both clear expositions of type theory in the literature and a well-defined code of practice to which most, if not all, zoologists would adhere. The fact that this is not so seems to derive from the history of zoology. Most early zoologists were trained first and foremost as classical scholars, thoroughly familiar with the philosophical concepts of Aristotle and Plato enabling them to interpret the divine order of the Cosmos. The 'universals' of Greek philosophy and the metaphysical notion of a driving force were very readily applied in Zoology. The animal kingdom presents an obvious natural order and in the works of Plato, Aristotle and God's Creation a metaphysical construct of order was equally obvious. A marriage of the two was inevitable.

The type concept of the zoologists of the 18th century is termed 'typology' or 'typological thinking'. The precepts of typology follow from the intellectual background of its proponents. The natural world was clearly divisible into discrete sets of recognisably similar individuals (species - species level taxon). Each taxon in accord with philosophic concepts had a perfect form or essence. To achieve the classical ideal of an ordered world required categorisation, an essential prerequisite of which was to give species names. Not, of course a new idea but hitherto somewhat random. Carl von Linne, the tireless Swedish doctor, presented the 18th century world with just what it wanted - an ordered system of names 'Linnaeus' and his immediate followers set about naming and ordering. Following their classical mentors they saw each taxon in terms of a perfect form. Those individuals which most closely approached this abstraction were considered typical or type and descriptions of the species were based upon them, or, alternatively an abstract ideal was based on typical forms which were the 'natural' basis of the description. Of course not all members of a taxon accorded with this ideal form, but when the purity of the Greek philosophic ideal was frequently thwarted by reality - the Scholastic "accidents". Any individuals which failed to accord with the perfect form were considered the equivalents of the Scholastic "accidents" and excluded from the description and tacitly from the ideal species.

Given these 'a priori' precepts it followed that early authors felt at liberty or even under an obligation, to replace material in their collection on which they had based descriptions. The reason for such replacements was usually that the types had been damaged in some way but sometimes because more perfect 'types' had become available. This practice was continued in some museums well into the 19th century. Another hangover of early type-concept in todays museums are collections labelled "Type-Collection of X-shire Lepidoptera or Type Collection of Ordovician Brachiopods".

Not only did the Scholastic perfect forms and related metaphysical ideas relate to species descriptions but such pre-Darwinian theories of evolution as were proposed hinged on a pervasive striving towards perfection. The acceptance of the Darwin-Wallace model of natural selection as a convincing mechanism for evolution threw into doubt not only Biblical Truths but also provided an objectively based counter-argument to such philosphical abstractions. Not much later Karl Marx was to have exactly the same impact on the Hegelian theories of social organisation - an astonishingly similar parallel!

One of the bases for the new explanation of evolution was the demonstrable variation within species. The emphasis on variation in the new evolutionary species concept was of course the antithesis of the 'perfect form' of the classical species concept but the full realisation of this significance was slow to emerge. Only gradually through the 19th century and early part of the present century was the deeply rooted static concept of species replaced by the modern idea of species as variable, genetically isolated, populations.

Contemporary taxonomists consider that descriptions should take account of the known variation of the species or, in some cases, be based on studies of variation (see Neville-George). This is not always possible, of course; some descriptions are based on only one specimen because only one specimen was available but even here there is tacit acceptance of the potential for variation. In this 'schema' types clearly cannot have representational function; they serve only as name-bearers.

It is essential that names should be unequivocally applied: everyone must call a cat a cat and a kettle a kettle otherwise chaos would result. Unequivocal name application is the essence of modern type-theory. Simpson (1967) has pointed out that in order to achieve this types must be unique and, in view of the confusion caused by historic usages of the term type, as well as by vernacular usages, proposes a new term 'onomatophore' (literally-name-bearer) to replace the term "type". Unfortunately this excellent suggestion has never been widely accepted and we are still left with an amalgam of old and new concepts.

Modern Type Method

Both Mayr and Simpson propose a type-doctrine in which only unique types are allowed and in which the only allowed function of the type is to bear a name. An author conceives a species as a genetically isolated variable unit which is described in terms of its variation. A single specimen from within the limits of variation of the authors species is designated type. The type does not in any way 'represent' the species, neither is it, to employ a 'common' usage 'typical' nor is it the basis of the description. To emphasise this many taxonomists now refer to the 'type of a name' and not the type of a (nominal) species.

The practice of designating a holotype or selecting a lectotype from a series of syntypes is almost universal and is in perfect accord with the 'unique type doctrine'. However many authors still base descriptions on single specimens or small groups of selected specimens when a large hypodigm is available, still use types as standards of reference or representatives, still regard types as amplifying descriptions and some even regard them as 'defining' the species. Even the most rigorous anti-typologists seem to shrink from designating 'atypical' specimens as type. Tacit witness to the lingering survival of 'typology' are the surviving subsidiary types - paratypes, paralectotypes and allotypes.

This synthesis of old and new type-concepts is not only apparent in current taxonomic practice but is, in some measure enshrined in the International Code of Zoological Nomenclature.

Categories of types - simple definitions

Most zoologists accept the definitions of types given in the International Code of Zoological Nomenclature (1961 revised 1964) and the following account is based largely on these definitions. The Code sometimes appears ambiguous or even contradictory. This unfortunate state of affairs arises from the history of type concept. Whereas the Code frequently stresses the need for unique types in accord with modern theory it also recognizes the type-series. What is more typological than the phrase defining type-series "The type series of a species consists of all the specimens on which its author bases the species except any that he refers to as variant or doubtfully associates with the nominal species or expressly excludes from it". It might at first sight appear that the authors of the Code are old-fashioned or confused but this is most certainly not the case. The majority of animal species were named and described when 'typological thinking' still held sway and since we choose to use the oldest name given to a species (priority) we are forced back to old types and old type concepts.

Simple definitions of the 'true' type categories

TYPE-SERIES

At the time of writing the original description of a species an author had before

him either

1. a series of specimens

2. a single specimen

on which he prepared the species description. These specimens on which the description was based are called the type-series for that species.

HOLOTYPE

If the type-series consisted of one specimen that specimen is called the holotype. If the type-series consisted of several specimens but one of these was referred to in the description as 'the type' or some expression indicates that one specimen of the series is equivalent to the type than that specimen is called holotype. Modern authors designate either the single specimen or one of a series as the holotype.

PARATYPE

After a holotype has been selected from a type-series the remainder of the specimens from the series are called paratypes.

In the Mayr-Simpson 'unique-type' doctrine paratypes are redundant. However many zoologists continue to designate them often for rather obscure reasons.

SYNTYPE

If the author has based his original description of a species on a 'type-series' of more than one specimen and has not designated or indicated a holotype then the series of equivalent specimens is referred to as syntypic and its individual components are called syntypes.

Zoologists are now disallowed from basing a species description on a series of syntypes. However this was a frequent practice of older authors - generated, at least in part by the intellectual acceptance of variation within species. Some syntypic series have, on subsequent examination turned out to be mixtures of two or even three taxa - a potent argument in favour of the unique type doctrine. In the interests of nomenclatural stability lectotypes (see below) should be designated for all species names based on such series. However lectotype designations should not be made individually but only in the course of revisionary work.

LECTOTYPE

It is usual nowadays to employ only the terms holotype and paratypes when describing a species. When a specialist studies a syntypic series for revisionary purposes it is recommended that he selects one of these to serve as the type. This specimen is called a lectotype and on its designation the remainder of the series become paralectotypes. Functionally holotypes and lectotypes are precisely equivalent the only difference between the two being that the lectotype was chosen from the original authors type-series by a subsequent author or by the original author in a subsequent work.

PARALECTOTYPE

After a lectotype has been chosen the remaining specimens from a syntypic series are called paralectotypes. Paralectotypes are the functional equivalents of paratypes but are 'chosen' (by being remaindered) by a subsequent author from the original authors syntypic series.

NEOTYPE

When all the original type material is believed to be lost or destroyed a neotype may be designated usually from more modern material of the species taken in the type-locality. This category is used only in exceptional cases.

Pseudotypes, typoids and type terms no longer in use

The six 'true' type terms have been discussed above. This number would, however be reduced to three by some authors who would accept only the unique type, i.e. holotype, lectotype and neotype. These authors would view paratypes and paralectotypes as being redundant and would seek the replacement of the syntypic series by the single lectotype.

However the term 'type' has been prefixed in a multiplicity of other ways. Frizzel (1933) lists 233 usages, Fernald (1939) lists 108 but only includes terms applicable to single specimens, and Sadbrosky (1942) gives a further 7 (these compendia apply to botany as well as zoology). The specimens to which these additional terms refer may have special significance or attributes such as, being figured, originating from the type-locality, being of opposite sex to the holotype or whatever but none are types in the modern sense and, in this context are best wholly ignored.

Further reading and references

The present paper has been concerned with the history of type- concept and with giving some simple definitions of type terms. (one of us (R.N.) is in process of preparing a much fuller account of both type-theory and practice). The works listed below are essential reading for those wishing to follow up this short introductory paper.

Anon. 1961 (revised 1964) International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology, London, July 1958. London; International Trust for Zoological Nomenclature (the'rule book').

Blackwelder, R.E., 1967. Taxonomy. John Wiley and Sons, New York 698pp. (A very sound and unrepentant work on the principles of neotypology).

Fernald, H.T., 1939. On type nomenclature. Ann. Ent. Soc. America 32: 689-702. (A compendium).

Frizzell, D.L., 1933. Terminology of types. American Midl. Nat. 14: 637-638. (A compendium).

Jeffrey, C., 1973. Biological Nomenclature. Systematics Association (Arnold) (An excellent short introduction for both zoologists and botanists).

Mayr, E., 1969. Principles of Systematic Zoology. McGraw Hill. New York (All zoologists should have a copy of this masterly treatise. It includes an annotated transcription of the Code).

Simpson, G.G., 1940. Types in modern taxonomy. American Journal Sci. 238: 413-431.

Simpson, G.G., 1961. Principals of animal taxonomy. Colombia University Press, New York. (A very lucid logical account of modern methodology).

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The Underwater Conservation Programme

Dr. Bob Earll, Projects Co-ordinator, Underwater Conservation Programme, Zoology Department, University of Manchester, Manchester M13 9PL.

Underwater Conservation Year was planned against a background of increasing 'diver pollution' and a concern that some action should be taken to conserve important sublittoral habitats. In order to collect information of value in planning conservation activity it was proposed that amateur divers supervised by marine biologists should be used. Bellamy and Whittick (1968) had shown the value of such an approach, since nationwide data on sublittoral populations could be collected in a short period of time. By the very nature of their activities amateur divers are ideally placed to aid the collection of data on sublittoral populations.

Due largely to the considerable efforts of Dr. Charles Sheppard the projects co-ordinator, and the organising committee a large amount of valuable data was

collected during the year. The projects divers became involved in ranged from recording the habitat at sublittoral sites, the species recording scheme (see article), a project designed to record the distribution of Echinus, and a nudibranch survey.

The Underwater Conservation Programme is the extension of Underwater Conservation Year. Broadly its aims are as follows;

1. to promote the conservation of the underwater environment, especially among amateur divers.
2. to liaise between amateur divers and research scientists in order to put forward a programme of research projects which will act as a scientific basis for future conservation programmes.
3. to organise an effective body which will provide continuity, communication, and co-ordinate activities for divers interested in underwater conservation and natural history.

Plans for the 1978 season are still being formulated, however the habitat, species recording project, Echinus and nudibranch projects are to continue. In addition to this a basic observation card scheme is to be introduced, serving not only to encourage divers to make biological observations but also to provide a very valuable source of information. If you feel that amateur divers could contribute to a project you are concerned with, either by collecting samples or records please let me know. Amateur divers quite frequently visit very isolated parts of our coast and can easily provide data from these areas. If you contact me I will be only too willing to put you in touch with an appropriate amateur diving group.

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The Species Recording Scheme

Bob Earll and David Erwin.

The Species Recording Scheme (SRS), was planned as an integral part of the projects for Underwater Conservation Year (UCY). Underwater Conservation Year was planned against a background of increasing 'diver pollution' and a concern that some action should be taken to conserve important sublittoral habitats. In order to collect information of value in planning conservation activity it was proposed that amateur divers supervised by marine biologists should be used. Bellamy and Whittick (1968) had shown the value of such an approach, since nationwide data on sublittoral populations could be collected in a short period of time. By the very nature of their activities amateur divers are ideally placed to aid the collection of data on sublittoral populations.

The Species Recording Scheme is a project based on the recording card principle. As such, the scheme is rather different from previous projects which have sought to use amateur divers since it requires an ability to recognise and identify marine life underwater rather than merely collecting samples. The scheme was designed for amateur divers and it is the first time a recording card scheme has been tried out with this group. Conceptually it is also rather different to traditional mapping - record card projects for not only are the species chosen important sublittoral species whose distribution can be mapped, but the species also act as indicators of key sublittoral habitat types. Card returns are made for single depth zones (i.e. 0 - 5m, 5 - 10m etc.) at any particular site. The species selected are taken from a number of phyla and are all prominent and easy to identify underwater. From this approach it is hoped not only to be able to record the distribution of important sublittoral species on a nationwide scale but also to be able to describe the habitats at the sites visited, many of these will be popular diving sites.

At the end of the first season (summer 1977) we have received almost 400 record cards from 60 contributors. Whilst the project was clearly pitched at too high a level for the 'average' club diver the returns are of excellent quality. On average each card contains 100 'bits' of information; during this year the data will be transferred to a computer based system.

We have produced a preliminary report illustrating our results and to provide participants with 'feedback'. The results of the first seasons work have been so encouraging that we intend to carry on with the scheme for another two years with the final aim producing an atlas of the common sublittoral marine life around the U.K. We hope to be able to complete this by 1980. Should anyone require further information on the project contact either David Erwin or Bob Earll.

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Observations on the Distribution of Caryophyllia smithi.

In several parts of the North of England divers have formed groups which cater for members interested in Marine Biology. The largest of these groups, the NORFED Marine Biology Group based in the N. West of England introduced a basic observation card scheme during 1977. Among the records received were the following observations on the distribution of Caryophyllia smithi. Gordon James of York University observed Caryophyllia in the North Sea off the Farne Islands and Beadnell Bay. Similar observations have been made by members of the North Eastern Marine Biology Group. Apparently these observations represent the most southerly distribution yet recorded for Caryophyllia in the North Sea.

The following observations are taken from the NORFED Marine Biology Groups Newsletter.

Observer	Site	Date	
B. Parr	Sgeir Eirin Rock, North of Staffin Bay, Scotland.	7.8.77	Caryophyllia on rock. 15m.
D. Moss	Lock Scridain, Isle of Mull. NM 442 241	10.8.77	5-6 specimens at 9m on rock amongst kelp.
R. Crosby	South of Oban, Seil Island, Easedale. NGR 740 176	13.9.77	Large numbers on boulder at 27m. Odd individuals on vertical rock wall up to 10m.
R. Crosby	Near Port Erin, Isle of Man. NGR 185 686	22.8.77	Caryophyllia on boulders at 15-20m.
G. James	Beadnell, Northumbria.	17.7.77	Caryophyllia on wreck of SS Somali. Slightly silty. 23m below C.D.
G. James	Blue Caps, Farne Islands.	16.7.77	Caryophyllia on vertical cliffs. 10m. Occasional.
G. James	Mull, Scotland. Ardtornish Bay below castle. 50° 31'N 5° 46'W		Single individual on rock scree. 12m.
G. James	N.W. Coast of Loch Buie. S. Coast Mull. 56° 19'N 5° 55'W.		Many animals on wreck at 9m. Water temperature 7°C.

R. Earll.

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REVIEW

British Sipunculans - Dr. P.E. Gibbs

The latest addition to the Synopses of the British Fauna by Dr. Gibbs is a carefully prepared and well-illustrated account of the Sipunculans, a phylum which hitherto was dealt with only in occasional papers by sipunculan taxonomists and ecologists or in large and expensive monographs. Dr. Gibbs deals first with the

anatomy, biology, collection and preservation of the group and then explains its checkered taxonomic history. For the non-sipunculan specialist, this section brings up to date the latest thinking concerning classification. The bulk of the synopsis is made up of keys to families, each family being dealt with first by a key and then a description of each genus. This part includes notes on geographical distribution and general ecology as well as concise drawing. The book is fundamental for ecologists needing a readily available accurate book dealing with Sipunculans.

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Some Recent Records of Okenia pulchella (Alder and Hancock) from Northumberland.

Okenia pulchella (Alder and Hancock, 1854) is one of the rarest of the British Nudibranchia, such that in 1976 there existed only one British record, dating from 1839; elsewhere it was recorded from Scandinavia, over half a century ago (Thompson and Brown, 1976).

In July 1977, an Agassiz trawl sample was collected from 'the Trink', an area of boulder-sized hard bottom material dispersed on mud, some six to seven miles off-shore to the East of Cresswell, Northumberland. Sorting through the hydroids from the sample, two adult specimens of O. pulchella were discovered. They were both just over 1cm. in length, and exhibited a mottled brown colouration. The specimens were photographed, the result being fortunately adequate with regard to recognition of this distinctive species, since, due to a subsequent mishap, the specimens have been lost.

A further single juvenile specimen of O. pulchella was taken and identified by J.B. Sigurdsson from Northumberland in a bottom plankton sample collected in 1976.

Reference: Thompson, T.E. and Brown, G.H. 1976. British Opisthobranch Molluscs. Synopses of the British Fauna (N.S.), No. 8: p. 85. The Linnean Society of London.

R. Bamber.
Dove Marine Laboratory,
Cullercoats.

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FORTHCOMING EVENTS

13th European Symposium on Marine Biology

27th September to 4th October, 1978.

Topic: Cyclic phenomena in marine plants and animals.
Physiological and behavioural rhythms. Cycles of condition, growth, reproduction and abundance.

Place: Sessions will be held in the Villa Marina, Douglas, Isle of Man.

Further details are available from:- EMBS Symposium Office
Department of Marine Biology
University of Liverpool
Port Erin
Isle of Man.

Tel. Port Erin (0624) 832027.

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There is to be an Institute of Biology Symposium on 'Monitoring the marine environment', on 28th-29th September, 1978, in the lecture hall of the Royal Geographical Society, London.

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LETTER TO THE EDITOR

Dear Sir,

Perhaps your membership can help me with regard to a problem type status which I am experiencing. I have some specimens of what I consider to be a new species of mollusc (as yet to be fully analysed), which will consequently be the holotype and paratypes; however, the female is brooding developing larvae, which hopefully will be released before I have to resort to preserving the specimen. Will these larvae be further paratypes (although relatively valueless for comparative purposes with regard to future identification) or is there perhaps such a term as a "larvotype"? Obviously they must be some class of primary type, and, if the term "allotype" is in accepted use, one would expect an equivalent term for larval forms. (I shall not select the holotype from the larvae).

Yours sincerely,

C.T. Canon.

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The Conchological Society of Great Britain and Ireland are holding the following summer field meetings which may be of interest to members.

Weekend - 5th/7th May.
Marine meeting to Rhosilli, Gower.
Leader: Mrs. C.J. Pain. Tel. 01-821 7674 evenings only.

Saturday, 15th July.
Marine meeting in Rye Harbour, Sussex.
Leader: Mr. D. Worth. Tel. 01-778 3087.

For further details please contact the Leaders of the meetings or the Field Meetings Organiser: Mr. T. Pain,
47 Reynolds House,
Millbank,
London, SW1P 4HP.
Tel. 01-821 7674 evenings only.

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