THE BIOLOGY OF THE FLEET

INCLUDING THE FULL REFERENCE LIST OF THE FLEET STUDY GROUP

Aspects of the flora and fauna of the lagoon

editor Dr. M. Ladle

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ISBN 0 85216 393 2

INTRODUCTION

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In the first account of "The Fleet and Chesil Beach" published in 1981 many aspects of the physical character of the beach and lagoon were described in detail. Since that time the Fleet Study Group has continued with its policy of encouraging research and archiving information relevant to the Fleet and its surroundings. In October 1984 a meeting was held at which recent or current research topics were described and discussed by scientists. This publication is essentially a record of that meeting.

Understandably, the scope of the present publication is less extensive than that of the 1981 account but a number of topics are discussed in depth and much new information is included; notably accounts of the distribution of the meiofauna, of subtidal communities, of a distinct form of the gastropod Akera bullata and of the Fleet as a "fish nursery" area.

In conclusion, the reference list at the end of this volume incorporates a full account of all the reprints and documents, referring to the Fleet, which have been acquired by the Fleet Study Group during the 10 years of its existence.

Together with the 1981 report the present collection of papers gives a broad coverage of most aspects of the ecology of the Fleet lagoon.

OPENING REMARKS

Fleet Study Group Meeting, Strangways Hall, Abbotsbury - 27.10.84

E.W.S. Green, Agent for Strangways Estates

I regret that I have nothing of a scientific nature to start off the morning's activity - indeed after working here for some seven years I am hesitant still to put my hand on my heart and say that I really know what a 'mollusc' is. My purpose is twofold:

1. To briefly trace the background of the Estates' interests in the Fleet and Chesil Bank.
2. To remind you how the Fleet Study Group came into existence and to thank the many people, from a variety of backgrounds, who have over the years contributed to the pool of knowledge that is gradually accumulating about the area.

There is in the Estate Office what is in effect a bibliography of the documents relating to the Fleet starting with the translation of King Canute's original grant of the land to Orc, his 'chamberlain'.

It is clear from the documents that the Fleet had in earlier times a greater commercial importance than in the present day - in the Middle Ages, judging by the documents, the right to take wrecks on the beach was of considerable importance and, of course, fishing was an important activity well into the present century, although today, alas, there are no 'crews' operating off the beach at Abbotsbury.

You may recall the quotation from Defoe, the 18th Century traveller, "..... the catches were so much that the men could hardly draw them on the shore - the mackerel the finest and longest I ever saw were at the seaside for a hundred for a penny".

It is, however, interesting to speculate on those things about which little is known, such as the attempts to drain the Fleet in the 1630's - the historic reasons for the changes in the mudflats - the history of the development of the ferrybridge.

The point, therefore, I would like to make is that, whilst we are adding all the time to knowledge of the Fleet's structure and content we have not been so successful in tracing the influence that man has had on the area and in particular the influence the continuity of ownership by the Fox-Strangways family has had on preventing its over-exploitation.

Turning then to the background of the Fleet Study Group it is, perhaps, surprising that it is now just under ten years since the initial gathering at Weymouth College of Further Education when, largely due to the energy of Miss Brotherton of the Dorset Naturalists' Trust, those who had a scientific interest in the Fleet agreed to the pooling of their knowledge and the encouragement of further investigation.

I believe that a great deal has been achieved since then which is reflected, not only in the variety of our speakers here today but also in the publication of the pamphlet on the Fleet which resulted from our previous symposium at Dorset County Museum in 1980.

I would, therefore, like to take the opportunity of thanking Mrs Jeanne Fitzpatrick, who is the Secretary of the Group, for her tireless efforts to keep the momentum going and to Dr Mike Ladle and Dr John Whittaker who have been the mainsprings of the Group's development.

FERRYBRIDGE RECONSTRUCTION IN RELATION TO MARINE FAUNA

D.R. Seaward, 3 Summerlands, Yeovil

The replacement of the Ferrybridge over Smallmouth, the inlet to the Fleet, by a new bridge some 200 m to the south, and the creation of a new channel and closure of the old, has been described elsewhere (Hayward, 1983 and Hunt, 1984). My concern was the effect which the project might have upon the marine invertebrates in the adjoining parts of Portland Harbour and the Fleet, during the construction phase with its associated disturbance.

Destruction would obviously be complete within the area of excavation for the new channel, and of deposition of spoil. Since this included a significant part of the population of the rare and local sea slug, Aeolidiella alderi, which is known within the British Isles from only a few sites in the Channel and the west coast of Ireland and Scotland (Seaward, 1982), some of these and other animals were moved short distances to safer areas nearby in November 1983, before excavation started, and an account is given in Hawthorne (1983). By January 1985, when the bridge work below sea level was virtually complete except for completion of channel excavation in deeper water, the low shore population of A. alderi was still present in about the same density as before work started, apparently unaffected by the proceedings. However, a month later in late February, numbers had dropped very considerably, coincident with the large mortality of bivalves from the sandflats adjoining in Portland Harbour. These events do not seem to be connected with the bridge works as there was no sign of pollution or deposition or other change, and a similar mollusc mortality occurred at Weymouth beach at the same time; the likely cause would appear to be the very severe winter weather of January 1985.

Filling of the channel under the old bridge destroyed a small area sheltering an interesting and unusual fauna described by Dyrynda (1984), including another sea slug Doto millbayana not previously recorded from Dorset. It will be interesting to see whether a similar association develops on the new bridge supports and channel.

The sandflats in Portland Harbour and the Fleet adjoining the bridge, in which live an unusual assemblage of molluscs, worms and anemones (Holme & Bishop, 1980), will take some time to readjust to the new channel. Some redistribution of sediment is already (April, 1985) taking place, and there are some small patches of gravel in the sand in shallow water to the south of the channel, which previously were not apparent and were probably covered by sand. These are rapidly colonised by seaweeds, particularly the recent-alien Sargassum muticum (Jap-weed), which has also become abundant in several areas close by (e.g. the Narrows and the old bridge channel), here it can obtain anchorage.

During the bridge work and up to March 1985, I have visited shores from Sandsfoot Castle to the Narrows, and adjoining the bridge works in Portland Harbour. In spite of some wash-out of fines during excavation and filling, and apart from the comments above, I have not so far been able to find any significant changes outside the sort of seasonal variation I have known over the past few years. Redistribution of the sandbanks to adjust to the new position of the channel may yet create some changes.

An unexpected consequence of the new bridge works is the increased public awareness of, access to, and use of, the sandflats in Portland Harbour south of the new channel, resulting in increased windsurfing, bait-digging, shellfishing, stone turning and associated trampling.

THE DISTRIBUTION OF ZOSTERA AND RUPPIA IN THE FLEET

N.T.H. Holmes

Synopsis of a report to N.C.C. by Alconbury Environmental Consultants

The Fleet, a large tidal lagoon on the south Dorset coast, is, together with the Chesil Bank, a Grade 1* NCR site and notable for its diversity of winter waders and wildfowl as well as its ancient Swannery at Abbotsbury. There are extensive beds of Zostera (Eel grass) and Ruppia (Tassel weed) in the Fleet which are of considerable significance both for the well-being of the swan population and in their own right. Such extensive mixed populations of these two aquatic plant genera are virtually unknown from elsewhere in Britain. This investigation, which attempted to map the exact distribution of the species, was partly generated from fears that the 'grass' was under threat from a variety of sources. The data collected form a base line to assess the stability of the different populations.

The survey was carried out in early August 1983. The whole of the Fleet was surveyed, but the west and east ends less intensively than the main body of the Fleet. Data were collected from 250 quadrats each of about $100m^2$ from grabs of material using a grapnel and from observations on the shore. Selection of sites was randomised within blocks. Semi-quantitative data on the relative abundance (cover and biomass) of individual species of aquatic angiosperms was collected and information on depth, substrate and associated algae tabulated. About 50 algal and mollusc samples were collected for others to investigate.

Four aquatic angiosperms were recorded and many new features of the flora emerged. Zostera angustifolia, Z. nolti and Ruppia cirrhosa are common in the Fleet; R. maritima less frequent and locally distributed. There is a clear zonation of species along and across the Fleet. R. cirrhosa is dominant in the west Fleet, where Zostera is absent, and declines to the east whilst Z. angustifolia, in almost a mirror image of the former's distribution, increases towards the east. In the centre of the Fleet the greatest variation is shown, with all four species being dominant within individual quadrats and all commonly represented. Z. nolti has a restricted distribution in the central stretch of the Fleet and shows a clear lateral distribution across the Fleet, dominating most frequently along the northern shore and occurring much less sparsely in the shadow of the Chesil. R. maritima is rare and shows a very disjunct distribution. Z. marina, previously reported, was not found.

Other species recorded include the rare stonewort, Lamprothamnion papulosum, which has a population stronghold in the Fleet. The green algae Ulva and Chaetomorpha are abundant in the Abbotsbury embayment to the west. Enteromorpha occurs sparsely throughout the Fleet and thrived at the outflow of a stream which had killed all the aquatic flowering plants. Tough filamentous Chadophoralean algae were dominant in the upper reaches of the Fleet where they smothered much of the Ruppia. Other algae were noted, including Sargassum drifting upstream which were generally unhealthy and dying.

Threats to the Zostera and Ruppia are assessed. Although the populations appear healthy and thriving, there is still great concern from many quarters based upon the observations of locals that they are threatened and declining. They maintain that: a) the populations of species have changed; b) the abundance of 'grass' has declined; c) the grass dies back earlier leaving less food for winter wildfowl; d) algae have increased dramatically. Due to the lack of detailed baseline data, it is impossible to draw firm conclusions from the survey, however the possibility of species populations having changed is discussed. This may be due in part to the 1930's Zostera decline and to hard winters. These population changes could also account for points b) and c). The recent increase in algae is identified as the greatest threat to a balanced flora in the Fleet. This problem may be increased by the effects of a bad winter, but enrichment of the water is thought to be the prime cause. This could have arisen from agricultural or domestic effluents or from eutrophication from the large swan population if the latter has increased in the last decade.

The report recommends i) a further survey should be carried out within the next three years to show whether the population of aquatic angiosperms is stable or fluctuating in order that causes of any fluctuations might be identified and remedial steps taken; ii) further statistical treatment of raw data tables; iii) further controls on discharges into the Fleet which cause local eradication of Zostera and Ruppia; iv) an analysis of swan population changes to assist in any nutrient budget investigations.

A SURVEY OF THE MEIOFAUNA OF THE FLEET

Elaine Christina Humphrey, Dept of Oceanography, University of Southampton

Introduction

This paper is essentially an abstract of an M.Sc. dissertation submitted through the Department of Oceanography, University of Southampton.

Marine zoologists classify bottom-living invertebrates, in terms of size, into MACROFAUNA - the larger bivalves, worms and crustaceans which are easily seen with the naked eye and can often be picked up with the bare hands; MICROFAUNA - consisting mostly of tiny, single-celled organisms visible only en-masse or in microscopic preparations and MEIOFAUNA - "in between sizes" which can be picked up individually with forceps or pipette.

The meiofauna is a vital link in many of the complex food webs involving bottom-living creatures. It consists of forms such as Nematoda (roundworms), Narpacticoid copepods, Ostracoda (tiny, bivalved crustaceans), Foraminifera (Protozoa similar to amoebae), small species of polychaete and oligochaete worms and a number of other forms of similar size.

In recent years the study of the meiofauna has received a lot of attention following the definition of the meiofauna, in 1942, by Mare. The first international conference on the meiofauna was held in 1969.

Methods

For the present study five stations were chosen with five samples taken at each station (Fig. 1). The lower size limit of the meiofauna was taken as those animals retained by a 63µm sieve.

A comparison was to be made between stations so each one was sampled at low water, and as near to the water line as possible. At each station five core samples for the meiofauna, five larger core samples for macrofauna, the salinity and temperature of the water, temperature of the sediment, pH of the water and samples of sediment for particle size analysis and organic content were taken.

To take the meiofauna samples a core tube of 13mm diameter was used. The corer was made of glass which has the advantage of being transparent, thus making it possible to examine the sediment sample inside but has the disadvantage of being easily broken. After a trial period reasonable samples were taken of 30mm depth and this became standard throughout the programme.

Results and Discussion

Table 1 shows temperature, salinity, pH and sediment organic content variations at the stations sampled.

The highest mean water temperature (17.3°C), and the highest mean sediment temperature (17.2°C) were both at station B (Table 1). This is lower than the temperature Whittaker obtained about May 1968 as then the minimum temperature of the Fleet was given as 17.5°C and the maximum was 25.5°C. In May 1969 Whittaker found a minimum water temperature of 12.9°C and a maximum of 23.9°C.

The field measurements of pH (Table 1) were high compared with sea water (about pH 8). This feature was also noted by Whittaker. The high pH recorded in the Fleet may be a factor in influencing the preservation of empty Foraminifera tests. One sample was estimated to contain about 6000 foraminiferids but only about 800 were counted as living (station D).

The sediment at the stations in the Fleet was found to be very poorly sorted containing a high proportion of coarse material. The coarsest material was found at station B where the highest number of individuals and species richness occurred.

Grain size and distribution of the meiofauna in the Fleet showed no direct relationship as high numbers occurred not only at station B, which had the highest mean grain size (2.1mm), but also at station E which had a much lower mean grain size (0.4mm). The degree of sorting at station E was the highest found in the Fleet though at a value of 0.975 it is still relatively poorly sorted.

The lowest measurement of the organic content (Table 1) was at station D where the lowest numbers of individuals were recorded. A possible correlation between numbers of individuals and organic content was investigated but no relationship was found.

In terms of overall numbers of meiofaunal animals station B was quantitatively the richest area ($10122/10cm^2$), followed by station E ($9517/10cm^2$), station C ($7078/10cm^2$), station A ($6062/10cm^2$) and the poorest station D ($4335/10cm^2$) (Table 2). The highest values of peak meiofaunal abundances on sandy beaches were given by Gray & Reiger as $9416/10cm^2$, by Harris as $1914/10cm^2$ and McIntyre & Murison as $6689/10cm^2$. McIntyre & Murison gave a value for May of $3081/10cm^2$. Nikouyan (1980) gives $2600/10cm^2$ for meiofaunal densities in a fine sandy estuarine beach in Southampton Water. He also looked at meiofauna densities in association with the burrows of the lugworm Arenicola marina in the same area and found much higher densities of $2600/10cm^2$ and $15000/10cm^2$. From these figures it can be seen that the Fleet is generally a very rich area in terms of meiofaunal abundance.

In conclusion, this preliminary survey has shown the Fleet to be very rich with regard to both species and species numbers (Tables 2-5). The Harpacticoida and Foraminifera, both of which were taken to the species level, were found to exhibit relatively high species diversity.

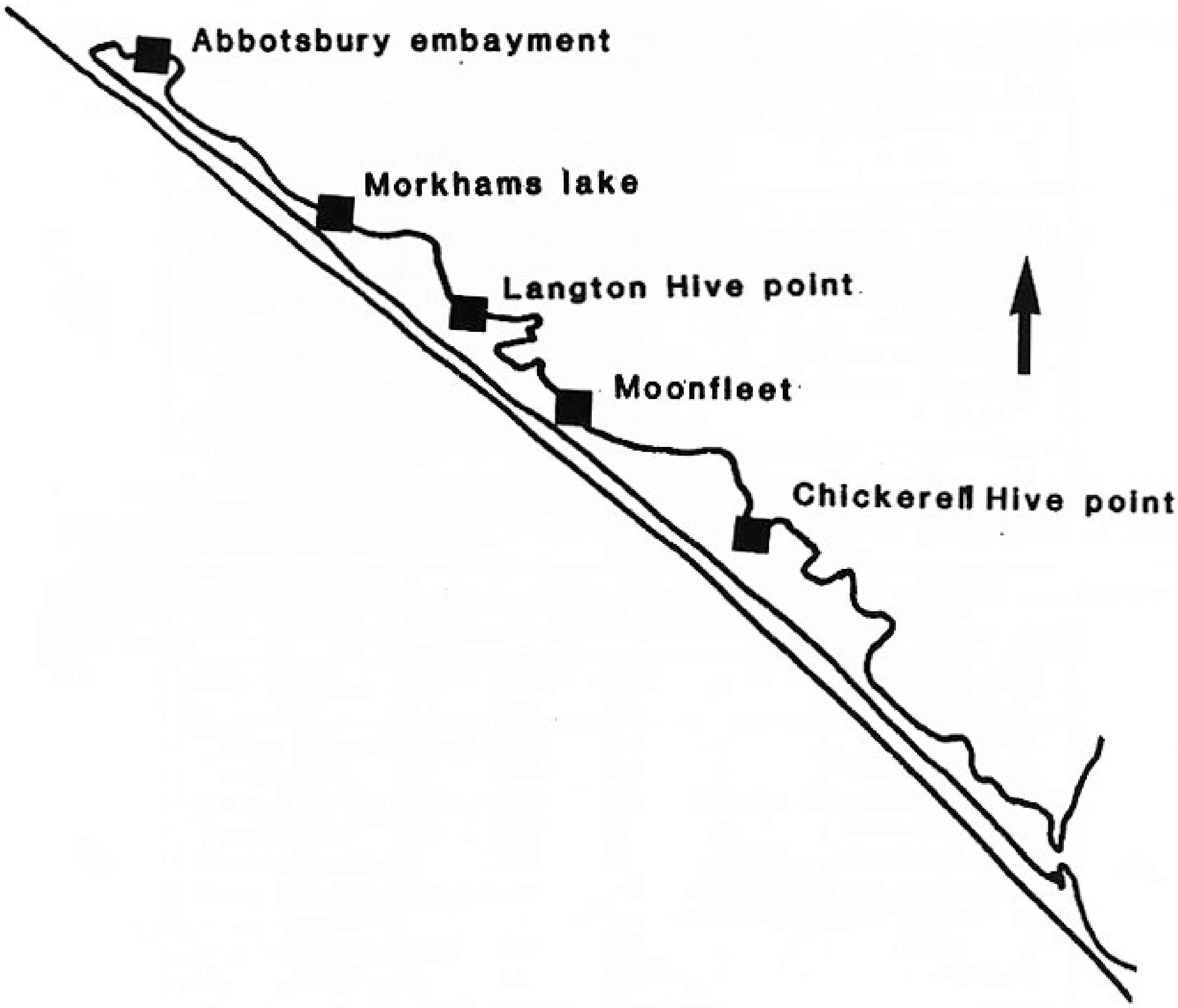

Figure 1. Map showing sites sampled. A. Chickerell Hive point; B. Moonfleet; C. Langton Hive point; D. Morkhams lake; E. Abbotsbury Embayment.

Table 1. Field data (28, 29 and 30 May 1981).
Sediment and water temperatures (mean values from the five sample sites at each station)

	Station				
	A	B	C	D	E
Sediment temperature °C	15.1	15.8	17.2	16.0	15.2
Water temperature °C	14.8	16.8	17.3	16.1	14.6
Salinity of water ‰	25.0	20.6	16.5	12.4	3.0
pH of water	9.4	9.9	9.9	8.9	8.2
Air temperature °C	12.2	13.2	13.2	13.8	13.4
Sediment organic matter mean %	6.3	5.2	6.9	3.2	5.1

Table 2. Abundance of taxa of animals in the 5 stations (numbers per 6.5cm²)

Taxa	A	B	C	D	E
1. Nematoda	3039	2938	1898	497	4984
2. Harpacicoida	131	324	118	22	13
3. Ostracoda	142	403	119	153	792
4. Foraminifera	145	1556	973	1763	137
5. Harpacticoida nauplii	253	646	281	57	28
6. Polychaeta	18	356	329	71	-
7. Oligochaeta	55	127	49	44	192
8. Corophium volutator	-	-	35	16	13
9. Unidentified worm-like taxa	102	148	1226	169	-
10. Others	55	81	47	26	27

Table 3. Abundance of species of Foraminifera in the 5 stations (numbers per 6.5cm²)

	Station				
	A	B	C	D	E
Ammonia beccarii	38	561	597	604	34
Elphidium spp	37	630	248	598	48
Elphidium macellum	19	57	7	-	-
Planispiral forms	9	68	60	409	45
Trochammina inflata?	12	69	5	11	6
Milliammina fusca?	28	16	3	1	1
Quinqueloculina seminulum?	2	78	26	42	-
Jadammina macrescens?	-	44	16	81	3
Pateoris hauerinoides?	-	9	3	5	-
Q. oblonga?	-	15	4	2	-
Q. dimidiata?	-	5	-	7	-
Reophax mobiliformis	-	1	-	-	-
Unidentified sp	-	3	4	3	-

Table 4. Abundance of species of Annelida in the 5 stations (numbers per 6.5cm²)

Species	A	B	Station C	D	E
Polychaeta					
Pygospio elegans	1	27	15	13	-
Manayunkia aestuarina	4	280	269	32	-
Post larvae	-	7	-	-	-
Sabellid sp	6	42	28	4	-
Polydora sp	-	-	17	22	-
Scoloplos armiger	8	-	-	-	-
Oligochaeta					
Unidentified sp	-	15	24	9	158
Remaining spp	55	112	25	35	34

Table 5. Abundance of other organisms in the 5 stations (numbers per 6.5cm²)

Species	A	B	Station C	D	E
Large Annelida eggs	-	14	4	2	9
Anthozoa	-	2	-	-	-
Littorina littoralis?	8	1	8	6	1
Acarina sp	4	2	4	3	4
Archiannelida	-	1	-	3	1
Sabellidae trochophore?	-	-	-	1	-
Abra tenuis	8	2	-	-	2
Gastropod eggs	1	4	-	-	9
Gastropoda sp	-	1	-	-	-
Cyathura carinata	-	1	-	-	-
Microdeutopus sp	1	-	-	-	-
Chironomidae larvae	-	-	4	2	1

SUBTIDAL COMMUNITIES WITHIN THE OUTER FLEET AND PORTLAND HARBOUR

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Introduction

The Fleet, the 14km long flooded interstice separating Chesil Bank from the impounded, former coastline conforms to the characteristics of a tidal lagoon. Marine exchange between this and the open sea is via a narrow entrance to the east, leading into Portland Harbour; whereas to the west, the lagoon is blinded-ended (Fig. 1). The very wave exposed and biologically barren outer flank of the storm beach contrasts with the sheltered conditions prevailing within the lagoon which have facilitated the development of rich and, to an extent unique, aquatic communities.

The Fleet can be subdivided into two components with contrasting physical characteristics (Dyrynda & Farnham, 1985). The eastern most 3km, which embodies two narrow sections, 'Smallmouth' and the 'Narrows', constitutes the lagoonal link channel (Figs 1 & 2). The original, natural entrance to the lagoon has long been artificially restricted by the construction of an embankment carrying the road to the Isle of Portland. Until late 1984, tidal exchange was confined to a narrow (50m) entrance, 'Smallmouth', passing through the north end of the embankment and spanned by the 'Ferrybridge'. During late 1984 a new entrance of comparable dimensions and spanned by a new bridge was constructed through the embankment approximately 100m south of the original. The old channel was infilled as the new one was opened such that tidal exchange was maintained throughout.

2km upstream of 'Smallmouth' is the 'Narrows', a 1000m section, uniformly approximately 50m wide, sandwiched between a promontory on the former coastline, and the storm beach. Recent papers on the hydrography of the Fleet by Whittaker (1981a), Robinson (1981, 1983) and Robinson et al. (1983) show that the link channel experiences a relatively normal tidal regime with a near full and regular cycle, but based on the very small, approximately 1.5m range characteristic of the Portland area. Good flushing combines with a relatively stable, polyhaline salinity regime, according to records not falling below 25‰ (Whittaker, 1981a; Robinson, 1981, 1983). Strong tidal currents are generated within the link channel, not only because it is the downstream section of the lagoon, but also a zone where flow is constricted, particularly within the 'Narrows' and at 'Smallmouth' where rapids form during spring tidal runs. A maximum tidal velocity of 4 knots has been recorded within the 'Narrows' (Whittaker, 1981a). The link channel is generally shallow, at less than 5m below chart-datum, and is floored by benthic substrates indicative of strong currents. Beds of gravel, stones and hard substrates characterise 'Smallmouth' and the 'Narrows', whereas sands predominate within the intervening section where currents are relatively weak. Hard substrates within the link channel support a rich epibenthic cover of macroalgae, particularly rhodophytes and phaeophytes, and of suspension feeding sessile invertebrates.

In contrast, the lagoonal basin experiences a reduced and more erratic tidal cycle and weak currents, concomitant poor flushing and more variable salinities (still generally polyhaline, only becoming mesohaline at the innermost section of the lagoon (Whittaker, 1981a; Robinson, 1981, 1983). Depths generally range from 3m below C.D. to much less and the prevailing epibenthic communities are meadows of seagrasses and (often floating) masses of chlorophytic algae (Whittaker, 1980, 1981b; Holmes, 1983).

Whittaker (1980, 1981a) first recognised the differences between the downstream and upstream sections of the lagoon, referring to these as the 'East' and 'West' Fleet respectively. The divide was set at the upstream end of 'Butterstreet Cove', 3km upstream to that separating the 'link channel' from the 'lagoonal basin' (Fig. 1). The classifications are compatible, differing only in emphasis. Whittaker (1980, 1981a) highlights the hydrographic and biological discontinuity at the west end of 'Butterstreet Cove', many species characteristic of the 'East Fleet', phasing out at that point (preliminary sampling of benthic at a series of stations along the lagoon during 1983 demonstrated the extinction of many rhodophytic algae and sponges at this location). However, from the viewpoint of the benthic substrate regime, a principle of the 1983 survey, the appropriate discontinuity is at the upstream end of the 'Narrows'. Beyond this point, coarse sediments and bedrock are soon replaced by fine sediments, and those more 'marine' species which do persist as far as Butterstreet, occur there only as free standing forms or as subsidiaries attached within seagrass beds.

Benthic macrobiological communities within the lagoon, particularly the lagoonal basin, have been investigated by members of the Fleet Study Group and others. The seasonal occurrences of sea grasses and chlorophytic algal masses were described by Whittaker (1980). Species inventories and distributions for the algae, ostracods and molluscs have been prepared by Burrows (1981), Whittaker (1981c) and Seaward (1980) respectively. During the summer of 1983, the Nature Conservancy Council commissioned two investigations of the subtidal benthos. Holmes (1983) reassessed the sea grass communities within the lagoonal basin, and Dyrynda (1984), assessed the distribution of benthic habitats and communities within the link channel, previously the least studied section of the lagoon. Aspects of the results of the latter survey are considered below and are reported more fully by Dyrynda (1984) and Dyrynda & Farnham (1985).

Channel bed substrates and communities were investigated by diving at a series of stations through the link channel zone and, for comparison, within Portland Harbour (Figs 1 & 2). Assessment procedures included <u>in situ</u> observation and recording, underwater photography, and the collection of quadrat samples of substrates and benthos for subsequent, detailed analysis. Although channel centre stations were concentrated upon, to construct a more comprehensive overall impression of the link channel, additional observations were made by long- and cross-channel dives. A species inventory was produced from the survey data.

In the absence of strong currents and wave exposure within the lagoonal basin, the load of suspended sediments generated there is small in comparison with more typical estuarine channels. Within the link channel, water clarity and light penetration are generally good, not only after the flood, but also after the ebb tides, and hence, infralittoral conditions (supporting macroalgal growth) prevail throughout the lagoon. High levels of nutrients and good water flow favour the flourishing of macroalgae and suspension feeding invertebrates alike, and both categories compete for substrate space, side by side, within the link-channel.

<u>Communities</u>

Community structure within the link channel varies primarily according to the strength of water currents, which govern not only the nature of substrates, but also the maximum sizes, and more significantly, drag factors, which benthic organisms can attain.

i) Community associated with stable hard substrates within the Narrows. (Stations 6-8) (Fig. 2)

The most species rich, highest biomass epibenthic community is associated with stable, hard substrates, of which the outcrops and boulders of corallian strata, which characterise the landward subtidal flank of the Narrows, constitute the major resource (Fig. 3). Illuminated faces of these support many 'high drag' erect algal forms such as Cystoseira nodicaulis and Laminaria saccharina. The brackish water sponge Halichondria bowerbanki occurs as a co-dominant upon illuminated faces of rock, growing as large mounds or plates up to 0.5m across, flattened in a plane perpendicular to the axis of flow. The sponge engulfs surrounding algae as it grows. Interstices within the resulting matrix are colonized by a multitude of smaller invertebrate species. Tube-dwelling forms, so anchored against current induced mobilization, are particularly common, e.g. the polychaete Platynereis dumerilii and the amphipod crustaceans, Jassa falcata and Corophium acherusicum. Although H. bowerbanki was the dominant invertebrate during summer 1983, more recent observations have revealed the hydroid Sertularia cupressina as a codominant during late winter and early spring. Cryptic (shaded) faces of rock support exceptionally large colonies of other sponges, e.g. Myxilla sp, Dysidea fragilis and Suberites massa, and in places, large numbers of the ascidians Phallusia mammillata and Ascidiella aspersa.

ii) Community associated with consolidated clay within the 'Narrows'. (Stations 7, 8)

Tracts of consolidated clay occurring between the corallian strata are maintained clear of superficial sediments only where the tides are strongest, i.e. particularly within the central 'Narrows', elsewhere being overlain by stones or gravel (Fig. 3). The crumbling clay surface supports the least species-rich, lowest biomass community. Such clay provides only a very poor anchorage for attached epibenthic colonizers, reflected in the sparseness and small size of the colonizing algae observed. Sporelings of larger, higher-drag forms such as Cystoseira and Fucus do colonize but are sloughed off before attaining an appreciable size. Only smaller, lower drag forms such as Chondria are able to successfully maintain occupancy through to reproduction. An interesting infaunal feature of the clay community within the central 'Narrows' is the presence of two species of boring bivalve, Barnea parva and the larger Barnea candida.

iii) Communities associated with the pebble regime within the 'Narrows'. (Stations 6, 7, 8)

The seaward half of the subtidal 'Narrows' is floored by the most landward extension of the storm beach (Fig. 3). Within the central zone, strong currents throw these pebbles into waves up to 1m in amplitude. Moving away from this area, the waves progressively decline, but are also developed upon pebble bars which have formed at each end of the 'Narrows'. The bars, it is believed, may be dominated by pebbles originally expelled by strong currents from the 'Narrows'. They also constrict tidal flow such that currents are increased locally within their vicinity.

During spring tidal runs, surface pebbles upon the waves within the central 'Narrows' may be exposed to currents sufficient for their mobilisation, even without any additional drag forces imposed by colonizing sessile biota. Surface pebbles that are colonized generally support low drag species. Seven thin encrusting algae and four species producing short, slender and hence low drag shoots were found to colonize pebbles on the surface of the waves (Dyrynda & Farnham, 1985). The infralittoral anemone Anemonia viridis and herbivorous echinoderm Asterina gibbosa also feature. Strong currents maintain spaces between pebbles free of finer sediments to a significant depth, and sub-surface pebbles can be colonized by abrasion resistant suspension feeding sessile invertebrates such as the polychaete Pomatoceros lamarckii and the bryozoan Cryptosula pallasiana. A large and delicate polychaete, Polycirrus aurantiacus was also found to be common within sub-surface interstices.

Moving away from the central 'Narrows', larger, higher drag algae begin to feature on shallower pebble waves, including two rare species, i.e. Solieria chordalis and Gracilaria foliifera (W.F. Farnham, I.D. & pers. comm.). As algal cover increases, individuals on adjacent surface pebbles often intermesh to form a more continuous matting which adds stability to the pebble column. This facilitates colonization and persistence of still larger and higher drag algae such as Laminaria saccharina, Sargassum muticum and Chorda filum, or of the anemone Taelia felina.

The pebble bars at the ends of the 'Narrows' support local forests of large, higher drag Sargassum and Chorda plants. It is believed that a large proportion of these have been expelled from the rapids along with their pebble substrates by the stronger currents there. Since 1983, local forests of large Sargassum plants have also developed within the 'Narrows', but only within small embayments along the landward shore where currents are locally weak. In addition to these large macrophytes, the western (upstream) pebble bar contains an interesting interstial fauna which includes a population of the rare burrowing anemone Scolanthus callimorphus.

iv) Communities associated with sand. (Stations 4, 5)

Downstream to the Narrows, hard substrates and coarse sediments increasingly give way to sand supporting only a surface scattering of small hard substrates, mainly stones from the storm beach, or more occasionally, shells of the slipper limpet, Crepidula fornicata. The epibenthos colonizing small substrates within this less current scoured zone includes many higher drag forms including in particular, Sargassum muticum and Gracilaria verrucosa, but also Chorda filum, Laminaria saccharina, the ascidians, Phallusia mammillata (very common) and Ascidiella aspersa, and the anemones Cereus pedunculatus and Anemonia viridus. Sand, which predominates within the centre of the intervening section between the 'Narrows' and 'Smallmouth' (i.e. Station 4) is largely clear of small substrates and epibenthos.

v) The hard substrate community at Smallmouth. (Station 3)

The supports of the old 'Ferrybridge', constituted a local resource of shaded, stable hard substrates within 'Smallmouth', in effect, serving as an artificial cryptic infralittoral habitat. Locally strong currents favoured the development of a species rich cover of suspension feeding sessile invertebrates (Dyrynda, 1984). The flanks of this locally deepened section of channel were of clear sand, whereas the bed was of gravel with stones and boulders. The new Smallmouth entrance and bridge are in many ways similar to the old entrance, which may be reflected in the development of comparable communities in due course.

vi) Communities associated with deeper water mud within Portland Harbour. (Stations 2i, 2ii)

Sheltered conditions created by the construction of the very large breakwaters enclosing Portland Harbour have facilitated the formation of deep accumulations of soft muds within the deeper water, eastern sector of the Harbour basin. Dense populations of the sea pen Virgularia mirabilis were identified at stations within this sector (at depths approximating 10m below C.D.). Other burrowing forms recorded include two uncommon species, Scolanthus callimorphus (also see section iii), the red band fish Cepola rubescens and possibly the crab Goneplax angulata (requires confirmation). Common surface dwellers include the nudibranch mollusc Philine aperta, the anemone Sagartiogeton undatus and hermit crab Eupagurus bernhardus, the latter two both colonizing shells of Turritella communis.

vii) Community associated with the north entrance of Portland Harbour. (Station 1)

The current-scoured channel bed within the north entrance to Portland Harbour (channel centre depth, 12m below C.D.) supports a dense cover of Crepidula fornicata (approx. 3000 live and dead individuals per square metre recorded from quadrats). Many of the constituent Crepidula clusters are colonized by sessile invertebrates including Phallusia mammillata, Ascidiella aspersa, Suberites domuncula and Cereus pedunculatus.

Discussion

The 1983 survey identified the presence of unique habitats, communities, and rare species within the link channel, which adds to the overall conservation significance of the Fleet and Chesil Beach, already well established by previous studies (Ladle, 1981).

Within the subtidal zone of the link channel, the 'Narrows' is of particular interest. In common with other tidal rapids systems associated with land locked basins, e.g. Lough Ine and Mweeloon and Cashla Bays in Ireland, and Loch Sween in Scotland (Kitching et al., 1967; Ryland & Nelson-Smith, 1975; Lewis & Powell, 1958; respectively), the 'Narrows' suports species rich, high occupancy and high biomass benthic communities. However, whereas the hard substrata of the bedrock regime are generally typical of such systems, the pebble regime is very unusual. Such well rounded and large pebbles are a wave generated phenomenon, created on the outer flank of the storm beach, and only subsequently exported to the rapids where the contrasting conditions of minimal wave exposure, but strong exposure to tidal currents, prevail. A number of subtidal species which feature within the 'Narrows' are generally rare within the U.K. (Dyrynda & Farnham, 1985), including the algae Solieria chordalis and Gracilaria foliifera; the sponge Suberites massa; the anemone, Scolanthus callimorphus; and a goby, Gobius couchi. Other species, although more generally known, occur in exceptional abundances or sizes, e.g. sponges in general but particularly Halichondria bowerbanki, the anemone Anemonia viridis, the starfish Asterina gibbosa, and the ascidian Phallusia mammillata.

Two important alien (introduced) species occurring within the link channel, are capable of substantially altering its gross ecology. Whereas one, Crepidula fornicata (slipper limpet) is not realizing its full potential as a community dominant, the second, Sargassum muticum (Japanese seaweed) is having major effects.

Under favourable conditions, Crepidula fornicata, which is a superior space competitor, proliferates to produce deep accumulations on any current scoured substrates ranging from sand to rock. Since the early part of this century, high-occupancy poulations have become established within many estuaries of southern Britain including the entrances to Poole and Langstone Harbours to the east (Dyrynda, 1985; Farnham, pers. comm., respectively), and locally, the entrance to Portland Harbour. Conditions within the link channel would appear to be favourable since Crepidula is not deterred either by shallow or brackish (even mesohaline) water (Dyrynda, 1985). Crepidula is present throughout the 'Narrows', but only at low densities. Any proliferation would devalue the conservation significance of this system by changing habitats and displacing other biota.

The second alien, Sargassum muticum (Japweed), is having a more profound effect (see Farnham, this vol.). First recorded in the Fleet in 1982 (W. Farnham, pers. comm.; Dyrynda & Farnham, 1985), this species is flourishing within the link channel under what appear to be very favourable conditions which include a vast resource of mobile small substrates, i.e. pebbles, which it prefers. In spite of attempts at clearance, quantities have increased substantially since 1983. Sargassum is undoubtedly changing the ecology of the link channel, most directly by displacing other biota. Chorda filum may be the most immediately affected since this is also a small substrate colonizer. During the 1983 survey, the two were often found together in mixed copses.

It is hoped that periodic re-evaluations of selected sampling stations within the link channel (which have recently commenced) will provide, by comparison against baseline data collected in 1983, further information on the changes that are taking place as the result of the introduction of aliens, and those which may follow more direct human interventions such as the restructuring of the entrance at 'Smallmouth'.

Acknowledgements

The survey greatly benefitted from generous assistance and support provided by many of the interested parties concerned with the Fleet.

The author is particularly grateful to Dr W. Farnham (Portsmouth Polytechnic) for invaluable collaboration. Also Simon Brown and Patricia Farnham (Portsmouth Polytechnic), Col. Smith and Major Church (Royal Engineers Training Camp, Wyke Regis); E. Green, J. Fair, R. Daly and D. Moxom (Fox-Strangways Estate); Commander Allen (Queens Harbour Master, Portland Harbour); Mr T. Vaughan (Dorset County Council); D. Seaward, J. Fitzpatrick (Fleet Study Group); D. Manuel (Oxford University), Dr. P. Miller (Bristol University), S. Stone (British Museum, Natural History); Dr R. Mitchell and S. Fowler (Nature Conservancy Council), and the Nature Conservancy Council for awarding the contract.

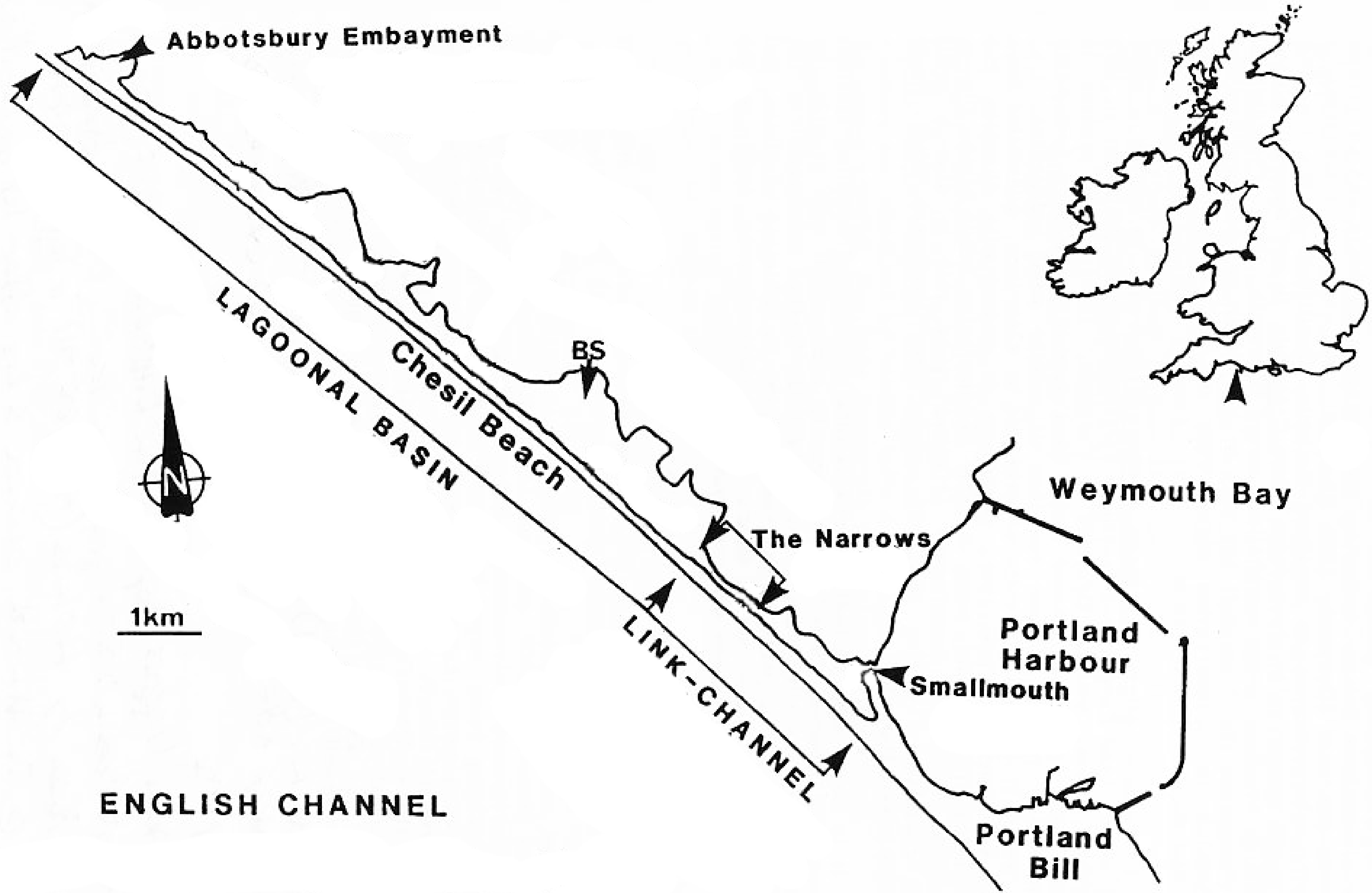

Figure 1. The Fleet Lagoon, and Portland Harbour.
(BS - Butterstreet)

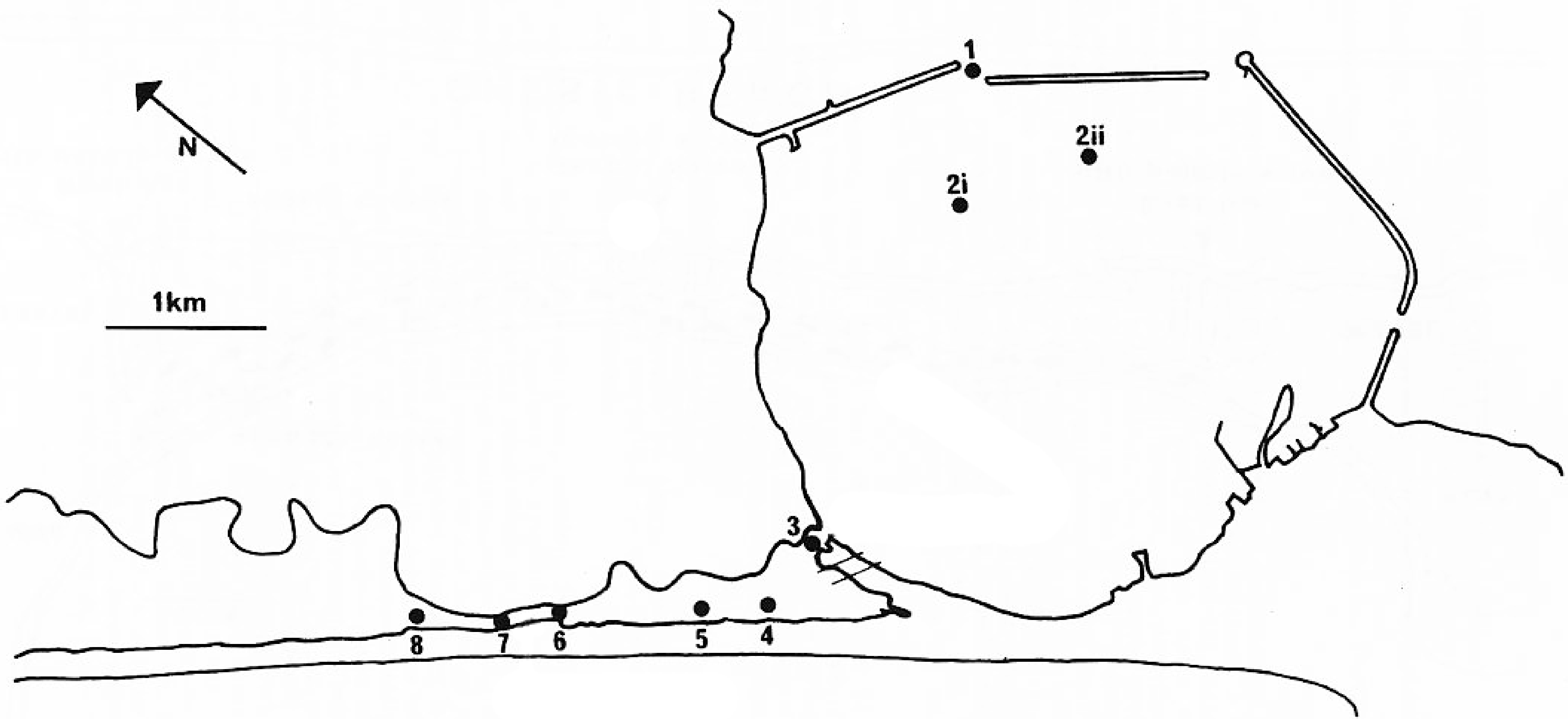

Figure 2. Dive survey stations within the link channel of the Fleet, and Portland Harbour. Stations were first surveyed during August and September, 1983. The path of the channel which replaced the old 'Smallmouth' in late 1984 is also indicated.

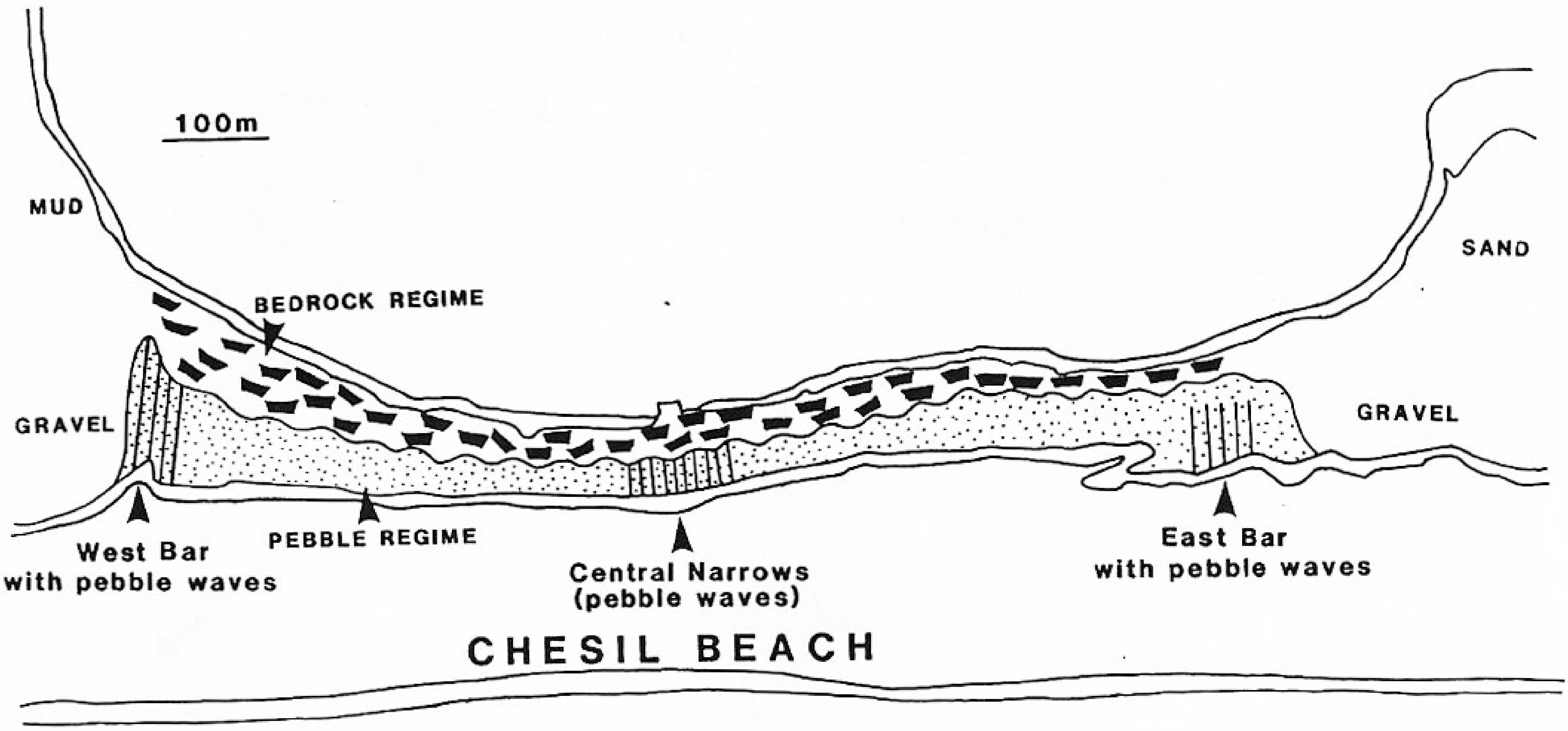

Figure 3. Diagrammatic representation of the distribution of seabed substrates within the 'Narrows', as compiled from diving investigations.
(after Dyrynda, 1984)

OBSERVATIONS ON THE OPISTHOBRANCH MOLLUSC AKERA BULLATA IN THE FLEET, DORSET

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and
D.R. Seaward

Introduction

The shelled opisthobranch Akera bullata has been an abundant member of the aquatic fauna of the Fleet for 130 years or more. In their 'A History of British Mollusca, and their Shells', Forbes & Hanley (1848-53) stated that "About four miles from Portland Bridge, the mud, at high water mark is fringed with thousands of them". They are still common, with densities up to 120 per square metre (Seaward, 1978). Nonetheless, the systematic position of Akera has only recently been agreed by experts on the group. Traditionally, the family Akeridae had been placed in the opisthobranch order Bullomorpha (e.g. Thompson, 1976), by virtue of its possession of a set of bullomorph characters, such as the external shell, consisting of several whorls, albeit somewhat fragile and incapable of accommodating the soft parts during defensive retraction. Furthermore, Akera has a flattened cephalic shield with rounded wing-like antero-lateral expansions behind the eyes. The foot is dilated to form broad parapodial lobes which, when not in use for swimming, are folded over the shell dorsally.

Recently, however, Morton (1972) has revived an idea of Guiart (1901), that the akerids were more closely related to the Aplysiidae. Our own studies on the spermatozoa of these and other opisthobranch groups have provided corroboration, which, taken to its logical conclusion, means that the Akeridae must be transferred from the Bullomorpha to the Aplysiomorpha.

Taxonomic Status of Akera bullata Muller, 1776

So much for the systematic position of Akera, now to the equally vexed question of the correct naming of the British records. Taking these as a whole, the taxon can be defined as follows:

The length of the external shell may reach 41mm, swollen, fragile, glossy, up to 6 whorls, pale amber in colour; the aperture is typically about the same length as the shell or shorter. The body can reach 70mm in extended length, pale grey or brownish (very dark in the largest individuals), bearing irregular blackish mottling, often forming longitudinal streaks on the head and sprinkled with white specks overall. The cephalic disc is slightly bilobed in front and is expanded laterally to form flattened flared cephalic lobes below which are the wrinkled organs of Hancock. The eyes can be seen antero-dorsally, lying beneath paler patches of the skin. The natatory parapodial lobes mask the shell to a considerable extent, especially in larger individuals. There is no clear demarcation between the pedal sole and the parapodia. The propodium is bilabiate. The anterior lip of the shell is ensheathed by a reflexed fold of the mantle edge. Posteriorly, another lobe of the mantle projects with a short exhalant siphon. The layer of the mantle which lines the shell internally is dark in colour with pale markings which can be very uniform in any locality. Swimming is sporadic and is brought about by graceful synchronous movements of the parapodia (Morton & Holme, 1955). Specimens have been reported from areas all around the British Isles (Seaward, 1982); further records have come from Norway, Denmark, the Baltic Sea, Atlantic and Mediterranean coasts of France, Spain and the Greek Ionian Sea, to a maximal depth of 370m.

A closer study of the British material leaves little doubt that two separate subspecies are embraced within the above description of the Akera bullata aggregate. One subspecies, the variety farrani Norman, 1890 occurs in the open waters of the English Channel and elsewhere, notably in Lough Ine, Co. Cork (Ireland). It may reach 70mm in body length, swims vigorously in the adult phase, often possesses an elongated, finger-like posterior pallial lobe, and a purple gland which can expel a defensive fluid from the mantle cavity. The subspecies nana Jeffreys, 1867, found in the Fleet, is different in several significant respects. This local variety rarely exceeds 20mm in overall body-length, swims only as a juvenile, has an obtusely rounded posterior pallial lobe (very rarely produced to form a tentacle) and lacks the ability to secrete defensive purple.

Both subspecies are illustrated in Fig. 1. How far are the differences between nana and farrani truly genotypic? It might be alleged, for example, that the smaller nana simply represented the juvenile stage of farrani. To settle this point, one would normally turn to details of the buccal mass or the reproductive biology (larval strategy, egg size, sperm morphology), but in the present perplexity these have not proved to be helpful. This is because there are insufficient radular formulae available from areas outside the Fleet for a valid comparison to be made of the buccal masses. Furthermore, the eggs and the lecithotrophic larvae of the two subspecies are similar (although the spawn masses of farrani are significantly larger), and the spermatozoa are of virtually the same length (308-315µm with 55-61 gyres in nana; 325-330µm with 585-59 gyres in farrani).

Results of the Sampling Scheme

It was decided that a detailed study of the subspecies nana in the Fleet would contribute to a resolution of the problem of the status of the bullata complex and a programme of monthly sampling was initiated in November 1984. The present interim communication includes biometric data up to the end of 1985. The sampling will be continued for at least another year, and that second phase will be accompanied by histological examination of the ovotestes. Temperature and salinity continue to be monitored at the study site, the foreshore at Langton Hive Point, near the village of Langton Herring.

Figure 2 shows the temperature and salinity regime during part of the period. Salinity (measured using a refractometer) varied widely, dropping to 22 p.p.t. or lower in mid-winter, rising to 35.5 p.p.t. in the summer, as high as that in the open water of the English Channel. The temperature of the water at Langton Herring was usually higher than that of the air, but this tended to reverse in the winter months.

The biometric data (Fig. 3) show conclusively that the life cycle of Akera in the Fleet is an annual one. Each generation grows until spawn masses are produced in April-June. Spent adults died off (moribund specimens were common in the field in late April 1985 and all had died by the end of June) and were replaced by newly settled young, which dominated the samples in June and July. These juveniles had the ability to swim by parapodial contortions until they were 2 or 3 months old.

The benthic stages appear to be detritivorous; the faeces contained finely diminuted plant debris together with some animal skeletons, Polystomella for example. There is at present no evidence that Akera feeds directly upon living Zostera, either the roots or the leaves.

Conclusions

These observations reinforce the view that the Fleet population of Akera bullata nana is ecologically distinct from the larger A. bullata farrani reported elsewhere. There is no intergradation between either the morphological or the ecological data recorded for the two subspecies. Moreover, it now appears that they are different behaviourally in that swimming is characteristic of juveniles in nana but of adults in farrani. But until our sampling programme is complete, we prefer to suspend final judgement on whether the two subspecies should be elevated to full specific rank.

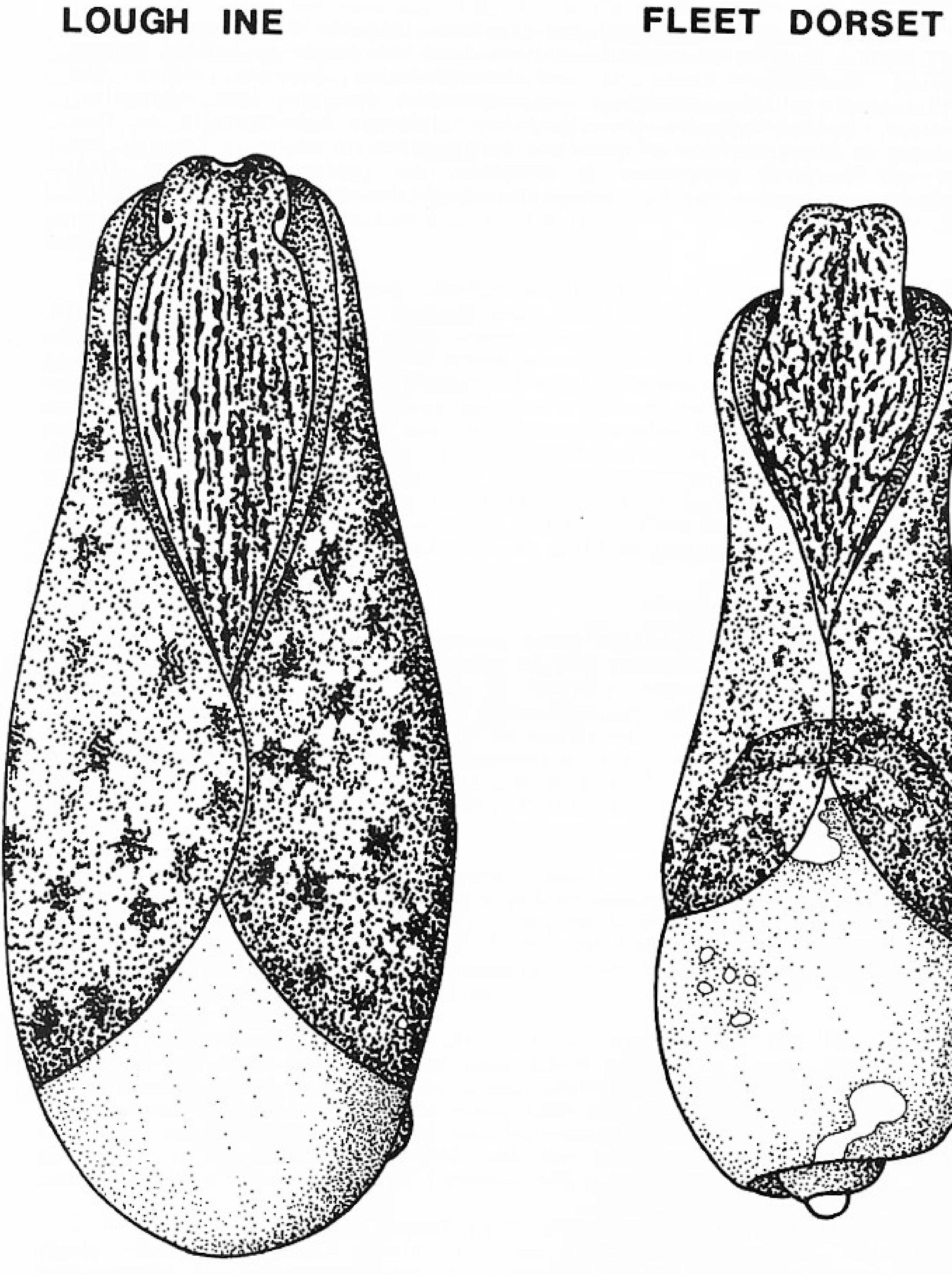

Fig. 1. Akera bullata, dorsal views of specimens from Lough Ine, Co. Cork (overall length 70 mm, subspecies farrani Norman), and from the Fleet, Dorset (overall length 16 mm, subspecies nana Jeffreys).

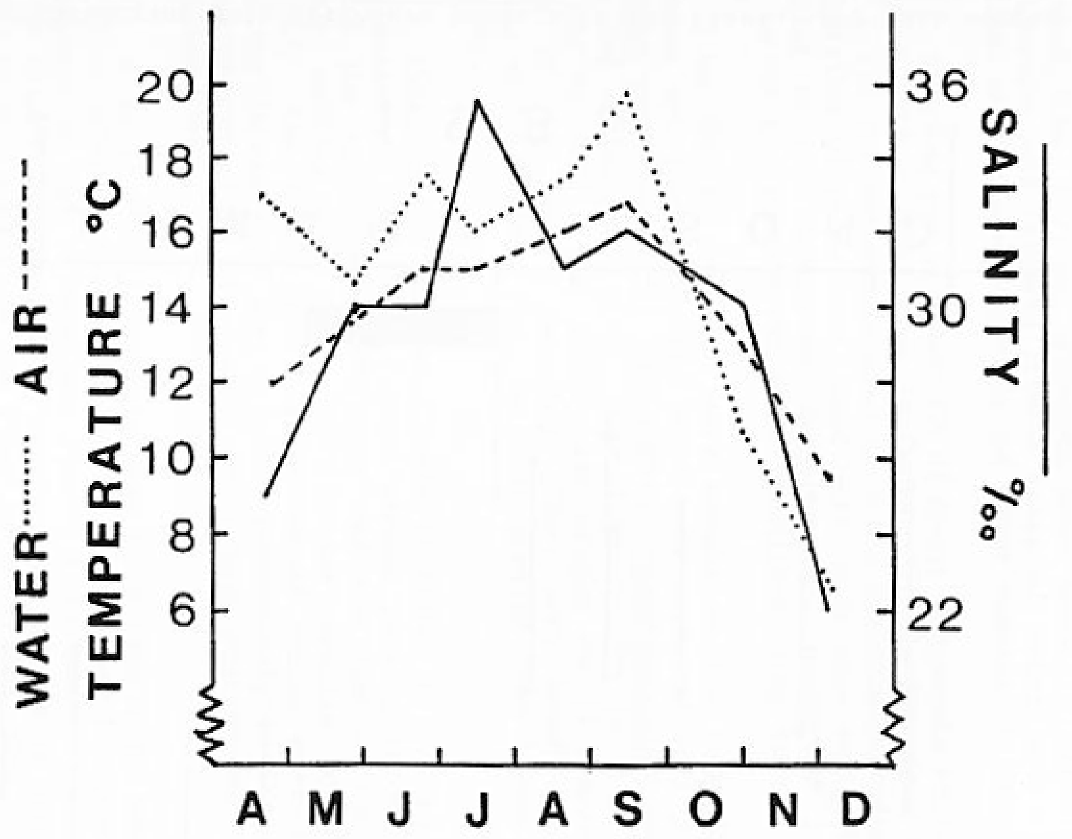

Fig. 2. Salinity and temperature measurements at Langton Herring during 1985; measurements made during approximately monthly visits.

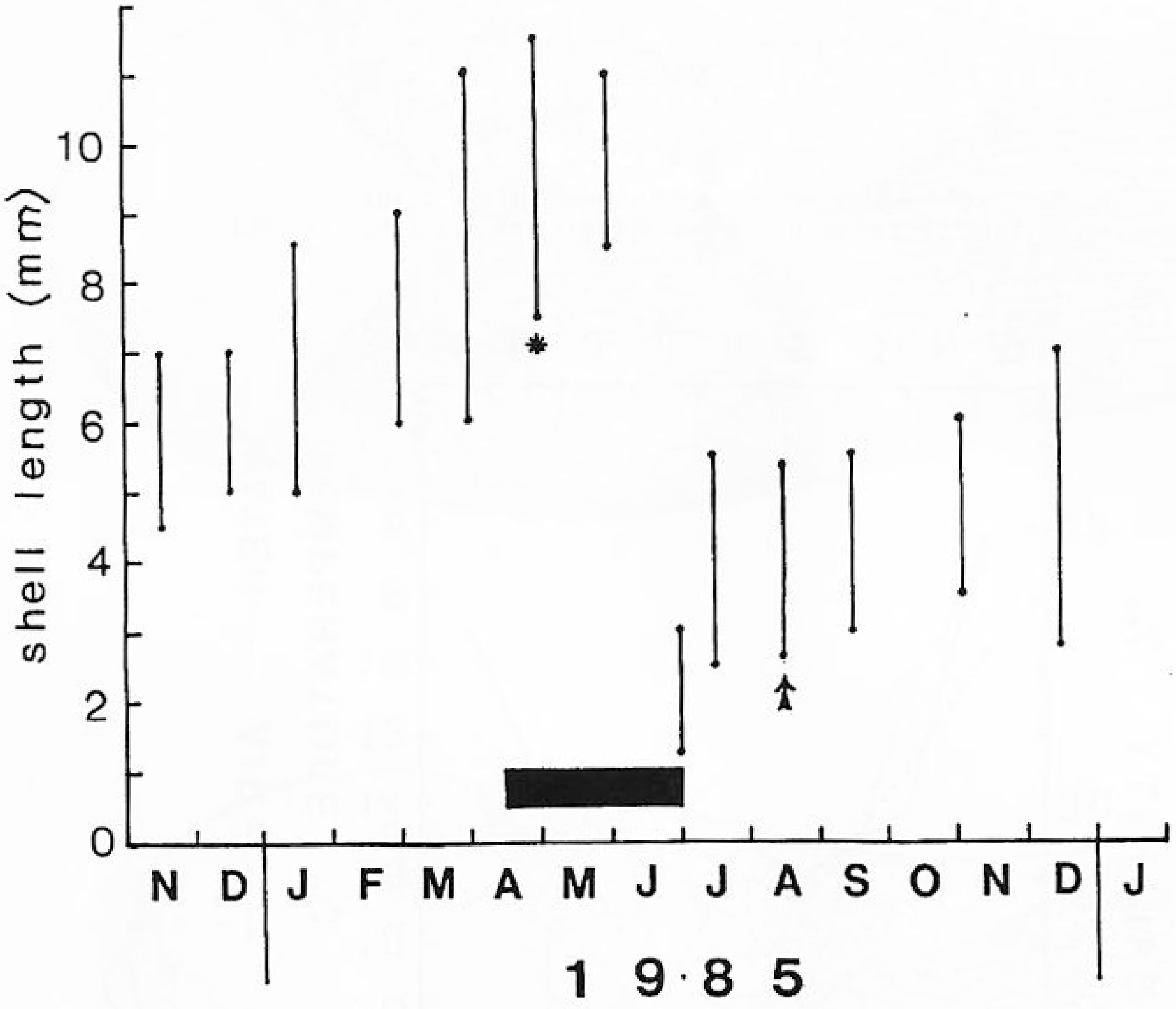

Fig. 3. Monthly collecting data for *Akera bullata* in the Fleet. For each sample, shell-length maxima and minima are indicated. The thick black bar shows the period when spawn was found in the field. The arrow indicates swimming behaviour; the asterisk indicates the pressence of dead and dying adults in the field.

THE FISHES OF THE FLEET WITH PARTICULAR REFERENCE TO THE YOUNG STAGES OF THE BASS (DICENTRARCHUS LABRAX L.)

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Introduction

This paper is based chiefly on work carried out by the scientists of the Freshwater Biological Association's River Laboratory on behalf of the Dorset County Council. It was the first scientific study of the ichthyofauna of the Fleet and details of the methodology and results are presented in a report prepared for D.C.C. by Bass, Beaumont, Ladle & Mann (1983). The objectives of the work were to determine whether bass (Dicentrarchus labrax L.) spawned within the Fleet as had been reported or whether eggs, larvae or post-larvae were present in the plankton which drifts in or out of the Fleet with each tide. Further, attempts were made to establish the distribution, age structure and relative growth rates of young bass within the lagoon and to collect incidental information on other species of fish.

Sampling was at intervals of about two weeks between May and the end of August with a final visit in October 1983. Six sites were sampled in all and the techniques used included plankton sampling at Smallmouth and the operation of seine nets, hand nets, push nets and gill nets at all stations according to the objectives. Samples were preserved in formalin and fish eggs, larvae and post-larvae were identified using Russell (1976).

No fish of any kind were caught on the two occasions that the gill nets were set. Hand operated pond nets captured only post-larval sandsmelts (Atherina presbyter Val.) and gobies (Pomatoschistus spp). All bass caught, up to and including 13 July, were 1-group fish in their second year of life (spawned in 1982), but three bass caught on 12 August were 0-group fish (young of the year). Sampling effort was subsequently concentrated on catching these 0-group fish. No bass greater than 150mm was captured during the study.

Plankton net samples (Table 1) failed to record the presence of the young stages of bass in the tidal stream passing through Smallmouth, either because the intensity of sampling was too low or because the small fish actively avoided the nets. Many other species of fish were, however, recorded. The larvae and post-larvae of gobies were very numerous. Many crustacean larvae were also present, particularly on the flood tides. Plankton netting ceased after mid-August when bass post-larvae were already present within the Fleet.

A total of 191 juvenile bass were caught by seine netting (Table 2) from three sites at Pirates Lane, Moonfleet and Langton Hive (Fig. 1). The distribution of bass within the Fleet is extensive but localised shoaling of the fish caused fluctuations in catches which made it difficult to estimate the numbers of bass which use the Fleet as a nursery. The netting results indicate that bass were present throughout the study and, in view of the results of work in the Severn estuary, they may well be present throughout the year (Claridge & Potter, 1983).

The first catches of post-larval bass were made later than anticipated (12 August). Other reports of post-larvae have suggested June and July as the normal time (Russell, 1980) but late appearance has precedents and, in S. Devon and Cornwall Dando, P.R. and Kelley D.F. (pers. comm.) report such an occurrence in 1983.

Seasonal growth of bass will vary from year to year and may also differ between localities. Fast growth and good survival have been reported in warmer-than-average years (Kelley, 1979). Restricted tidal exchange in the Fleet (Robinson, 1981) renders it liable to particularly high summer temperatures compared to many other estuaries.

Differences in the food of young bass (determined from gut contents) reflect, to some extent, seasonal changes in availability and size of potential prey organisms. There are also clear differences in the choice of prey by bass of different sizes (Table 3). The food of both 0-group and 1-group bass was dominated by various crustaceans and there was a total absence of the, extremely numerous, post-larvae of sand smelts from the diet. Kennedy & Fitzmaurice (1972) found a similar dominance of small crustaceans in 1-group bass from a tidal lagoon on the south coast of Ireland.

Occurrence of Other Fish in the Fleet

Large shoals of small grey mullet were frequently observed in the Fleet and commercial catches are taken with gill nets by some local fishermen. Anglers regard them as a desirable but hard-to-catch quarry. Mullet were frequently captured in the 40m seine and the age structure of the fish retained has not been analysed. For the major part of the study, mid-May to mid-August, no post-larvae were recorded, but many were taken in the micro-mesh seine on 24 October. Difficulties were experienced in separating mullet species, particularly with young fish, as at least two species (*Crenimugil labrosus* and *Liza aurata*) were present and possibly also *L. ramada*.

The sandsmelt (*Atherina presbyter*) was the second most abundant fish captured (after gobies) in the Fleet. The large numbers of sandsmelt post-larvae presented difficulties in the search for bass, as they were superficially similar and this entailed time-consuming checks - reducing the total number of 0-group bass that could be processed. Sandsmelt eggs, which have rarely been observed in other British waters, were recovered on the ebb tide from the plankton at the end of May. They were attached to fragments of a finely-branched green alga, indicating that they are essentially benthic in occurrence and not planktonic, which is in agreement with Bamber, Henderson & Turnpenny (1982). Post-larvae were recorded from mid-June onward and occurred at all sampling sites throughout the summer. Adult (60-140mm) fish, taken in the 40m seine, declined in numbers later in the study. This may be attributed to emigration from the Fleet. Staff from the Marine Biology Unit, Fawley (C.E.G.B.), are in the process of analysing the copious sandsmelt data to compare with their population studies in Southampton water.

Plankton samples collected on the flood tide in mid-May contained flounder (*Pleuronectes flesus*) post-larvae. Larger fish were taken in seine nets and covered a wide range of sizes. Low overall catches prevented any clear conclusions as to their importance in the Fleet.

Not many eels were caught, despite the presence of a thriving eel fishery. This discrepancy was probably due to sampling being confined to shallow, intertidal regions of the lagoon.

Conclusions

The study provided no evidence to support the possibility of bass spawning within the Fleet. It is now generally believed that these fish spawn chiefly in offshore situations and that the larvae migrate inshore, often to shallow brackish water. The status of the Fleet as a nursery area was confirmed by regular recovery of young fish from a number of sites but it was not possible to estimate the size of the population except to say that it was substantial. The young fish were relatively quick growing for a species nearing the northern limits of its geographical distribution.

The absence of evidence of bass spawning within the Fleet suports the observations of Demestre *et al.* (1977) for brackish lagoons on the coast of Spain.

Acknowledgements

The major work carried out since the first compilation was supported by Dorset County Council and carried out by scientists of the Freshwater Biological Association's River Laboratory. Assistance, equipment and advice was given by Dr M.G. Pawson (M.A.F.F. Lowestoft), Dr T.E. Langford (C.E.G.B. Fawley), Dr P.R. Dando (M.B.A. Plymouth), Mr D.F. Kelley and Mr J. Churchouse.

Table 1. Families of fish recorded in plankton samples from the Smallmouth in 1983 (eggs, larvae and post-larvae).

		Number recorded	
		Flood	Ebb
Dragonet	Callionymidae	-	-
Flounder	Pleuronectidae	10	-
Rockling	Gadidae	4	-
Sandeel	Ammodytidae	9	2
Goby	Gobiidae	>239	>162
Blenny	Blenniidae	4	-
Wrasse	Labridae	4	1
Sandsmelt	Atherinidae	2	9
Pouting	Gadidae	1	-
Stickleback	Gasterosteidae	-	>18
Herring	Clupeidae	2	-
Pipefish	Syngnathidae	-	>0

Table 2. Species of fish caught in seine and other nets, 1983.

			Number
Bass	*Dicentrarchus labrax*	-	191
Mullets	*Liza aurata*) *Crenimugil labrosus*)		>180
Sandsmelt	*Atherina presbyter*	-	>183
Goby	*Pomatoschistus microps*	-	>139
3 spined stickleback	*Gasterosteus aculeatus*	-	>56
Flounder		-	>41
Pipefish	*Syngnathus*	-	>2
Wrasse	*Crenilabrus melops*	-	>2
Eel	*Anguilla anguilla*	-	>5
Sandeel	*Ammodytes* sp	-	1

Table 3. The food of young bass from the Fleet at Langton Hive. Items present in more than 20% of stomachs are indicated.

	0+	1+
Mysidaceae	40	5
Gammaridae	27	9
Idotea sp	21	14
Polychaeta	4	-
Diptera	3	6
Corophium spp	2	51
Jassa sp	-	5
Others	3	10

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