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## Interstitial Fauna from Northern Ireland

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ARMONIES

The area investigated is centred around the Queen's University Marine Biology Station, Portaferry, Co. Down, Northern Ireland. Portaferry is situated at the head of the channel connecting Strangford Lough with the Irish Sea. The lough extends 30 kilometres in a north-south direction. The maximum width is 8 kilometres but the main body of the lough is about 5 kilometres wide. Much of the northern end is only 4 metres deep whereas most of the southern part is between 12—45 metres. The salinity varies little from that of the adjacent sea. The maximum tide range is 4 metres.

The channel connecting lough and sea is 5 kilometres long and only 800 metres wide in places. Hence it is called Strangford Narrows. Strong currents occur with the ebb and flow of the tide through the Narrows. The maximum current is 7½ knots during spring tides. As the channel widens out the current slows rapidly. There are wide differences in the degree of shelter between beaches inside and outside the lough.

Turbulence varies greatly from area to area due to these differences in current and exposure. The result is bottom and shore deposits ranging from rock and boulders to fine sand and mud. Substrata suitable for interstitial fauna range from very coarse shell at the entrance to the lough to the fine sand at the northern end. Hence the area seems particularly suitable for studies of distribution in relation to particle size.

Some idea of the diversity of the interstitial fauna can be gained from the following list. Some of the Crustacea encountered have been examined by Dr. J. B. J. WELLS and an account of these can be found elsewhere (WELLS 1963).

### Cnidaria

- Halammohydra octopodides* (2)
- H. schulzei* (1, 2)

### Turbellaria

- Kalyptorhynchia
- Acrorhynchides robustus*
- Baltoplana magna*
- \*) *Carcharodorhynchus*  
      *subterraneus* (1, 3)

- \*) *C. polyorchis*
- \*) *Cheliplanilla caudata* (5)
- \*) *C. karlingi*
- \*) *Cicerina brevicirrus* (5)
- \*) *C. remanei*
- \*) *C. tetradactyla*

\*) No distinction between these species has been made in the present survey.

- ✓ *Danorhynchus duplostylis*
- ✓ *Diascorhynchus rubrus*
- ✓ *D. serpens*
- ✓ *Gnathorhynchus conocaudatus*
- ✓ *Gyratricella attemsi*
- ✓ *Gyratrix hermaphroditus*
- ✓ *Neognathorhynchus lobatus* (5)
- ✓ *N. suecica*
- ✓ *Odontorhynchus lonchiferus*
- ✓ *Paracicerina laboica*
- ✓ *Proschizorhynchus arenarius*
- ✓ *P. faroensis*
- ✓ *P. gullmarensis*

Others

- ✓ *Acanthomacrostomum spiculiterum* (1)
- ✓ *Archilopsis unipunctata*
- ✓ *Bulbotoplana acephala*
- ✓ *Coelogynopora biarmata*
- ✓ *Euxinia baltica*
- ✓ *Gnathostomula paradoxa* (2, 4, 5)
- ✓ *Hangethelia calceifera*
- ✓ *Macrostomum pusillum*

Gastrotricha

- ✓ *Cephalodasys maximus*
- ✓ *Dactylopodalia baltica* (2)
- ✓ *Dinodasys* sp. (4)
- ✓ *Diplodasys ankei* (1, 3)
- ✓ *Macrodasys buddebrocki* (2, 5)
- ✓ *M. caudatus* (4)
- ✓ *M. remanei*
- ✓ *Mesodasys lobocercus*
- ✓ *Paradasys cambrensis*
- ✓ *P. subterraneus*
- ✓ *P. turbanelloides* (2)
- ✓ *Paraturbanella intermedia*
- ✓ *P. teisseri* (4)
- ✓ *Platydasys brachycephalus*

Annelida

- ✓ *Dinophilus taeniatus* (4)
- ✓ *Diurodrilus minimus* (4)
- ✓ *Mesonerilla armoricana* (2)
- ✓ *M. lagei* (1, 3)
- ✓ *M. roscovita* (1)
- ✓ *Nerilla antennata* (3)
- ✓ *Nerillidium gracile* (2, 3)
- ✓ *N. simplex* (1)
- ✓ *N. troglochaetoides* (4)
- ✓ *Polygordius* sp. (1)

- ✓ *Psammorhynchus tubulipenis* (4)
- ✓ *Ptyalorhynchus coecus*
- ✓ *Rhinepera remanei* (4, 5)
- ✓ *Rogneda hibernica*
- ✓ *Scanorhynchus forcipatus*
- ✓ *Schizochilus choriurus*
- ✓ *Schizorhynchoides spirostylus*
- ✓ *Thylacorhynchus arcassonensis*
- ✓ *T. conglobatus*
- ✓ *T. vicarus* (4)
- ✓ *Uncinorhynchus flavidus*
- ✓ *Utelga heinkei*
- ✓ *Zonorhynchus seminascatus* (5)

- ✓ *Otoplana foliacea*
- ✓ *Paramalostomum dubium*
- ✓ *Parotoplana capitata*
- ✓ *Polystilophora filum*
- ✓ *Promesostoma caligulatum*
- ✓ *Provortex tubiferus*
- ✓ *Proxenetes angustus simplex*
- ✓ *P. flabellifer?* *clavicornis?*
- ✓ *Vorticeros auriculatum*

- ✓ *Tetranchyroderna cirrophora* (2)
- ✓ *T. coeliopodium*
- ✓ *T. polyacanthus*
- ✓ *T. suecica* (2, 4)
- ✓ *Thaumastoderma heideri* (2)
- ✓ *Turbanella cornuta*
- ✓ *T. hyalina* (5)
- ✓ *T. subterranea*
- ✓ *Urodasys mirabilis*
- ✓ *Aspidiorphorus marinus*
- ✓ *Chaetonotus* spp.
- ✓ *Neodasys chaetonotoideus* (5)
- ✓ *Xenotrichula beauchampi*
- ✓ *X. micranthus*

- ✓ *Protodrilus adhaerens* (2)
- ✓ *P. chaetifer* (4)
- ✓ *P. symbioticus*
- ✓ *Trilobodrillus heideri* (2, 4)
- ✓ *Ophryotrocha baccai*
- ✓ *Psammodrillioideus fauveli* (1)
- ✓ *Psammodrillus balanoglossoides* (2)
- ✓ *Phyllodoce pusilla*
- ✓ *Pisione remota*
- ✓ *Zeppelinina monostyla*

Various

- ✓ *Gollingia minuta* (4)
- ✓ *Encentrum* sp.
- ✓ *Echinoderes* sp.
- ✓ *Batillipes mirus* (5)
- ✓ *Microcharon harrisi* (3)
- ✓ *Gnathia hastata* (1)
- ✓ *Lepidomenia hystrix* (1, 3)

- ✓ *Embletonia pulchra*
- ✓ *Hedylopsis* (*brambelli* SWEDMARK in litt.) (2, 3, 4)
- ✓ *Philinoglossa helgolandica*
- ✓ *Leptosynapta minuta* (1, 3)
- ✓ *Heterostigma lagei?* (1)
- ✓ *Psammostyela delamarei?* (1)

The numbers on the list refer to the following collection localities. Numbers are not given to all the species from these localities but only to those thought to be of particular interest in the context of this paper.

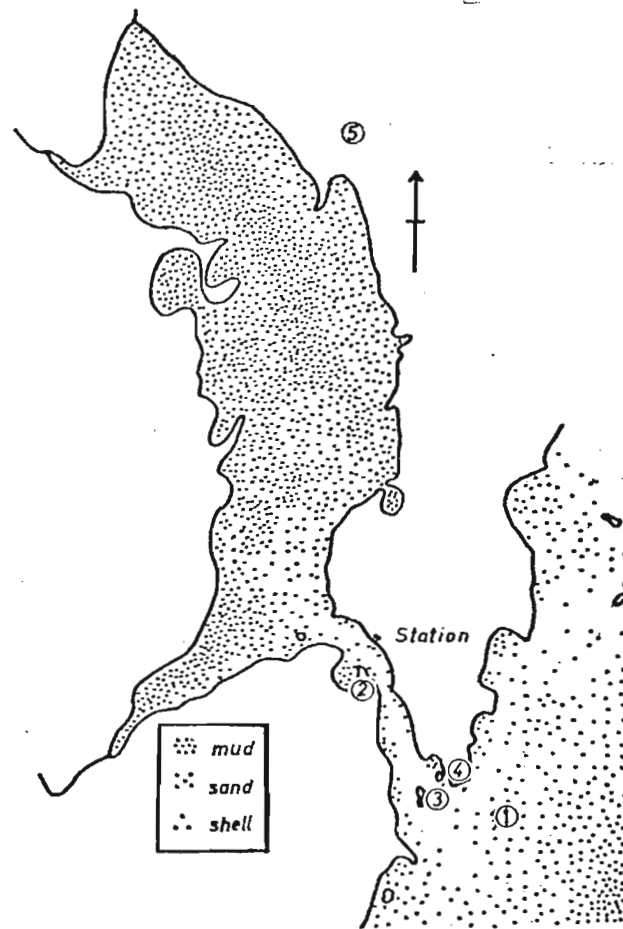


Fig. 1 Strangford Lough. Numbers refer to localities mentioned in the text. Inshore islands omitted.

1. Strangford Fairway Buoy. This lies just outside the lough entrance. The substrate is medium shell gravel lying at 25 metres depth. The macro-fauna of this area (see WILLIAMS 1954) corresponds closely to the boreal offshore gravel community of JONES (1950). In addition to the species listed at least four undescribed solenogasters occur. This group seems to be a neglected component of the interstitial fauna. SWEDMARK (1956) has remarked on the occurrence of solenogasters near Marseille. The only other mention seems to be their absence from Amphioxus sand at Banyuls (MONNIOT 1962). Large numbers of larval *Gnathia hastata* occur in substrate from the buoy area.

2. Strangford Harbour. This lies at the north-west end of the Narrows. The substrate, dredged from 3 metres depth, is fine shell gravel. It is sufficiently finer than the previous area to allow the occurrence of several species of Gastrotricha. *Halammohydra schulzei* occurs here also but is joined by *H. octopodides*. The species of *Nerillidium* and *Mesonerilla* occurring at the buoy are replaced by *N. gracile* and *M. armoricana*. Undescribed species include two elongated forms — a proseriate flatworm with numerous nematocysts and a macrodasyoid gastrotrich 5—6 mm long.

Further up the lough, for instance at Ballywhite Bay (see BOADEN 1963), samples of medium and fairly fine sand have been dredged. In such samples kalyptorhynchid turbellarians are common and *Halammohydra octopodides* replaces *H. schulzei*.

3. Rock Angus. The coarsest littoral substrate examined is from pockets of fairly coarse shell gravel exposed at low tide on an island at the entrance to the Narrows. The occurrence here of normally sub-littoral forms (such as *Nerillidium*, *Mesonerilla*, *Microcharon*, *Hedylopsis* and two of the

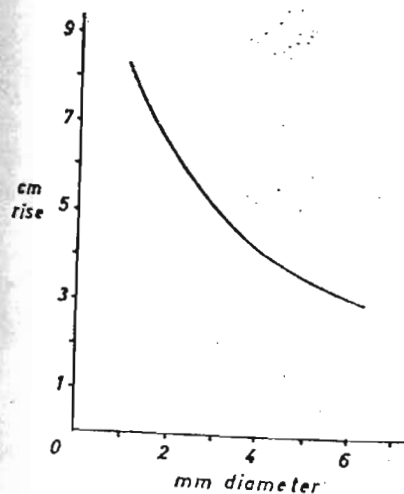


Fig. 2 Height reached by water after 10 minutes capillary rise through graded sands.

undescribed solenogasters) is attributed to the extremely humid conditions resulting from the great tidal turbulence around the island.

4. Black Island. This lies in a small bay on the eastern shore of the Narrows, nearly opposite Rock Angus. A fauna which is extremely rich both in the number of species and the number of individuals is found in samples of medium and fine shell gravel.

5. Various localities toward the north end of the lough. Here the shore is relatively flat with extensive areas of fine sand. Typical species are *Turbanella hyalina*, *Neodasys chaetonotoideus*, *Zonorhynchus seminascatus*, *Cicerina brevicirrus* and *Cheliplanilla caudata*. A gnathostomulid identified as *Gnathostomula paradoxa* (but see BOADEN 1965) is of common occurrence. The median particle diameter of sands where this fauna occurs ranges from a little over 200  $\mu$  down to 145  $\mu$ . This is somewhat lower than the distribution barrier of about 200  $\mu$  deduced by WIESER (1959) from studies of Puget Sound.

Some localities near the entrance to Strangford Lough also have a median grain diameter of little over 200  $\mu$ . However it must be noted that some of the samples from these yield a rather different fauna. Typical species include *Paradasys* spp., *Turbanella cornuta*, *Diascorhynchus rubrus*, *Paracicerina laboica* and *Thylacorhynchus conglobatus*.

The median grain sizes mentioned have been determined by the classical method of weighing sieved fractions. I believe that this is an inadequate, sometimes even misleading, guide to interstitial space.

The available interstitial spaces and their diameter are greatly affected by small mineral and detritus particles lying amongst the larger particles. A small change in percentage weight of fine particles in a given sample can make a great difference to the available interstitial space but practically no difference to the median diameter by weight. This is especially true if the fine particles are of low density compared with the larger particles (e. g. detritus compared with quartz).

Conversely, a large change in the percentage weight of large particles makes very little difference to the available interstitial space but a large change in the calculated median diameter.

Therefore, in investigating the relationship between granulometry and distribution of interstitial fauna, it is desirable to use characters of the substrate other than median diameter by weight. Some approaches toward this are found in the papers by RENAUD-DEBYSER (1963) and RENAUD-DEBYSER and SALVAT (1963).

Sectioning of resin embedded sand to enable direct measurement of interstitial size is a method being used by B. WILLIAMS at the Marine Science Laboratories, Menai Bridge (personal communication).

Another approach is by actual counts of particles of various diameters in a given volume of sand. In common with other approaches this counting

method cannot be undertaken in the field. I am therefore combining this with measurements of sand capillarity. Capillary rise or flow is obviously related to the dimensions of the interstitial system. Figure 2, derived from a table by G. C. RAO (1964) shows the rate of capillary rise in some different grades of sand.

Perhaps approaches such as these will lead to a clearer understanding of the distribution of interstitial fauna and evolution of more appropriate field measurements. The Strangford Lough area with its wide variety of fauna and substrate seems particularly suited to such endeavour.

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#### Diskussion

WIESER: I wonder whether additional parameters could not be used in order to give a better definition of the substrate, for example, skewness of the sizefrequency curve.

BOADEN: It would certainly be possible to make more complete analyses of the substrate. Much work on the physical characteristics of sand has been undertaken by american geologists for instance. However, my hope is to find a parameter which can be measured readily in field samples and which provides data of ecological significance. Thus I will avoid becoming a geologist and remain a zoologist.

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<sup>1)</sup> Die Anregung zu Dr. A. Bückmann, tag widme.

<sup>2)</sup> Herrn H. Mayer von „Meteor“ un