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THE ESCALLOP *PECTEN MAXIMUS* IN MULROY BAY.

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The escallop *Pecten maximus* in Mulroy Bay

by

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ABSTRACT

Following the discovery in 1978 of large numbers of escallops in the North Water of Mulroy Bay, a detailed study of stocks was made in 1979. Spat settled out at shell height 190 to 220 μm from late July to 9 August, greatest density was 1,390 spat per metre of 12 mm diameter blue polypropylene rope. Mean daily growth rates from August to mid October ranged from 196.6 μm falling to 17.5 μm from mid October to December. Greatest densities of adult escallops occurred near rocks at depths from 3 to 15 m. Age frequency determinations showed that settlement had occurred every year since 1967. Serious predation by *Asterias rubens* took place on escallop held in lantern nets. The most successful containers for growth were North West plastic trays held below 5 m depth.

INTRODUCTION

Mulroy Bay is a marine lough system on the north coast of Ireland connected to the open sea by a series of long and narrow channels. The tidal range within the lough is diminished as a result. The lough (Fig. 1) is well sheltered from excessive exposure and no oceanic swells are able to penetrate to the two main parts. The sea water enters through the narrows into the Broadwater, and the Moross channel enables the sea water to penetrate into a further sea lough, the North Water, which is approximately 1 km by 3 km in extent.

The bathymetry of the North Water is not fully known. Admiralty Chart No. 2698 refers to depths of 51 metres, but as the soundings are spread far apart much of the topographic detail has been lost, for example an unmarked reef (Caroline's reef) exists to the West of Croaghan Island which rises from a depth of over 30 metres to a depth of 9 metres, and then descends to over 15 metres on its eastern side.

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During 1978 a preliminary assessment of Mulroy Bay was made by the Diving, Environmental and Mariculture Units of the Fisheries Research Centre. This survey revealed that large numbers of adult escallops were present about the perimeter of the North Water. These were thought to be capable of producing great numbers of larvae, which at the time of settlement might be trapped onto collectors to provide spat for cultivation or for reseeding escallop beds. Accordingly in 1979 the North Water was chosen for a more detailed study. The results of the 1979 investigation presented in this report refer principally to the distribution and biology of escallops and their predators. In May 1980 a bathymetric survey was conducted and a chart was drawn.

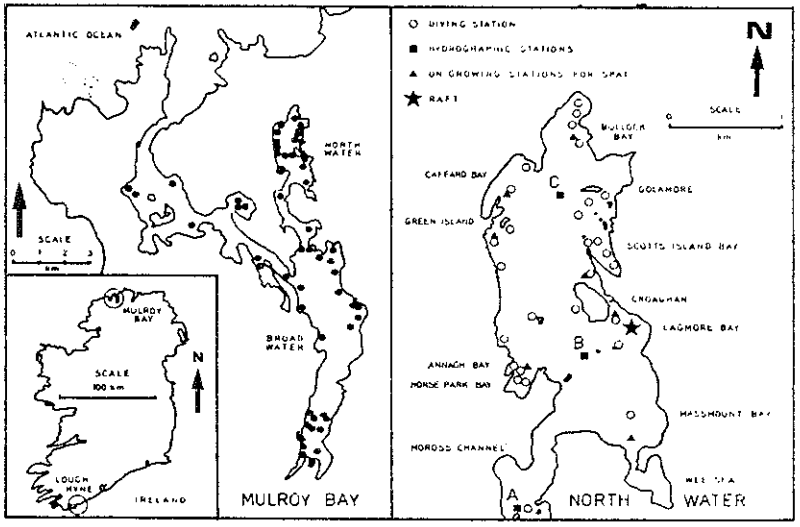

FIGURE 1. Mulroy Bay, Co. Donegal, showing 1978 diving stations. The inset of the North Water of Mulroy Bay showing 1978 and 1979 diving stations, on-growing stations and hydrographic stations as well as regions referred to in the text.

METHODS

No hydrographic data from this area were available prior to 1979, apart from a few observations made during 1978 by the Environmental Unit of the Department of Fisheries and Forestry. Hydrographic stations (Figure 1) were established during 1979 and were situated North of Ferry Islands in the Moross Channel (Station A), between Stookan and Lambs Island (Station B), and between Scotts Island and Caffard Point (Station C). At these stations measurements of temperature using a reversing thermometer and water transparency using a Secchi disc were made and 24 plankton tows were taken at Stations B and C at different time periods.

Vertical hauls were made using a 63 μm Nytal mesh with an open diameter of 30 cm. The bridle of the net was covered with a 10 mm open mesh to prevent *Aurelia aurita* from entering. The larvae of predators, fouling organisms and bivalves were examined on return to the laboratory. Escallop settlement was monitored by skin-diving or by using standard SCUBA equipment. While diving, all depths were measured by means of a SOS helium depth gauge.

Settled escallops were collected from weighted ropes, of 12 mm diameter blue polypropylene, which had been placed across the entrance to Annagh Bay, Horse Park Bay, Caffard Bay and along the Mid Western Slope at depths varying from the surface to over ten metres. The ropes were laid at varying periods from May of the same year by members of the North Water Co-operative with the intention of collecting mussel seed. The escallop spat which settled on these ropes were removed by shaking the ropes vigorously in baths of sea water, this caused the byssus to be broken and the spat settled to the bottom of the bath. Tunicates and waste water could then be poured off with the surface water by tilting the bath.

The spat were then brought ashore and graded. Those passing through the mesh of North West plastic trays, were placed within 2 mm open diameter plastic mesh envelopes, and those that passed through a cement riddle were placed within NW plastic trays, and the largest within Pleno trays.

The 2 mm black mesh envelopes were made up from sections of flat tubing of 39 cm stretched diameter. The open ends of the tubing were folded over and held closed by sliding a slitted section of electrical conduit, made of stiff plastic, over each end. The NW plastic trays are heavy duty grey plastic interlinkable units with an open mesh size of 6 mm. The overall dimensions of these trays are 51.5 cm square by 5.5 cm in height.

The Pleno trays are small wedge shaped trays of 6.5 mm open diameter and a uniform depth of 38 mm. The radial measurement of each tray is 18 cm and the measurement across the base is 26 cm. The Pleno trays were selected for holding spat at a number of sites about the North Water of Mulroy Bay for escallop growth trials at depth of 2 to 3 metres. These trays were held within Japanese type lantern nets of 12 mm mesh suspended from a buoy. The majority of the spat were however held at depths of 2 to 3 m either within Pleno trays or NW plastic trays beneath a raft in Lagmore Bay. From mid October the trays were lowered to depths of 5 to 7 m. Settled escallops collected from ropes and lantern nets at varying intervals of time were measured in order to obtain estimates of growth. Information on the distribution of escallops and predators was obtained from dives made during 1978 and 1979; age determinations were made on a large sample of escallops collected on dives near Golamore Island.

RESULTS

Hydrography

Stratification had appeared by the end of July, when the 1979 study began (Figure 2) and during the second week of August the warmer water had become mixed down to 45 metres. Thereafter no sharp changes of temperature with depths were noted. Temperatures in excess of 15.0°C occurred from 45 metres to the surface from 9 August to 10 September (a period of 32 days) and temperatures of 14.0°C or greater were observed from 27 July to 19 September (53 days). Temperatures of 16.0° and above occurred only for short periods of time but these did not penetrate deeper than 5 metres (Table 1).

Water transparency was measured mainly during the early part of the investigation and this ranged from 7.9 metres to 10.2 metres (Figure 2).

Water movements were not measured, but tidal flow is strong in the Moross Channel and during tidal inflow some water movement towards Massmount Bay was noted, there being at times a sharp delineation with the slacker water to the north. In the region of Massmount Bay small numbers of the weed *Sacchoriza polyschides* were seen in drifts at a depth of 13 m; this species was seen attached only in the Moross Channel, together with *Laminaria saccharina*. A moderate flow of water was found at the entrance to the Wee Sea. No other water movements were noticed apart from surface drift resulting from wind action.

Plankton

The numbers of crab and starfish larvae were counted while alive and all bivalve larvae were preserved for later identification. The numbers of crab and starfish larvae in the plankton were variable, reaching their greatest numbers during August. No starfish larvae occurred in the plankton after 21 August and few crabs after 29 August. Some decapod larvae did appear in the plankton hauls during mid-September (Table 2).

Settlement of escallops

Escallops settled out of the plankton at a mean shell height of 208 μm (range from 76 measurements 190 μm to 220 μm) from the end of July up to 9 August. Natural settlement was observed on the following marine algae:

Chorda filum	*Asperococcus fistulosus*	*Ceramium diaphanum*
Laminaria saccharina	*Furcellaria lumbricalis*	*Sphacelaria* sp.
Gigartina stellata	*Polysiphonia* sp.	*Audouinella* sp.

Spat were also found on a green filamentous alga and on the test of the tunicate *Ascidiella aspersa.* The numbers settled (Table 3) were found to vary throughout the North Water. The greatest quantities of spat were found on rope and the monofilament netting of Japanese lantern nets. In Annagh Bay on 15 August the densest concentrations of escallop spat attached to *Chorda filum* were 242 per metre of *Chorda* length; 12 mm diameter blue polypropylene rope had up to 1,390 spat per metre. On 1 September spat were found attached to *Chorda* at concentrations of up to 712 per metre.

Variable numbers of settled spat and starfish were found attached to lantern nets (Table 4). The lantern net at Caffard Bay was examined by diving before it was lifted and it was found that many of the spat detached themselves from their byssus and swam, to sink later on to the soft mud beneath the lantern net at a depth of *ca* 12 m. Spat were found to be locally abundant on the sea floor, exceeding 50/m^2 beneath the lantern net.

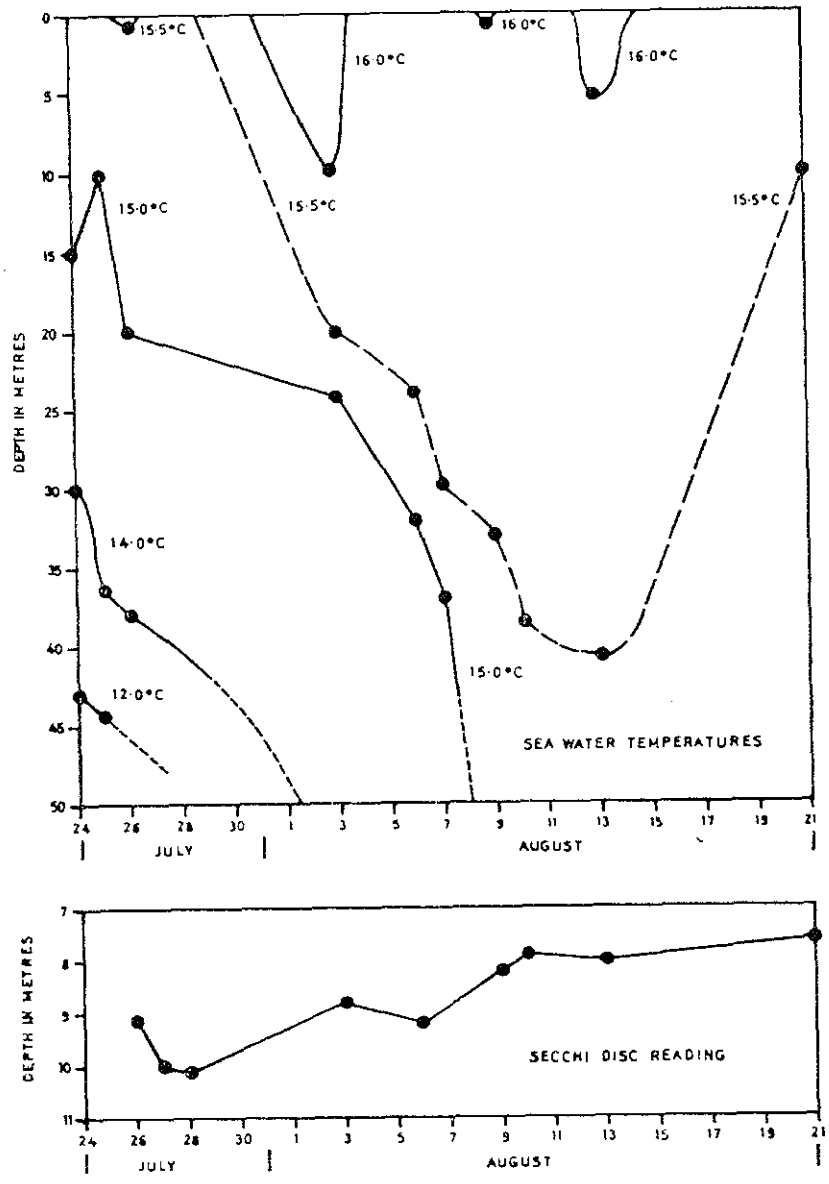

FIGURE 2. Vertical profile of sea water temperatures and secchi disc readings during July and August, 1979.

Escallops were seen to have settled out at all depths that were measured. The deepest location was at 45 m adjacent to station B. The greatest densities of settled spat occurred between 5 m and 15 m (Table 5). In Annagh Bay, Horse Park Bay, Caffard Bay and Bullock Bay very few escallops were found attached at depths of less than 3 m. Eight samples of rope from a depth of 3 m to 4 m gave a mean abundance of 139 spat per metre (range 80 to 180) and four saples taken off rope at 2.5 m depth had a mean of 25 spat per metre (range 0 to 40).

Settled escallops were found from 1.5 m below mean water level, where they were sparse, to 10 m. From 3 m to 10 m depth at Caffard Bay spat were abundant on horizontally suspended ropes. Spat were found attached to a number of weeds collected from 7 m depth by skin diving along the mid western slope.

Growth

Table 5 gives details of shell height measurements of 6,841 spat from 51 samples over five time intervals. The size of the spat collected from the lantern nets gives an indication of the growth at each location. Poorest growth was observed in the region south of Croaghan Island. At the beginning of September the largest spat were sorted and re-distributed according to their size. Those placed in Pleno trays were held at five different locations in the North Water of the lough in lantern nets. These spat were examined on two subsequent occasions 16 to 18 October and 5 to 14 December 1979. Growth rates are indicated in Table 6. Caffard Bay, Bullock Bay and South Massmount Bay showed the best rates of growth but growth between Pleno trays were variable at each site (see Table 7).

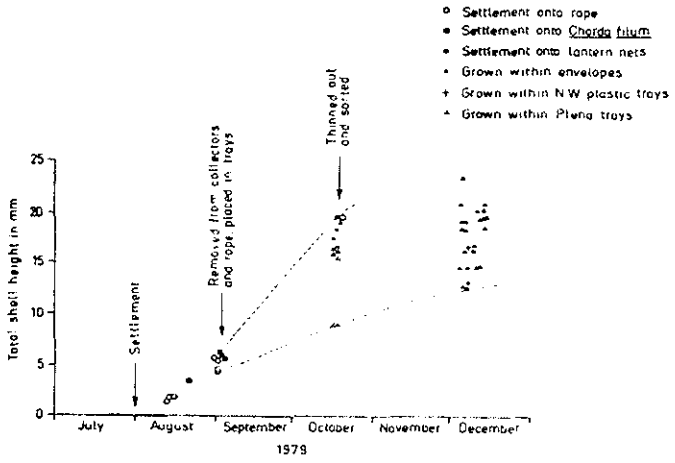

FIGURE 3. Mean shell height of escallop spat per tray under various treatments.

Approximately 350,000 spat were held beneath a raft to the south of Croaghan Island in three types of container. All spat held within Pleno trays had been sorted by passing them through a riddle of 8 mm diagonal mesh measurement. The small escallops were placed in plastic envelopes of 2 mm mesh or into NW plastic trays. An estimated total of 350,000 spat were held in these three container types until 16 October when all spat contained with the envelopes were removed and placed into NW plastic trays. The spat originally contained within the NW plastic trays were held at densities of up to 6,000 per tray until 16 October. The most rapid growth was seen to occur among those escallops which had been left free on lantern nets or on ropes (Figure 3). The mean growth rates of all escallop spat measured during the periods studies were

Dates and Mean Sizes	Sea Temperature at 5m °C	Estimate of mean daily growth rate
14 August (1.86mm)—1 September (5.40mm)	16.05—15.75	196.6μm
1 September (5.40mm)—17 October (15.68mm)	15.75—12.75	223.5μm
17 October (15.68mm)—10 December (16.63mm)	12.75— 8.75	17.5μm

71 escallop spat were obtained from onion bag collectors laid on 9 August and raised on 18 October and their mean size was 7.49 mm.

Distribution and age composition of adult escallops

The distribution of escallops about the North Water has not yet been fully examined, nevertheless some useful conclusions may be drawn from the limited number of dives (25) made during 1978/79 (Figure 4). Escallops were found about the edge of the lough on sandy mud or mud substrates adjacent to rock rubble and rock outcrops, and in shallow bays. The densities of escallops were found to be variable being most plentiful near to rock at depths ranging from 3 to 15 m and a typical profile of the edge of the North water is presented in Figure 5. No escallops were seen on the deep water muds nor on the ledges of the cliff-like reefs.

A sample of 184 escallops collected by diving was examined. The age frequency presented in Table 8 shows that settlement had occurred every year since 1967.

Escallop predators and competitors

The relative abundance of predator larvae is outlined in Table 2. On no occasion were crabs found within collectors *(Macropipus arcuatus* and *M. depurator).* The known distribution of the crabs is outlined in Figure 6.

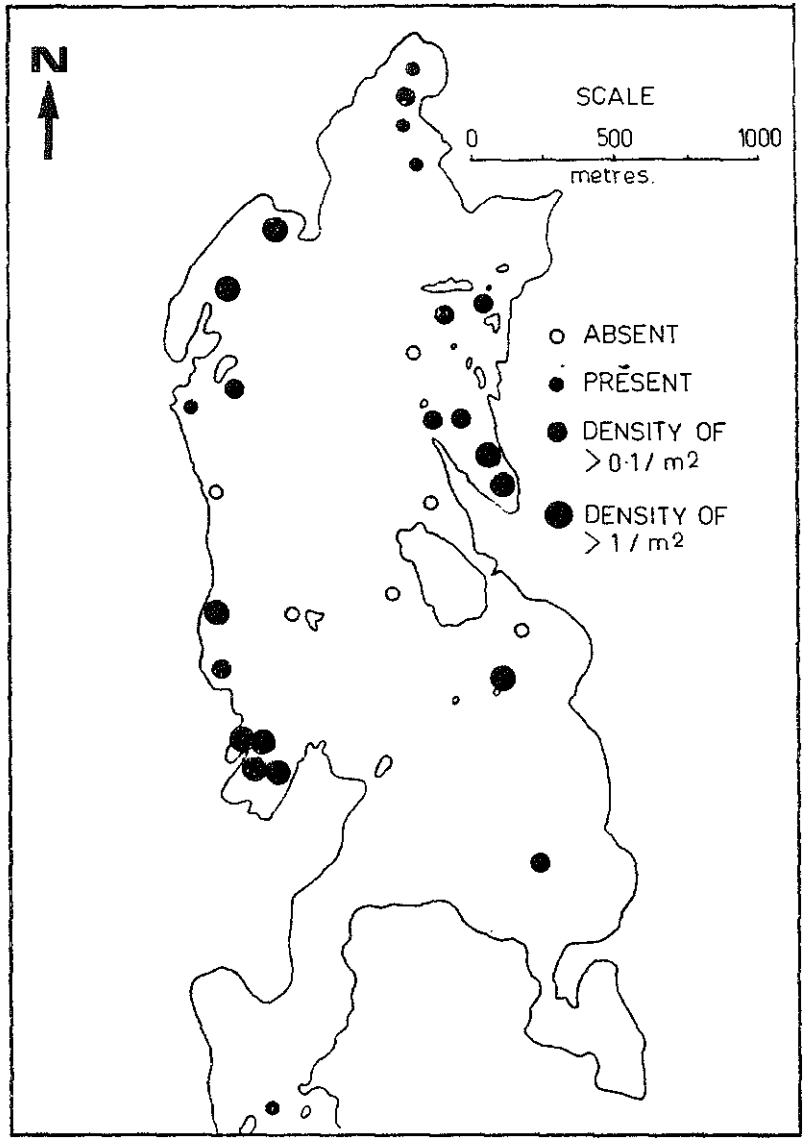

FIGURE 4. The distribution of *Pecten maximus* in the North Water of Mulroy Bay as determined by diving.

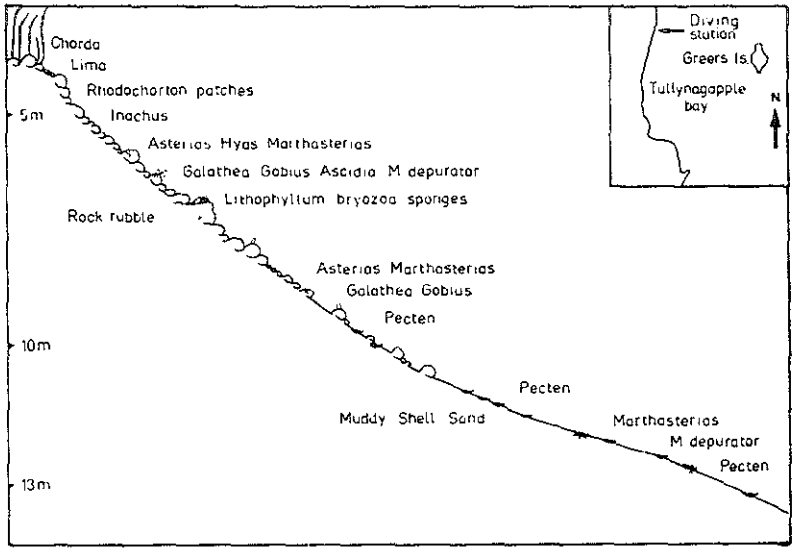

FIGURE 5. Sketch of sea floor to 14m depth at mid western slope. A typical profile for many areas within the North Water.

Starfish, however, were abundant both on lantern nets and trays suspended in the water during the month of August. Large numbers of *Asterias rubens* settled out of the plankton onto lantern nets as may be seen from Table 3, but no *Asterias* were found on any trays or nets introduced to the water after 2 September. An indication of the size of the *Asterias* collected from suspended structures is presented in Table 9. No spawning of *Asterias* was observed but a female *Marthasterias glacialis* collected from 5 metres depth in Bullock Bay was seen to spawn after being taken ashore on 14 August. The distribution of the starfish *A. rubens, M. glacialis, Leptasterias mulleri* and *Solaster papposus* is outlined in Figure 7. The starfish *Asterias rubens* has been seen to feed upon the spat, juveniles and adults of escallops as has the spiny starfish *M. glacialis*. *A. rubens* commonly feeds on *Turitella communis* on the soft mud in Caffard Bay and has also been seen to feed on escallop spat at this location.

The main fouling organisms were the tunicate *Ascidiella aspersa,* the mussel *Mytilus edulis* and various bryozoa. The *A. aspersa* settled during July and August and only a few settled out of the plankton after 2 September. They were found in the North Water at Bullock Bay and Massmount Bay where they occupied over 10% of the surface area on rocks or stones.

The mussel must be considered as a fouling organism because when it is placed into trays with escallops the latter are pulled together by the byssal threads thereby creating a mass of spat which holds the mussel within. This causes many of the spat to die. Those spat that remain alive appear to be smaller than other free spat within the trays and require more attention at the time of sorting.

Collectors laid on 9 August and raised on 18 October beside Station B were examined for the distribution of the various fouling organisms and predators. It was found that various anellids were found at all depths, so was *Ascidiella* which was abundant at 10 m. The tunicate *Ciona* was not found at depths of 30 to 40 m, they were however only occasionally found in collectors at all other depths. Bryozoa were not found on collectors below 25 m. *Asterias* were not found at depths of 10 to 41 m but were found in abundance to 4 m and only a few were found in those collectors suspended at 44 and

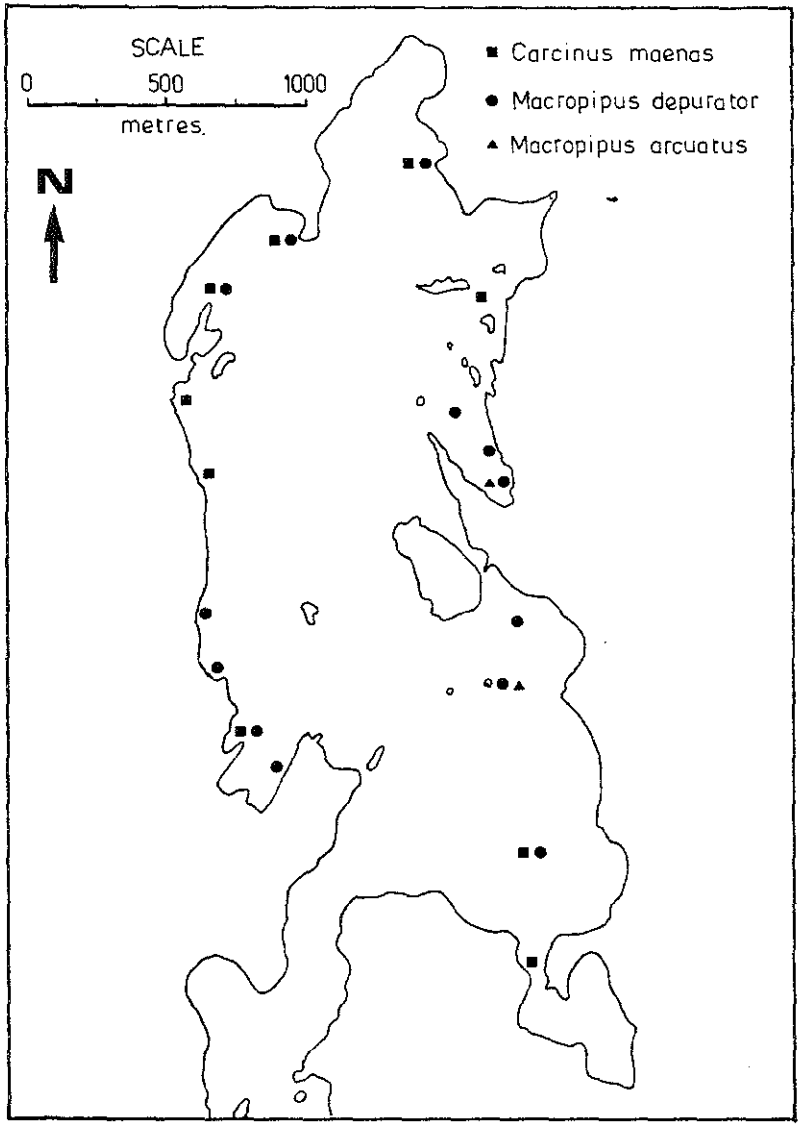

FIGURE 6. Distribution of crabs in the North Water.

47 m below the surface. At Tullynagapple Bay suspended horizontal ropes at depths exceeding 10 m did have *Asterias* attached.

The large numbers of dead escallops on the lantern nets may have been a result of predation from the starfish, *Asterias*. The spat in Pleno trays usually suffered mortalities of less than 1% and never more than 10%. In those cases where the mortality was greater than 1% some *Asterias* were found within the tray.

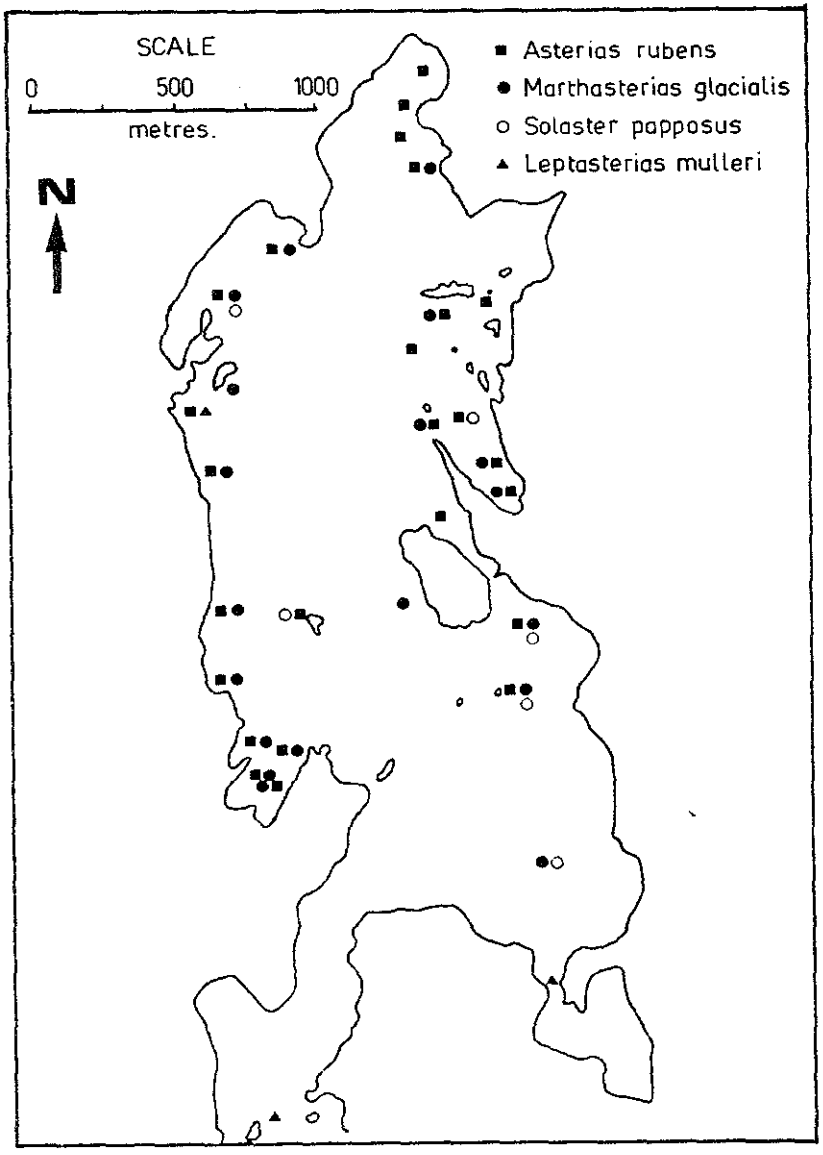

FIGURE 7. Distribution of starfish in the North Water.

DISCUSSION

The North Water of Mulroy Bay would appear to be a very productive area and further investigations are planned for 1980. The large numbers of escallop present in the North Water produce large quantities of larvae which if provided with a suitable surface for settlement can supply numbers large enough for escallop seed production. The mechanism that stimulates spawning is not known but since the only major physical change in the water column appears to be the change of temperature (during July in 1979) it is possible that this may result in triggering spawning. There is evidence of annual settlement since 1967 (Table 7). The annual abundance of settlement cannot be determined from the information now available but the results of settlement since 1967 offer some encouragement.

The spat after settlement grew well until October, probably because of the high sea temperatures attained within the lough during 1979. After mid October when sea temperatures were less than 12.7°C growth was marginal. (Sea temperatures in Lough Hyne in Co. Cork were more than 2° lower than in Mulroy Bay and here no settlement was recorded). The spat held within Pleno trays grew well but as these trays are small, much time was taken up with handling. During September the same volume of spat had been placed in each Pleno tray but many passed through the larger mesh of 8.5 mm forming the walls of the tray, so that different numbers were found in the trays when measured during October and December. The differing numbers in each tray as a result may have modified growth.

The North West plastic trays appeared to be very suitable, although the growth within these containers was not as good as that seen in Pleno containers. Spat held within 2 mm mesh envelopes grew the slowest. It is clear that the small spat collected in September can be grown on with little difficulty and with low mortalities, but handling them involves proportionately more time and they still attain a smaller size and do not appear to catch up with the sizes of the larger spat by December. Should these then be sold as seed in the spring they would have a lower value than larger spat. The only major difficulty at present would appear to be the large numbers of the starfish *Asterias rubens* that settle out onto collectors. The numbers of mussels settling out are small and create an inconvenience at the time of sorting. Placing of collectors lower in the water column may reduce the effects of both starfish and mussels. Tunicates appear to settle throughout the water column and their numbers may be reduced by placing the collectors into the water closer to the time of escallop settlement.

A number of the spat have been distributed to a number of organisations about the Irish coast to examine growth and survival. A larger number are to be used in a reseeding experiment on the SW coast.

RECOMMENDATIONS

1. Escallop collectors should be placed in the water before and close to the time of settlement.
2. Collectors should be set between 5m and 15m depth.
3. Collectors should be held in such a way that they are motionless in the water.
4. Collectors should be removed and the spat sorted before they exceed 7mm in shell height.
5. North West plastic trays are suitable for holding escallop spat.
6. Should spat settlement be great, the smaller spat should not be held in trays.
7. Following removal from the collectors, holding spat beneath a float (such as a raft) that heaves in the water ensures flushing of water in and out of the trays, thereby removing waste food and faecal material and supplying clean water for respiration and feeding.
8. As many starfish as possible should be removed when spat are being placed in trays, and the trays should be re-examined during October for any additional starfish.
9. The trays holding the spat should be disturbed as little as possible and should be held below 5m during the winter to avoid fresh water run-off and the lower temperatures often associated with it.
10. Dredging within the North Water should be discouraged since there is a possibility of deoxygenation being caused by the disturbance of chemically reducing particulate matter. Furthermore, the presence of finely divided suspended matter may adversely affect the larvae and their settlement.

ACKNOWLEDGEMENTS

I would like to thank members of the North Water Co-operative for their interest and assistance in the collection, sorting and storage of spat. Field work from July to September was assisted by Ciaran McManus employed on a student bursary. Osborne Morton of the Ulster Museum kindly identified the collection of seaweeds made in 1979. Colm Duggan gave invaluable advice and assistance in spat collection. Christopher Moriarty read and commented on the manuscript.

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Table 1A. Measurements of temperature at Station A.

Date	Time BST	Metres depth 0.1	1	3	5	8	10
27—7	2000	15.05	15.05	15.00	15.00	—	14.95
3—8	1645	16.20	16.20	16.05	16.05	16.00	—
6—8	1745	15.80	15.80	15.75	15.75	—	15.75
7—8	1830	15.60	15.70	15.70	15.65	15.60	—
10—8	2115	15.60	15.60	15.65	15.65	15.60	—
13—8	2030	16.05	16.05	16.05	16.10	16.05	—
4—9	1615	15.60	15.70	15.80	15.80	15.80	—
7—9	1730	15.50	15.60	15.60	15.65	15.70	—
10—9	1800	15.30	15.40	15.35	15.35	—	15.30

Table 4. Numbers and sizes of escallops and numbers of starfish removed from lantern nets on 2 September, 1979.

Location	Number on lantern net	escallop height mean size (mm)	S.D.	Dead	Number of Starfish	Escallop spat % Dead
Caffard Bay	53,940	5.58	1.43	14,223	1,891	26.4
North Croaghan	41,600	6.54	1.83	1,460	3,800	3.5
Massmount Bay	5,035	6.12	1.71	397	1,710	34.0

Table 5. Distribution of organisms with depth found on collectors laid west of Station B on 9 August and raised on 18 October.

Depth (m)	1	4	10	15	20	26	30	36	41	44	47
Pecten maximus N.	12	17	23	13	7	4	1	3	2	0	3
Asterias	+	+	—	—	—	—	—	—	—	+	+
Bryozoa	+	+	+	+	+	+	—	—	—	—	—
Ascidiella	+	+	++	+	+	+	+	+	+	+	+

Table 1B. Measurements of temperature and Secchi disc transparency at Station B.

Date	Time BST	Metres depth 0.1	1	3	5	10	15	20	30	35	40	43	45	Secchi Disc (m)
24—7	1830	15.00	15.00	15.00	15.00	15.00	15.00	14.95	14.75	—	12.50	—	11.40	—
25—7	1430	15.10	15.10	15.15	15.15	15.00	14.95	14.90	14.60	14.40	13.10	11.90	—	—
26—7	1400	15.60	15.50	15.15	15.15	15.10	15.05	15.00	14.80	14.20	13.90	—	—	9.1
27—7	1900	15.05	15.05	15.00	15.00	14.95	14.85	14.80	14.70	—	—	14.60	—	10.0
31—7	1500	16.40	—	—	—	—	—	—	—	—	—	—	—	10.1
1—8	1900	16.60	—	—	—	—	—	—	—	—	—	—	—	9.1
2—8	1350	16.40	—	—	—	—	—	—	—	—	—	—	—	8.2
3—8	1530	15.95	15.95	15.95	15.95	15.95	15.85	15.50	14.60	—	14.50	—	—	8.8
6—8	1630	15.80	15.80	15.75	15.75	15.70	15.65	15.60	15.30	14.55	14.40	—	—	9.2
7—8	1915	15.70	15.65	15.75	15.75	15.80	15.75	15.75	15.50	—	—	14.75	—	—
9—8	1900	16.00	16.00	15.95	15.95	15.90	15.85	15.75	15.55	—	15.35	—	15.20	8.2
10—8	2000	15.70	15.70	15.75	15.75	15.70	15.75	15.70	15.70	—	15.30	—	—	7.9
13—8	1830	16.20	16.20	16.05	16.05	15.90	15.85	15.70	—	15.55	—	—	—	8.0
21—8	1430	15.50	15.50	15.45	15.50	15.45	15.45	15.40	15.40		15.30		—	—
29—8	1300	—	—	—	—	—	—	—	—	—	—	—	—	8.3
4—9	1530	15.60	15.65	15.55	15.55	15.50	15.45	15.40	15.20	—	15.20	—	—	9.3
7—9	1615	15.55	15.60	15.55	15.55	15.50	15.50	15.50	15.40	—	15.20	—	—	9.7
10—9	1715	15.40	15.40	15.35	15.35	15.30	15.25	15.30	15.25	—	—	—	15.25	—
19—9	1530	—	14.60	—	—	—	14.65	—	—	—	14.40	—	—	—
18—10	1300	12.70	—	12.70	—	12.75	—	12.65	12.60	—	—	—	—	—
8—12	1500	8.70	8.75	—	8.75	—	8.75	—	9.15	—	—	—	—	10.5

Table 1C. Measurements of temperature and Secchi disc transparency at Station C.

Date	Time BST	Metres Depth 0.1	1	3	5	10	15	20	23	Secchi Disc (m)
25—7	1500	15.10	15.10	15.05	15.05	14.70	14.70	14.60	14.60	—
26—7	1500	15.90	15.70	15.40	15.05	14.90	14.75	14.70	—	8.5
27—7	1700	15.05	15.05	15.00	15.00	14.90	14.85	14.80	—	8.9
31—7	1600	16.70	—	—	—	—	—	—	—	8.8
1—8	1800	16.60	—	—	—	—	—	—	—	—
2—8	1300	16.15	—	—	—	—	—	—	—	9.8
3—8	1415	15.75	15.75	15.75	15.75	15.60	15.25	15.00	—	9.2
6—8	1500	15.90	15.90	15.75	15.75	15.70	15.45	15.40	—	8.7
7—8	2130	15.80	15.80	15.75	15.75	15.60	15.45	15.35	—	—
10—8	1815	15.70	15.70	15.70	15.70	15.70	15.55	—	15.35	7.8
13—8	1600	16.40	16.40	16.00	16.00	15.75	15.65	15.45	—	7.8
21—8	1300	15.45	15.45	15.40	15.40	15.35	15.45	15.50	—	7.6
29—8	1200	—	—	—	—	—	—	—	—	8.2
2—9	1600	—	15.80	—	15.75	—	15.45	15.25	—	—
4—9	1350	15.60	15.60	15.55	15.55	15.50	15.45	15.40	—	9.3
7—9	1500	15.60	15.60	15.55	15.55	15.50	15.45	15.40	—	9.0
10—9	1630	15.40	15.40	15.35	15.35	15.30	15.25	15.20	—	8.2
19—9	1300	14.60	14.60	14.60	14.65	14.60	14.70	14.70	—	—

able 2. Numbers of starfish and crab larvae counted from paired vertical plankton hauls.

* = Present
** = Common

ate	July 1979 25	26	27	31	August 1979 3	6	10	13	21	29	September 1979 2	7	10	18
ation B Depth 45m)														
pinnaria	—	—	2	—	<1	1	—	—	—	—	—	—	—	—
achiolaria	—	—	2	2	4	8	2	<1	—	—	—	—	—	—
oea	—	—	1	1	—	1	—	<1	—	1	—	—	—	—
egalopa	—	—	6	4	18	7	7	2	2	3	—	—	—	7
yphonautes		**	**	**	**	**	**	**	*	**	**	**	**	*
ation C Depth 23m)														
pinnaria	2+	—	1		<1	<1	<1	0	3	—	—	—	—	—
achiolaria	4+	—	4		1	5	<1	1	0	—	—	—	—	—
oea	—	—	—	—		<1		0	0	1	0	—	—	—
egalopa	1+	—	1	3	10	8	3	0	2	1	<1	—	—	5

Table 3. Greatest numbers of escallops collected per metre of length on rope or on *Chorda filum*.

	Horse Park Bay	Annagh Bay	Tullynagapple Bay	Mid-western	Lurgachloghan Bay	Caffard Bay	Bullock Bay
Rope 15 Aug.	599[a]						
Rope 2½m 15 Aug.		250[c]					
Rope 3m+ 15 Aug.		1390[b]					
Chorda 6m 15 Aug.		242[d]	100[e]	1[e]	10[e]		600[e]
Chorda 1 Sept.						712	
Chorda 2 Sept.						263	
Chorda 13 Sept.	133[f]						

a, based on 452 spat obtained from 75.5cm length of 12mm diameter polypropylene rope.

b, based on 4 measurements of spat attached to 1cm sections of rope, mean = 13.9/cm.

c, based on 8 measurements of spat attached to 1cm sections of rope, mean = 21.5/cm.

d, estimated from section of *Chorda* 127cm length with 307 spat.

e, estimates made from observations while skin diving.

f, estimated from one sample of 16 escallops on a 12cm length of *Chorda*.

Table 6. Measurements of escallop spat from different locations, treatments, and time periods.

Date	N	Mean	S.D.	Substrate	Depth	Location
13 Aug.	53	1.79	0.93	Rope	3m	Horse Park Bay
13 "	11	1.18	0.40	"	2½m	Horse Park Bay
15 "	269	1.90	0.72	"	3m+	Horse Park Bay
21 "	16	3.38	1.02	Chorda	3m+	Annagh Bay
30 "	69	5.74	1.42	Rope	2m	Horse Park Bay
1 Sept.	390	5.19	1.72	"	3m+	Horse Park Bay
1 "	163	4.31	1.52	"	3m+	Tullynagapple Bay
1 "	255	4.42	1.54	"	6m	Caffard Bay
2 "	192	6.16	1.71	Lantern	2—3m	Massmount Bay
2 "	252	5.58	1.43	"	2—3m	Caffard Bay
2 "	256	6.54	1.83	"	2—3m	North Croaghan
16 Oct.	117	9.10	2.02	Envelope	4m	Raft South Croaghan
16 "	145	9.21	2.28	"	2½m	West of Green Island
16 "	160	17.66	1.40	Pleno	2½m	West of Green Island
16 "	51	15.71	1.36	"	2—3m	Caffard Bay
16 "	105	16.22	1.23	"	2—3m	Bullock Bay
16 "	75	15.43	1.76	"	2—3m	Bullock Bay
16 "	86	15.28	1.49	"	2—3m	Bullock Bay
16 "	125	16.41	1.35	"	2—3m	Bullock Bay
16 "	138	16.70	1.25	"	2—3m	Bullock Bay
17 "	30	19.40	2.82	Lantern	2—3m	South Croaghan
17 "	153	16.13	1.41	Pleno	2—3m	Massmount Bay
17 "	148	16.38	1.25	"	2—3m	North of Croaghan
17 "	115	19.49	2.51	Lantern	2—3m	North of Croaghan
17 "	60	18.53	2.87	Pleno	2—3m	Massmount Bay
18 "	77	19.04	3.00	Rope	6m+	Annagh Bay
5 Dec.	71	23.35	1.98	Pleno	2—3m	Caffard Bay
5 "	199	14.08	3.05	"	2—3m	Caffard Bay
5 "	178	19.02	2.09	"	2—3m	Caffard Bay
5 "	99	18.48	1.81	"	2—3m	Bullock Bay
5 "	101	20.74	1.77	"	2—3m	Bullock Bay
6 "	173	16.42	1.73	"	2—3m	North Croaghan
6 "	110	19.32	1.80	"	2—3m	North Croaghan
6 "	78	18.57	2.15	"	2—3m	North Croaghan
7 "	111	12.65	1.83	"	2—3m	South of Croaghan
7 "	137	12.09	2.03	"	2—3m	South of Croaghan
7 "	139	18.78	1.56	"	2—3m	Massmount Bay
7 "	188	16.52	2.48	Trays	5m	Raft South Croaghan
7 "	295	12.94	3.65	"	5m	Raft South Croaghan
7 "	244	14.65	2.07	Pleno	5m	Raft South Croaghan
10 "	104	16.38	1.30	"	2—3m	West of Green Island
10 "	92	16.75	1.41	"	2—3m	West of Green Island
11 "	47	20.15	1.43	"	2—3m	Bullock Bay
11 "	103	19.62	1.75	"	2—3m	Bullock Bay
11 "	193	14.53	1.79	"	2—3m	North of Croaghan Island
11 "	195	14.37	1.57	"	2—3m	North of Croaghan Island
13 "	71	19.63	1.88	"	2—3m	Caffard Bay
14 "	163	18.46	2.36	"	2—3m	Caffard Bay
14 "	66	20.12	1.76	"	2—3m	Caffard Bay
14 "	77	20.86	1.94	"	2—3m	Caffard Bay
14 "	96	19.33	1.59	"	2—3m	Caffard Bay

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Table 7. Variability of escallop size and mortality at different locations within the North Water: 5 to 14 December, 1979.

Location	Number of trays	Mean Shell height (all trays)	Maximum mean	Minimum mean	% Mortality (all trays)
West of Green Island	2	16.55	16.75	16.38	5.4
Caffard Bay	8	18.50	23.35	14.08	0.9
Bullock Bay	4	19.70	20.74	18.48	2.1
North Croaghan	5	16.05	19.32	14.37	0.4
South Croaghan	2	12.34	12.65	12.09	7.6
Raft	1	14.64	—	—	1.0
South Massmount Bay	1	18.78	—	—	6.4

Table 8. a) Age frequency of samples taken by diving at five locations in the North Water.

b) Age frequency sample taken by skin divers at Forked Islands (S.E. of Golamore).

a)

Age in 1980	3	4	5	6	7	8	9	10	11	12	>13 pre	
Year class	'77	'76	'75	'74	'73	'72	'71	'70	'69	'68	'68	N
Green Island	—	—	1	2	1	9	5	2	4	—	1	25
Massemount Bay	—	—	1	3	1	3	2	3	2	2	2	19
Caffard Bay	—	—	3	3	1	5	4	1	—	2	2	21
Lagmore Bay	1	—	3	6	5	1	5	2	2	—	—	25
Scott Island Bay	1	3	5	3	11	6	4	5	3	—	1	42
Total	2	3	13	17	19	24	20	13	11	4	6	**132**

b)

Age in 1980	5	6	7	8	9	10	11	12	>13 pre	
Year class	'75	'74	'73	'72	'71	'70	'69	'68	'68	N
Forked Islands	16	50	42	30	25	10	9	1	1	**184**

Table 9. Sizes and densities of the starfish *Asterias rubens* and of the tunicate *Ascidiella aspersa*.

Organism	Date	Location	Sample Size	Mean mm	S.D.	Substrate	Density /m
Asterias rubens	15 Aug.	Horse Park Bay 3m +				Rope	9.3
Ascidiella aspersa	15 Aug.	Horse Park Bay 3m +	46	8.65	± 6.85	Rope	60.9
Asterias rubens	1 Sept.	Tullynagapple 3m +	199	2.78	± 1.56	Rope	—
Asterias rubens	16 Oct.	Bullock Bay	8				—
Asterias rubens	16 Oct.	Collector Station B	100	*ca* 11		Collector	—

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